Knowledge Politics in National Nuclear Energy Planning in Thailand (2007-2017) with a Case Study of Ubon Ratchathani Province

Miss Tipakson Manpati

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts Program in International Development Studies
Faculty of Political Science
Chulalongkorn University
Academic Year 2017

การเมืองของความรู้ในการวางแผนพลังงานนิวเคลียร์ในประเทศไทย (พ.ศ.2550-2560) กับกรณีศึกษาจังหวัดอุบลราชธานี

นางสาวทิพย์อักษร มันปาติ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาการพัฒนาระหว่างประเทศ
คณะรัฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2560

Thesis Title	Knowledge Politics in National Nuclear Energy Planning in Thailand (2007-2017) with a Case Study of Ubon Ratchathani Province
By	Miss Tipakson Manpati
Field of Study	International Development Studies
Thesis Advisor	Carl Middleton, Ph.D.

Accepted by the Faculty of Political Science, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Faculty of Political Science
(Associate Professor Ake Tangsupvattana, Ph.D.)

THESIS COMMITTEE

.....Chairman
(Emeritus Professor Surichai Wungaeo)

.....Thesis Advisor
(Carl Middleton, Ph.D.)

.....External Examiner
(DECHARUT SUKKUMNOED, Ph.D.)

ทิพย์อักษร มันปาติ : การเมืองของความรู้ในการวางแผนพลังงานนิวเคลียร์ในประเทศไทย (พ.ศ.2550-2560) กับกรณีศึกษาจังหวัดอุบลราชธานี (Knowledge Politics in National Nuclear Energy Planning in Thailand (2007-2017) with a Case Study of Ubon Ratchathani Province) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: คาร์ล มิดเดิลตัน, 113 หน้า.

ประเทศไทยมีความปรารถนาในการมีพลังงานนิวเคลียร์เพื่อผลิตกระแสไฟฟ้ามาเป็นเวลานาน และมีแผนโครงการพลังงานนิวเคลียร์อยู่ในแผนพัฒนาพลังงานแห่งชาติฉบับปัจจุบัน พีดีพี 2015 (2015-2036) เหตุผลในการบรรจุพลังงานนิวเคลียร์มีความเชื่อมโยงกับการที่ประเทศมีการคาดการณ์การเพิ่มขึ้นของความต้องการพลังงาน พลังงานนิวเคลียร์ถูกมองว่าเป็นตัวเลือกที่น่าดึงดูดใจในการสร้างความหลากหลายของแหล่งพลังงาน ซึ่งทุกวันนี้ประเทศไทยพึ่งพาแหล่งก๊าซธรรมชาติภายในประเทศเป็นเป็นอย่างมาก และนำเข้าพลังงานจากแหล่งต่างๆ ในด้านหนึ่ง พลังงานนิวเคลียร์ได้รับการส่งเสริมว่าเป็นพลังงานตัวเลือกที่ปล่อย 'ก๊าซคาร์บอนน้อย' เพื่อยับยั้งการปล่อยก๊าซเรือนกระจก ในอีกด้านหนึ่งเทคโนโลยีนิวเคลียร์นำมาซึ่งความเสี่ยงสำคัญที่เป็นไปได้ต่อชีวิตบนโลก ด้วยอุบัติเหตุทางนิวเคลียร์และการแพร่ขยายอาวุธนิวเคลียร์ (Rajesh, 2001, p. 35)

วัตถุประสงค์หลักของการวิจัยชิ้นนี้ คือ เพื่อวิเคราะห์กระบวนการตัดสินใจ จากมุมมองการพิจารณาธรรมาภิบาลสิ่งแวดล้อม ว่าการบรรจุพลังงานนิวเคลียร์อยู่ในแผนพัฒนาพลังงานนิวเคลียร์ของประเทศไทยถูกปรับไปตามการผลิตความรู้และวาทกรรมอย่างไร งานวิจัยยังมีเป้าหมายในการค้นคว้าดังต่อไปนี้ 1) ระบุตัวแสดงสำคัญที่มีส่วนร่วมในการผลิตความรู้และวาทกรรมนิวเคลียร์ 2) ประเมินช่องว่างในการสร้างความรู้โดยตัวแสดงต่างๆ ที่โต้แย้งเกี่ยวกับแผนพัฒนาพลังงานแห่งชาติของประเทศไทย รวมทั้งประเมินความเสี่ยงและการกระจายความเสี่ยง, มหันตภัยฟูกูชิมะ และความเหมาะสมของจังหวัดอุบลราชธานี ในฐานะพื้นที่ที่มีความเป็นไปได้สำหรับโรงไฟฟ้าพลังงานนิวเคลียร์ และ 3) ประเมินอำนาจและการเมืองภายในเครือข่ายนโยบายนิวเคลียร์ เพื่อทำความเข้าใจว่าใครมีอิทธิพลในการโต้เถียงมากที่สุด โดยมีวิธีการใดที่ทำให้ข้อโต้เถียงนั้นบรรลุผลและทำไม

งานวิจัยนี้ใช้กรอบแนวคิด 4 ประการในการค้นคว้าและวิเคราะห์ปัญหาในการผลิต เผยแพร่ และบริโภคความรู้ เกี่ยวกับแผนสำหรับพลังงานนิวเคลียร์ในประเทศไทย ซึ่งประกอบด้วย 1) วิทยาศาสตร์, เทคโนโลยี และสังคม 2) เครือข่ายนโยบาย 3) การเมืองเชิงเปรียบเทียบระดับอำนาจ และ 4) การสร้างวาทกรรมและความรู้

งานวิจัยใช้เครื่องมือหลายอย่างในการเก็บข้อมูลจากทั้งแหล่งปฐมภูมิและแหล่งทุติยภูมิ ประกอบด้วย การค้นคว้าข้อมูลเอกสารเชิงคุณภาพ, การสัมภาษณ์กับผู้เชี่ยวชาญ, การประชุมกลุ่มย่อย, การสัมภาษณ์เชิงลึก, การสัมภาษณ์แบบไม่เป็นทางการ และการสังเกตการณ์ ข้อมูลพื้นที่จัดทำในตำบลคำเขื่อนแก้ว อำเภอสิรินธร จังหวัดอุบลราชธานี เพื่อทำความเข้าใจให้มากขึ้นว่ามีการเผยแพร่ความรู้ (สู่ประชาชน) และมีวาทกรรมอะไรบ้าง เพื่อทำการประเมินกระบวนการตัดสินใจเกี่ยวกับว่า ประเทศไทยควรดำเนินการโรงไฟฟ้าพลังงานนิวเคลียร์ในจังหวัดอุบลราชธานีหรือไม่

งานวิจัยนี้มองไปที่วาทกรรมที่ถูกสร้างขึ้นโดยเครือข่ายนโยบาย ในหัวข้อ 1) ความต้องการพลังงานและบทบาทของพลังงานนิวเคลียร์ 2) ฟูกูชิมะ 3) ความเสี่ยงและความปลอดภัย และ 4) การเปลี่ยนแปลงสภาพภูมิอากาศ งานวิจัยพบว่าวาทกรรมที่ถูกผลิตขึ้นนั้นถูกโต้แย้ง วาทกรรมเหล่านี้ได้รับอิทธิพลโดยเครือข่ายนโยบาย เพื่อปรับเปลี่ยนความเข้าใจของสาธารณะต่อการพิจารณาทางเลือกเทคโนโลยีและผลกระทบที่อาจตามมา

การเสนอโครงการสร้างโรงไฟฟ้านิวเคลียร์ในจังหวัดอุบลราชธานีตั้งข้อโต้เถียงขึ้น ชุมชนท้องถิ่นในคำเขื่อนแก้ว และหัวสะพานมีความกังวลหลักเช่นกัน ด้านความเป็นอยู่ที่ดีและทรัพยากรในท้องถิ่น อาทิ น้ำในการหล่อเย็นเครื่องปฏิกรณ์นิวเคลียร์ เนื่องจากพวกเขาพึ่งพาน้ำในการดำเนินวิถีชีวิต

โดยสรุป การจำกัดหรือความไม่เพียงพอของการพิจาณาสาธารณะในการโต้เถียงเกี่ยวกับพลังงานนิวเคลียร์ ชี้ให้เห็นถึงความไม่เท่าเทียมในการมีส่วนร่วม ซึ่งมีผลกระทบต่อคุณภาพในการสร้างการมีส่วนร่วมของสาธารณะในกระบวนการตัดสินใจเกี่ยวกับว่า โรงไฟฟ้านิวเคลียร์ควรมีการสร้างในจังหวัดอุบลราชธานีหรือไม่ งานวิจัยชิ้นนี้พบว่า การพิจารณาธรรมาภิบาลสิ่งแวดล้อมมีความสำคัญต่อคนในท้องถิ่นเพื่อมีส่วนร่วมในกระบวนการตัดสินใจ เนื่องจากความเป็นไปได้ของผลกระทบจากการดำเนินการโรงไฟฟ้านิวเคลียร์ จะมีผลกระทบโดยตรงต่อสุขภาพของพวกเขา และทรัพยากรในท้องถิ่นที่พวกเขาพึ่งพาอาศัย

สาขาวิชา การพัฒนาระหว่างประเทศ ลายมือชื่อนิสิต .....

ปีการศึกษา 2560 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

5981211624 : MAJOR INTERNATIONAL DEVELOPMENT STUDIES
KEYWORDS: NUCLEAR / KNOWLEDGE PRODUCTION / DELIBERATIVE ENVIRONMENTAL GOVERNANCE / POWER DEVELOPMENT PLAN / UBON RATCHATHANI PROVINCE

TIPAKSON MANPATI: Knowledge Politics in National Nuclear Energy Planning in Thailand (2007-2017) with a Case Study of Ubon Ratchathani Province. ADVISOR: CARL MIDDLETON, Ph.D., 113 pp.

Thailand has long aspired to nuclear power for electricity generation, and there are plans for nuclear power projects in the most recent Power Development Plans (2015-2036) – PDP 2015. The reason for incorporating nuclear power relates to anticipation of growing energy demand. Nuclear power is seen as an attractive option for diversifying energy sources, as to date Thailand has largely depended on domestic natural gas reserves and imported fuel resources. On the one hand, nuclear power has been promoted as a 'low carbon' emission option to mitigate greenhouse gas (GHG) emissions. On the other hand, nuclear technology carries significant potential risks to life on earth, through nuclear accidents and proliferation of nuclear weapons (Rajesh, 2001, p. 35).

The main objective of this research is to analyze the decision making process, from the perspective of deliberative environmental governance, of how incorporating nuclear power in Thailand's PDP was shaped by knowledge production and discourse. The research also aims to explore the following: i) identify key actors involved in producing nuclear knowledge and discourse; ii) assess gaps in knowledge production by the actors contesting the Thailand's PDP, including assessing risks and their allocation, the Fukushima disaster, and the suitability of Ubon Ratchathani as a potential site for a nuclear power station and; iii) assess the power and politics of 'nuclear policy networks', to understand who influenced the debate most, how this was achieved and why.

This research used four concepts to explore and analyze problems of knowledge production, circulation and consumption, regarding plans for nuclear power in Thailand which includes: i) Science, technology and society; ii) policy networks; iii) the politics of scale and; iv) discourses and knowledge production.

The research used different tools to collect data from both primary and secondary sources, including: desk-based qualitative documentary research; interviews with experts; focus groups; in-depth interviews, informal interviews and observations. Fieldwork research was conducted in Kham Kuean Kaeo sub-district, Sirindhorn District, Ubon Ratchathani Province to better understand what knowledge has been disseminated (to the public) and what discourses had taken place, so as to assess the decision making process concerning whether Thailand should proceed with a nuclear power station in Ubon Ratchathani Province.

This research looks at discourses produced by actor-networks concerning four themes: i) power demand and the role of nuclear power; ii) Fukushima; iii) risks and safety; and iv) climate change. The research found that the discourses produced are contested. These discourses were also influenced by policy networks, so as to shape public understanding about considering energy technological choices and impacts it might entail.

The proposed nuclear power plant project in Ubon Ratchathani opened many debates. Local communities in Kham Kuean Kaew and Hua Sapan shared key concerns about well-being and local resources, such as using water for cooling the nuclear reactor, as they depend on it for making local livelihoods.

In conclusion, limited or insufficient public deliberation in the nuclear debate suggests an inequality of participation that affects the quality of public engagement in the decision making process about whether or not a nuclear power station should be constructed in Ubon Ratchathani Province. The research found that deliberative environmental governance is essential for local people to participate in decision making processes, as potential impacts from an operating nuclear power plant would have direct impacts on their health and local resources they depend upon.

Field of Study: International Development Studies Student's Signature .....
Academic Year: 2017 Advisor's Signature .....

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my professor and advisor Dr. Carl Middleton, for his constant support throughout my study at MAIDS and this thesis. His support also goes beyond academic arena that I greatly appreciate to have the opportunity to learn so much from him. There were many challenges happened during the time of conducting this thesis and I received enormous support and encouragement from Ajarn Carl. I wish to thank him for his kindness, insightful comments and constructive guidance throughout, so that this thesis have been possible.

I would like to thank to my thesis committee members, Emeritus Professor Surichai Wungaeo and Dr. Decharut Sukkamnoed for insight investigation of the thesis and gave me invaluable comments and feedback. Their inputs help improve this thesis that I am grateful for.

I would like to thank to Pol-Sci-ASEAN Scholarship for granting me funding to support my enrollment and study at MAIDS program. I would also like to thank to MAIDS program for supplying field work grant that enabled me to collect data on the ground for the research. I am also thankful to Zomia for supplying a student financial loan. These are distinguish supports I am fortunate to receive which played significant part in my academic achievement.

I would like to thank to all MAIDS staffs for their help and assistance with coordination and facilitation through MAIDS program administration processes.

Many thanks to colleagues in Ubon Ratchathani province for introducing me to key informants in the local area as well as facilitating travel arrangement during my field work.

My appreciation goes to Sean for supplying me useful information, giving me thorough feedback. I also appreciate Pieter for reading through my thesis and giving detail reflection and inputs. Appreciation also goes to Sean and Bobby for editing my thesis.

My appreciation also goes to Pi Toshi, Pi Heng, Pi Ae, Tuck, Shining, Jom, Melody and Soul for mentorship, friendship and support in various ways which contribute to countless encouragement that I could complete this thesis.

I also wish to thank my respectful professor Dr. Tanet Charoenmuang, beginning with his generosity, intelligence and ethics advice that support my professional and academic development through completion of the master degree at MAIDS.

Last but not least, I am grateful to my beloved family: my parents, my brother and my sister for everything in life. They support me so that I can follow my dream in work and further studies. I am deeply gratitude to my family for unconditional love which is a wonderful blessing I have throughout my life.

CONTENTS

Page

Page

Page

LIST OF TABLES

LIST OF FIGURE

LIST OF PICTURES

LIST OF ABBREVIATIONS

AEC:	ASEAN Economic Community
ASEAN:	Association of Southeast Asian Nations
ASEANTOM:	ASEAN Network of Nuclear Regulatory Bodies or Relevant Authorities
ASEAN2NPSR:	ASEAN Network for Nuclear Power Safety Research
BAU:	Business-As-Usual
CGN:	China General Nuclear
CSO:	Civil Society Organization
CO_2:	Carbon dioxide
EGAT:	Electricity Generating Authority of Thailand
ENAC:	Emergency Notification Assistance Convention
EPPO:	Energy Policy and Planning Office
GHG:	Green House Gases
HLW:	High Level Waste
IAEA:	International Atomic Energy Agency
INDC:	Intended Nationally Determined Contribution
INIR:	Integrated Nuclear Infrastructure Review
IPCC:	Intergovernmental Panel on Climate Change
LLW:	Low Level Waste
MEE Net:	Mekong Energy and Ecology Network
MLW:	Intermediate Level Waste
MoEN:	Ministry of Energy
MOST:	Ministry of Science and Technology
NAICC:	Nuclear Accident Independent Investigation Commission
NCPO:	National Council for Peace and Order
NEPC:	National Energy Policy Council
NESDB:	National Economic and Social Development Board
NESDP:	National Economic and Social Development Plan
NGO:	Non-governmental Organization
NIRS:	National Institute of Radiological Science
NPIEP:	Nuclear Power Infrastructure Establishment Plan
NPIECC:	Nuclear Power Infrastructure Establishment Coordination Committee
NPPDO:	Nuclear Power Program Development Office
NST:	Nuclear Society of Thailand
NWFZs:	Nuclear Weapons Free Zones
OAEP:	Office of Atomic Energy for Peace
OAP:	Office of Atoms for Peace
PDP:	Power Development Plan
RATCH:	Ratchaburi Electricity Generating Holding PCL
RE:	Renewable Energy
REDP:	Renewable Energy Development Plan
SCOD:	Scheduled Commercial Operation Date
SEANWFZ:	Southeast Asia Nuclear Weapon-Free Zone

SMR:	Small Modular Reactors
STS:	Science, Technology and Social
TEPCO:	Tokyo Electric Power Company
TINT:	Thailand Institute of Nuclear Technology
TLFS:	Thailand Load Forecast Sub-committee
UNFCCC:	United Nations Framework Convention on Climate Change

CHAPTER I INTRODUCTION

1.1 Statement of problem

Science and technology are forms of power exercised and implemented by many kinds of institutions within evolving human society, as such, Jansanoff (2004), briefly describes them as *"political agents"* (p. 14). For this reason, science, technology and society are interrelated. The decision to prioritize any given type of technology for operational purposes can create different pathways for society. In other words, the underlying choice of a particular technology is created through the the actor's imagination, cultural preferences, and economic or political resources (Bijker 1997; Bijker et al. 1987; Jasanoff, 2004, p. 16).

Epitomizing this relationship, nuclear power is a double-edged technological product grew out of *"advancement"* concept. On the one hand, nuclear power has been seen as technological advancement to support the demand from industrial activities for an economic source of energy for growth. Nuclear power is greatly indebted to scientific experiments for the positive benefits of humankind it can offer. On the other hand, there is also a growing awareness concerning environmental and climate change impacts from the use of nuclear power, as well as potential harm from terrorism associated with the nuclear proliferation. Nuclear power can come at great cost from its negative effects that at the extreme have the power to destroy life on earth through accidents and use of nuclear weapons (Rajesh, 2001) (p. 35). Negative effects of the nuclear power will extend for many generations, as human will have to cope with safely managing the long-term problems of hazardous radioactive waste. Although contaminated radioactive materials could possibly be buried using a deep geological repository method, for a considerable time frame of 50-1000 years (Rethinaraj, 2012) (p. 83), leakage remains possible.

Nuclear power brings up variety of opinions and concerns. This type of energy is viewed as a potential solution to transitioning energy sources from fossil fuel to 'low-carbon' energy option, in which its impacts and risks are framed as technical issues to be managed. At the same time, there are major concerns about higher construction costs, long construction times, added to by the complications of long-term environmental impacts, and risk associated with nuclear proliferation of weaponization for terrorism, and nuclear accidents.

Thailand's interest in and attempt to pursue the nuclear power for electricity generation can be traced back to the Cold War period. The National nuclear agency was first established in late 1950s with technical support from the US government through "Atoms for Peace" program. The beginning of nuclear development in Thailand was also realized through passing the "Atomic Energy for Peace Act", B.E. 2504 in 1961. Following this, the Office of Atomic Energy for Peace (OAEP) was established.

The very first attempt to use nuclear technology for electricity generation was when Thai government proposed nuclear power plant project in Aow Pai, Chonburi province in 1966 and it was approved. But then it was not constructed after the discovery of natural gas in 1970s. The nuclear power was brought back to Thailand's government agenda again, and initially included in the Power Development Plan 2007 (the PDP was later revised to many versions and new ones, including in 2010 and 2015 respectively). Following this national energy policy, change a feasibility study for nuclear power locations was conducted by Thailand's National Energy Policy Council ("China, Thailand Agree to Nuclear Energy Cooperation," 2017). From a total of 17 potential sites all over the country it was concluded for Ubon Ratchathani province (near Thai-Laos border) was the first of the top five tentative technical candidate choices (Cherid, 2012). High energy demand forecasts were given as the reason to include nuclear power in the PDP.

The Fukushima nuclear disaster in early 2011, however, refreshed memories of other nuclear disasters, such as at Three Mile Island (1979) and Chernobyl (1986) and revived international sentiment against nuclear power. After the Fukushima disaster, Thailand revised PDP 2010 to 2nd version and postponed its first nuclear power project by 3 years from 2020 to 2023 (EGAT, 2012) (p. 1). The PDP 2010 then was revised again to 3rd version and postponed nuclear power plants plan to six years from 2020 to 2026 (Siripirom, 2014).

Thailand, however, remains an aspirant for nuclear power for electricity generation. Time frame to start nuclear power projects is postponed further. The latest Power Development Plan 2015 (2015-2036), in which two nuclear energy facilities of 2,000 MW are envisaged to begin operating in 2035 and 2036 and provide some 5% of the country's energy supply mix. In addition, revising the earlier Nuclear Energy for Peace Act was proposed by the Ministry of Science and Technology, and following this approved by the military appointed National Legislative Assembly in May 2016.

In contemporary Thailand, whether a nuclear power station should be built has been heatedly debated. The Ministry of Energy, private power companies, such as Ratchaburi Electric Generating Holding – Thailand's largest power company (45% owned by EGAT) (Hopkins, 2016), and China General Nuclear (GCN) argue in favor of nuclear. They say this cooperation will benefit Thailand with *"the most advanced, most economical and safest nuclear power"("China, Thailand Agree to Nuclear Energy Cooperation," 2017)*. Working towards this goal, Ratchaburi Power has invested in two power stations in China, which implies preparing for their own projects in Thailand. Meanwhile, a coalition of Thai civil society groups, academics, and national and international NGOs, including Energy Watch, Greenpeace, Mekong Energy and Ecology Network (MEE Net), and other nuclear groups have challenged these plans. They have argued there are other safer and cheaper alternatives (Wipatayotin, 2012). Whereas nuclear power, which is *"outdated technology"* (Rujivanarom, 2016), and *"dangerous"* would exacerbate natural disasters, from earthquakes to extreme climate change (Hopkins, 2016).

This thesis explored the politics of the nuclear power industry in Thailand. Aiming to understand why the Thai government continues to consider nuclear as part of its energy supply mix. It used four organising concepts, namely: i) science, technology and social (STS) studies; ii) policy networks; iii) the politics of scale; and iv) discourses and knowledge production (see section 1.3).

The research examined relationships between science, technology and society in which different technological choices create different consequences, impacts and pathways. The research also identified actors and their policy networks, their interests, relationships and history in contests about nuclear power. Policy networks about nuclear power are linked with political power and the interests of actors in favor and against nuclear power, to form coalitions about nuclear energy to frame the discourses of their respective positions. The research also examined the 'politics of scale', involving actors in different positions, and the resources and power they exercise and how they arrange activities to support of their claims in the debate (i.e. national level debates vs local level debates) that influence decision making processes around the nuclear power in Thailand context. Discourses and knowledge production are interrelated elements which actors *"collectively"* produce and politicize in support of their arguments about nuclear power, some in favor and excluded others, such as 'low-carbon' energy, 'zero' carbon emissions, 'reliable' and 'predictable' energy source. The research identified discourses and knowledge production that were in play in the decision-making processes, and assessed why the Thai government is considering nuclear as part of its energy supply mix, including the plan to develop a project in Ubon Ratchathani province.

This thesis argues that science and expert knowledge produced by state has dominated the dissemination of pro-nuclear discourses. In this process, the proportion of resources coming from state are unevenly distributed, so as to bias information for public understanding and gain acceptance on nuclear power. Specifically, large budgets were drawn from the Energy Conservation Fund for nuclear studies during 2008 to 2011, this was a controversial issue that civil society criticized, arguing the fund had been misused.

Knowledge production (as explained in 1.3.4) within the network of selected nuclear experts was facilitated by government agencies, international experts, aid agencies affiliated with the nuclear industry, so as to mould public understanding about the nuclear technology. Opposition to nuclear technology information that was provided by 'nuclear experts', critiques from various public groups, civil society groups and non-governmental organizations, were made in an effort to identify the 'gaps' in knowledge the 'nuclear experts' provided to the public. In response to a range of public concerns, the network of 'nuclear experts', together with the accumulation and uneven concentration of resources, enhanced their power to frame nuclear power as 'clean' technology, a similar to 'clean coal' technology, so as to increase public acceptance as public concerns about environmental and climate change impacts intensified over time.

Nuclear power is also a geopolitical issue, with Vietnam and Cambodia also interested in this technology (but apparently not proceeding at the moment.)

This research recognizes various concerns about nuclear technology that actors shared. Therefore, rather than just repeating pro-nuclear and anti-nuclear debating points, it attempts to address the gaps in the knowledge production process, which was a key part of why and how their arguments were established or excluded. In particular, this thesis tries to encourage a more deliberative environmental governance, where actors can participate in the debates within a fair and pluralistic decision making process about energy policy and planning which has important implications for environmental quality and local community development.

1.2 Research questions and objectives

1.2.1 Research questions

The main research question that this thesis will address is:

- Through the lens of deliberative environmental governance, what knowledge and discourses are shaping the decision on whether Thailand should proceed with a nuclear power station?

In order to answer this question, the following sub-questions are asked:

- Who are key actors involved in producing nuclear knowledge and discourses?
- What are the contesting discourses in the following key debates: Power demand and the role of nuclear; Fukushima; Risk and safety; and Climate change?
- How these knowledge and discourses shaping the decision on whether Thailand should proceed with a nuclear power station in Ubon Ratchathani province?

1.2.2 Research objectives

The main objective of this research is to:

- Analyze the decision-making process, from perspective of deliberative environmental governance, about incorporating nuclear power in Thailand's Power Development Plan was shaped by knowledge production and discourses.

The sub-objectives of this research are to:

- Identify key actors involved in producing nuclear knowledge and discourse.
- Assess gaps in knowledge production by the actors in contesting the Thailand Power Development Plan; Risks and their allocation; the Fukushima disaster; and the suitability of Ubon Ratchathani as a potential site for a nuclear power station.
- Assess power and politics within the nuclear policy networks, so as to understand who influenced the debate most, how this is achieved and why.

1.3 Conceptual framework

This research combined key four concepts to analyze the role of nuclear policy networks, the process of knowledge production, including who were included and excluded in decision making process for incorporating nuclear power into Thailand's energy supply mix. Focusing on this conceptual framework, this research assessed relationships between actors involved in nuclear power, both supporter and opponents. The research further analyzed how the policy networks for nuclear power strategized their claims in their own term for their preferred energy choice. It discusses why deliberative environmental governance should be considered as key element for future inclusion Thailand's power planning so as to increase the quality of the decision-making process.

1.3.1 Science, technology and society

Science, technology and society are interrelated. They are not entirely independent entities that can exist and evolve without human ideologies being embedded in them. Thus, scientific knowledge and ideologies that contributes to technology choices are politicized and contested. The process involves actors (policy networks) making claims and engaging in debate (discourses and knowledge production) when making decisions about a 'preferred technology'. In this debate the anticipated benefits from choice of technology are contested, and this is linked with the power and political-economic relationships of organized actors and networks (politics of scale), that shape societal pathways. (Yoo, 2013) describes this as:

> *"Different technologies create different types of consequences to the environmental as well as society." (p. 27)*

(Jansanoff, 2004) describes it as:

> *"The material and cultural resources with which human actors bring new natural phenomena into view, or seek to domesticate unfamiliar inventions, often exist before the "discovery" of the objects themselves. The design of technology is likewise seldom accidental; it reflects the imaginative faculties, cultural preferences and economic or political resources of their makers and users (Bijker 1997; Bijker et al. 1987 cited in Jasanoff, 2004)" (p. 16)*

In terms of energy technology choices for Thailand, in which the government considers nuclear to be part of the energy supply mix, and drawing on the book *The Politics of Green Transformations (2015)*, the concept of *"green transformation"* is helpful for analyzing the interrelated role and contribution of science, technology and society; how

actor-networks contest ‘energy pathways’, including the tools, strategies, and resources, they use to influence the pathway for their ‘favored-technology’. (Ian Scoones, Peter Newell, & Leach, 2015) explains in this book that:

> *“Contests over pathways are thus not just about end-points, or the role of technology, markets or the state, but also about the knowledge underpinning them. In this sense, the science that is invoked to legitimate calls for green transformations is also a site of political contestation. It does not provide neutral value-free guidance as to what is to be done and by whom (Millstone, this book), even though it may be represented as doing just that. Dig a little deeper and we find the assumptions embodied in understandings of complex processes of (global) environmental change to be subject to scrutiny and dissent (p. 4).”*

As nuclear power is considered as a source of energy for diversifying the national energy mix in the latest Power Development Plan 2015, this concept will be used to analyze the relationships of science, technology and society, through social processes involving the role of ‘experts’, ‘knowledge’, and ‘market’ (including ‘technology’, ‘risk’, ‘climate change’) illustrating technology choices that have implications for Thailand’s energy pathways.

1.3.2 Policy network

Policy networks consist of individual actors and people from within organizations and institutions who have shared sets of interests and are involved, cooperate, and influence policy making to shape a particular policy which they anticipate will benefit them. Within these policy networks, inclusion and exclusion of actors occurs through *“collective action”*. (Peterson, 2003) described ‘network’ as:

> “*Clusters of different kinds of actor who are linked actors together in political, social or economic life. Networks may be loosely structured but still capable of spreading information or engaging in collective action…*”

He further explains policy networks as:

> *“The term policy network connotes ‘a cluster of actors, each of which has an interest, or “stake” in a given… policy sector and the capacity to help determine policy success or failure’”* (Peterson and Bomberg 1999: 8 cited in Peterson, 2003, p. 1).

A ‘policy network’ conceptual framework, is used to explain the relationships of actors for and against nuclear power. This conceptual framework identifies how these policy networks about nuclear power in Thailand are closely linked with shared interests.

These support the main reasoning for their positions, their history in the nuclear industry and the arguments they use to influence debate, more so than other actors and on their own terms.

1.3.3 Politics of scale

Scale refer to the physical spatial of the location where associated policy actors interact, exchanging ideas, information and knowledge, and implementing activities in their own interests. But scale is more than just physical landscape or space where things happen, it is a social construction with a hierarchy of positions and power, where different actors are involved with differing channels to access resources for exercising power and implementing activities in support of their claims in the debate (i.e. national level debates vs local level debates) that influence decision making processes in pursuing particular goals. Concisely, the core meaning of scale, (Louis Lebel, Po Garden, & Imamura, 2005) explained:

> *"Scales are a joint product of social and biophysical processes."*

The politics of scale reflect actor's relationships and the level of effects arising from their involvement in influencing a decision making process through differing strategies, in different contexts and situations. The role of actors is dynamic, as described in the following explanation:

> "*…different social actors constrain, create, and shift scales and levels (Cash et al. in preparation) to serve their own interest (Swynedouw 1997a, b). Actors can change power and authority by working at different spatial levels. They can alter access to resources, and the decision-making processes with respect to those resources. Scale choices can be a means of inclusion and exclusion"(Louis Lebel et al., 2005)*

Policy networks operate across scales to coordinate and facilitate interests between national and local levels. But in the hierarchy of power the higher scale or higher position tends to have more political power and access to the resources. (Sneddon, 2003) draws on Latour (1986) and Murdoch and Marsden (1995, p. 372) to explain that power and scales that is,

> *"…a 'composition' made by many people but attributed to one of them. The amount of power exercised is not related to how much someone `has' but to the number of actors involved in its composition. So power is an outcome of collective action."* (Sneddon, 2003)

This concept will be used to explore how different actors deploy their power of their positions in different contexts, situations and scales, so as to support debates around the potential use of nuclear power in Thailand.

1.3.4 Discourses and knowledge production

The meaning of discourse in (Death, 2015) is explained as follows:

> *"Discourses constitute certain ways of thinking about, representing and acting upon the world (Doty, 1996). Within discourses particular things are made visible and others invisible, truths are created and regimes of knowledge established, practices and technologies are concretised and subjects are produced. Material objects may exist independently of discourse, but it is discourses which give them meaning and significance (Doty, 1996). Discourses are systems of representation that produce meaning itself, or 'practices that systematically form the objects of which they speak' (Foucault, 2002)."*

Concise and comprehensive descriptions of discourses are offered by other scholars:

> *"Discourses are shared sets of concepts, categories and ideas that provide adherents with a framework for making sense of situations, embodying judgments, assumptions, capabilities, dispositions and intentions (Dryzek, 2006 in (Jonh Dore, 2012)."*

"Discourses are powerful" (Dore, Lebel, and Molle, 2012, p.26). Discourses are produced by webs of power based on the interests of different actors and contribute to formulation of *"linguistic and textual styles, classificatory systems and particular discursive formations can be seen to empower some and silence others"* (James Keely & Scoones, 1999). However, discourses are not complete knowledge, thus limitations lie within connotations bringing in contestation from politics of scale where actors in different positions and power coordinate and cooperate to pursue their interest with one another.

As for knowledge production, (Sangkhamanee, 2010) points out that:

> *"When investigating the process of knowledge production, it is important to look at what is being left out, both intentionally and unintentionally, by the application of a rigid methodology defined exclusively within a single approach (p.5)."*

The production of discourses and knowledge production are intertwined process which involves coordinated actors and power to claim their arguments influence the debate in supporting their position. Discourse and knowledge production are the politics of knowledge, which has a shared set of ideas and concepts and power, to frame narratives

of situations that influence our understanding and decision making. Discourses are contestation of power within the actor-networks and the product of policy which is guided by the interests of the actor-networks in shaping one another and influencing the policy making processes (James Keely & Scoones, 1999) (summary).
This concept will be used to assess the process of discourses and knowledge production around nuclear power in Thailand and unpack power relations within it. In the process of discourse and knowledge production, how actors are involved in it and whose roles carry most influence in defining their claims for support for and against nuclear power, and why. This research points out actor-networks that obtain different level of resources, to facilitate production of discourses and the knowledge around the nuclear issue in favor of their vision.

1.4 Methodology

1.4.1 Research site

Nuclear energy was initially included in Power Development Plan (PDP) 2007 and in later PDPs including the more recent PDP 2015. Following this, feasibility study was carried out between 2008-2011 suggested total 17 potential project sites all over the country. EGAT concluded one of the most favourable sites was in Ubon Ratchathani province (Cherid, 2012), near the Thai-Laos border. The proposed site for a nuclear power plant was nearby Kham Khuean Kaew village and Hua Sa Pan village in Kham Khuean Kaeo sub-district, Sirindhorn district, Ubon Ratchathani province. This is about 1 km from the Sirindhorn dam built on Lam Dom Noi River that flows into the Mun River – one of the major tributaries of the Mekong River. This potential site has major Thai-Laos transboundary implications for regional ecological threats and human health risks.

This research conducted case study fieldwork at this location at the community level, to understand what knowledge has been disseminated (to people) and discourses have taken place so as to assess the decision-making process about whether Thailand should proceed with a nuclear power station in Ubon Ratchathani province.

Photo 1: Map of research field work from Google Earth

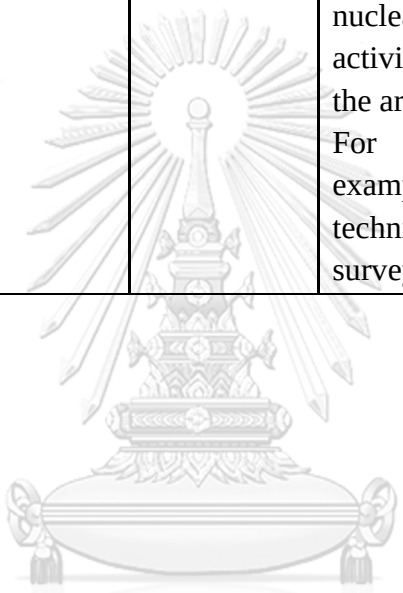
1.4.2 Research overview

Sub question	Data needed	Data source	Research tool	Data analysis
Who are key actors involved in producing nuclear knowledge and discourses?	- Actors involved in nuclear power debates - The type of knowledge they produce - The actors' interests and their main reasoning about nuclear power plant plans in Thailand - Their role and relationship	- Archive review which included, for example, government documents, and review of other research. - In-depth interview with key informants from government sector, academia, NGOs (see table 2)	- Qualitative documentary research - In-depth interview for key informants	- Discourse analysis by looking into framing of nuclear power from different perspectives that gathered from both quantitative documentary research and in-depth interviews with key informants from nuclear institutions, academia in the nuclear field, NGOs/CSOs, and local people in proposed nuclear site in Ubon

	s with others - Their activities and history in the nuclear industry			Ratchathani province
What are the contested nuclear power discourses? What is discussed and what is not discussed between each groups?	- Different typology of knowledge raised by each policy network groups - Assumptions that each groups make in contest of knowledge production, circulation and consumption	- In-depth interview with key informants from government sector, academia, NGOs/CSOs (see table 1) - Archive data review in order to identify discourses being described by each groups.	- In-depth interview with cross-cutting questions based on four themes including: 1) Thai PDP 2) Benefits and risks sharing 3) Fukushima 2011 nuclear accident, and 4) Potential site (Ubon Ratchathani case study)	- Content analysis what knowledge and discourses produced by each groups. For example, how facts/ figures/ statistics are represented by different groups.
What argument and evidence do they develop in each groups, including for the plan to	- Chronology of the recent debate in nuclear power (2007 to present)	- Conducted field work by visiting local community in the proposed nuclear site	- Focus group with villagers in the proposed project site. The researcher	- Responds from villagers about nuclear power are used to identify what knowledge they learned

develop the project in Ubon Ratchathani province?	- What are the official processes underway (laws / rules/ procedures) - What are the key arguments produced by the pro- / anti-nuclear networks and how have they evolved over time? - What studies have been prepared in favor/ against nuclear and the UR site - Whose argument influences the debate more and why?	in Ubon Ratchathani province to gain updated information on the ground. Kham Khuean Kaeo sub-district, Sirindhorn district in Ubon Ratchathani was a proposed area to build nuclear power plant. The EGAT conducted technical survey for the project far from the Sirindhorn reservoir around 1 kilometer.	consulted with local NGOs to help identify initial informants. Then using snowball effect by asking the villagers to recommend other information source that then followed up by in-depth interview with individuals. - Observation around the proposed project area for cross-checking information further if there are more updated information or any contradiction about information gained from	about the nuclear and from which source and how they perceive about it. This is to analyze the relationship of knowledge production process and nuclear policy networks on strategies associated in conveying the nuclear knowledge and their power - Materials produced to convey about the nuclear power is tool for knowledge production. The research used it to analyze content of the material and how it frames the nuclear power that inform nuclear policy networks.

			qualitative document research and in-depth interviews. - Documentation about signs of nuclear activities in the area. For example, technical survey area.		



1.4.3 Research tools

This research used different tools to collect data from both primary and secondary sources including: desk-based qualitative documentary research; interviews with expert; focus group; in-depth interviews; informal interviews and observations. The research tools used are described as below.

1.4.3.1 Desk-based qualitative documentary research

The research gathered data related to nuclear development in Thailand from archival data so as to understand the history and actors involved in the development of nuclear power in Thailand. For example, the archival data used are: Thailand's Power Development Plans, National Economic and Social Development Plans, Atomic Energy for Peace Act, academic papers, NGO reports, news articles, and multimedia publications related to both nuclear power development in Thailand and globally concerning nuclear technology, i.e. nuclear accidents, nuclear proliferation and nuclear waste management.

1.4.3.2 Expert interviews

Expert interviews were carried out to understand the organization of roles in nuclear knowledge production in Thailand. The experts were from academic institutions and non-governmental organizations/civil society organizations working in the energy field, including nuclear power, who provided insightful comments on nuclear discourses produced in the arena of Thailand's Power Development Plan processes.

1.4.3.3 Focus group

A focus group was carried out as a platform to bring local people together, people who agree and disagree about the nuclear power plant project, to share their perspectives and responses on nuclear knowledge they have received, so as to identify what led to inclusion and exclusion of actors in participation and decision making processes about nuclear power plans at local and national level.

1.4.3.4 In-depth interviews

In-depth interviews were conducted with key informants, these included: villagers, local activists, school teacher and local government representatives, so as to understand their roles and relationship as an organizational unit in the production, circulation and consumption of nuclear knowledge and discourses. Key questions for in-depth interview were focused on the nuclear power planning and decision making processes. As nuclear power poses benefits and risks in the local area, these key informants were asked to identify key assumptions that actors make in contesting nuclear knowledge

production, circulation and consumption processes, including mapping their relationships with each other within the ‘nuclear actor-networks’.

1.4.3.5 Informal interview

Informal interviews were conducted to assess the impact of nuclear knowledge, which was produced and disseminated in the local area. Interviewees were selected randomly from around the Sirindhorn dam reservoir area, and further from Kham Kuen Kaeo village and Hua Sa Pan village. Informal interviews were conducted with local business owners, rice farmers and fisher folk, to further identify their perspective on potential impacts such as water management and land use.

1.4.3.6 Observation

An observation approach was used during field work to gain first-hand data on the current situation around the proposed nuclear power plant site in Kham Khuean Kaeo sub-district, Sirindhorn district, Ubon Ratchathani province. In addition, observations were used to gain a better understanding of the real living conditions of the local people, landscape, natural resources, and infrastructure that contribute to nuclear discourses, such as the project benefits and risks that underlie different actors’ role on deliberative environmental governance in the decision making process for nuclear power.

1.4.4 Data collection and sampling

1.4.4.1 Expert interviews

Table 1 Key informants and interviewees

Government The governmental organizations are key actors that involve in nuclear power plant development in Thailand. Their roles include making policy, making regulations, implementing nuclear power plant research and development, and provide training.	• Sirindhorn Dam official, Sirindhorn District, Ubon Ratchathani province • Kham Khuean Kaeo Sub-district Administrative Office, Sirindhorn District, Ubon Ratchathani province • Other local government officials in Sirindhorn District
Academic The academic institutions which have related work and have been involved in nuclear energy issue play important role to inform public about nuclear power development, engage in debates	• Department of Nuclear Engineering, Chulalongkorn University • Energy Research Institute, Chulalongkorn University

about this type of energy, provide expertise knowledge and involve in policy making about national energy planning.	• Faculty of Engineering, Ubon Ratchathani University • College of Medicine and Public Health, Ubon Ratchathani University • Social Sciences Department, Faculty of Liberal Arts, Ubon Ratchathani University
Non-Governmental Organizations/Civil Society Organizations NGOs/CSOs involved in monitoring nuclear power development plan demonstrates different viewpoints about the nuclear energy in Thailand.	• Energy Watch • Greenpeace Southeast Asia • Mekong Energy and Ecology Network (MEE Net) • Local NGOs in Ubon Ratchathani
Villagers Villagers in the nuclear proposed project site are key stakeholder in nuclear energy development. Their perception and perspective regarding the nuclear power reflects how the nuclear knowledge is produced and has influenced their understanding in particular way, what are tools and strategies used, and who includes and excludes in the nuclear knowledge production.	• Kham Khuean Kaeo village • Hua Sa Pan village • Villagers around Sirindhorn dam reservoir

1.4.4.2 Field visits

In this research, field visits were conducted in Kham Kuean Kaew Sub-district, Sirindhorn District, Ubon Ratchathani province to collect data regarding proposed nuclear power plant project there. Two separate trips to the local area were designed in coordination with key informants. Different research tools were employed to collect data in the local area within the scheduled time frame.

The first field visit was conducted on 25-29 June 2017. It began with meeting two local NGOs representatives for informal interviews to gain an overview information about the local situation. Through this initial meeting, the researcher used a 'snow ball' effect approach to identify informants for conducting further in-depth interview with local community members. The researcher then visited Hua Sa Pan and Kham Khuen Kaeo villages, and the proposed nuclear project site to observe the local situation, livelihoods,

landscapes, natural resources, infrastructure and public services (school, public healthcare, hospital, water supply, electricity) in the area. During this visit, informal interviews were conducted with four villagers in the area, so as to gain general responses on the nuclear power project for which they had received information. This was followed by in-depth interviews with other four key informants, including a Kham Khuen Kaeo village head, a Hua Sa Pan village head, a Hua Sa Pan villager and a Kham Khuen Kaeo sub-district organization. In addition, an in-depth interview was conducted with a representative of the Sirindhorn dam to learn about the nuclear power project's background as proposed and its current status, the organization's role regarding the nuclear power plans and relevant activities at the local and national level. The first field visit provided an overview of the situation of the local community, general responses of villagers and background information on the project from relevant government agencies representatives.

The second field visit was conducted on 12-15 July 2017. A focus group was organized at Kham Khuen Kaeo sub-district, participated by 11 community members (3 women and 8 men) from Kham Khuean Kaeo village and Hua Sa Pan village. The participants were selected from a diverse range with roles in the community including village head, village committee representative, village healthcare group representative, farmers and fisher folk. Guideline questions were prepared to structure the discussion so as to gain information on community households, the dynamics of the local situation in response to the proposed nuclear power project site near their homes and identify shared concerns, from those who agreed and disagreed about the nuclear power project. Community mapping was also used as part of the focus group activity to explore the shared ecology of the local area around proposed nuclear power plant site and the project's potential risk to their communities. In-depth interviews were followed up with individuals in order to clarify some points discussed in the group. The researcher also re-visited Sirindhorn dam and conducted another in-depth interview with their staff representative, so as to learn about the dam water management including visiting its solar farm project exhibits for learning about renewable energy type.

1.4.5 Research scope and unit of analysis

The main unit of analysis of this research is at an organizational level, specifically, actors within organizations. It looks at how different actors involved in producing discourses around the nuclear power plants in Thailand (i.e. organization and community group work around nuclear power issue and what kind of knowledge they produce and what relationship they have with one another). The analysis in this research does not include business actors that are involved in questioning plans for nuclear power in Thailand. The research lays out the debates from and between government

officials, academics, NGOs/CSOs and local people's perspectives in response to nuclear knowledge production, from nuclear policy networks.

1.4.6 Research limitations

Unfortunately, it was not possible to interview representatives from the Ministry of Energy, Nuclear Energy Department at the Electricity Generating Authority of Thailand, Ratchaburi Electricity Generating Holding PCL (RATCH), Nuclear Society of Thailand (NST), Office of Atoms for Peace (OAP), Thailand Institute of Nuclear Technology (TINT), and other related agencies. Had this been possible it would have made this research more comprehensive, but. As a substitute published documents and archival (secondary) material was used for analysis of these organizations' positions and policies for analysis.

Nuclear power is a sensitive issue and very dynamic in Thailand. It brings up a wide range of attitudes in support and opposition, and interviewees are often cautious in sharing their opinions. Thus, it is important to be aware that an individual's opinion about nuclear power does not necessarily reflect those of the organization they are working for or representing.

This research was conducted some six years after the proposed nuclear power project in Ubon Ratchathani was a heated issue, i.e. up to 2011. Thus, it reflects the dynamics of the issue itself and local people's perspectives about the current local politics. The research intended to follow up on local people's response to the plans for nuclear in the latest PDP 2015, so as to provide updated information from local area, to combine with archival documents and recent reports.

In the time of writing this research, a plan for a electrical nuclear power plant in Thailand has been included in PDP 2015. The frequency of activity regarding the nuclear power plant project is now less intense following the Fukushima nuclear accident in 2011. Thus the issue remains dynamic and future studies should be encouraged.

1.5 Research ethics

The researcher informed participants of the purpose of this study in both written form and by verbal description prior to conducting interviews. Upon receiving permission from the interviewee(s), the researcher recorded the conversation to ensure that it was noted correctly. For those interviewees who did not want to be recorded, the researcher took detailed notes as much as possible to incorporate it in the research analysis. Data from in-depth interviews is for the purpose of this research only. Privacy has been carefully guarded to ensure personal information, identity and security of the source are protected. Attribution of data sources is based on how they preferred to be identified,

such as full name or anonymity. The researcher will conduct a thorough review prior to finalizing this thesis. The final thesis will be shared to public in full form.

1.6 Significance of problem

One can say that 'nothing in the world is without risk' (Rajesh Basrur, Koh Swee Lean Collin, & Youngho, 2012) (p. 196) when embarking on nuclear technology for electricity generation which claims to be emitting 'low-carbon' to the atmosphere. On the contrary, nuclear technology has downside implications for human health and the environment. The catastrophic effects of failures, from combinations of natural and technological disasters, that happened in Fukushima in 2011, is an example to remind us of risks embedded in the nuclear technology. These contribute to risk to public health and environmental damage associated with long term nuclear waste management. Debates about considering nuclear power for Thailand's national energy supply mix involves politics in producing knowledge to agree and disagree with it. But there is little literature in Thailand that focuses on the politics of policy networks around the nuclear power.

Thus, this research raises questions for further investigation of why nuclear power remains within Thailand national supply energy mix, looking through the lens of deliberative environmental governance on how decisions are made. This research identified actors and assessed the process of decision making about how nuclear power came about to be included in the national energy supply, despite contestation between nuclear actor-networks.

The research enhances our understanding of the role of actors in decision making processes around nuclear power in Thailand's energy system regime and shed some light on gaps in knowledge, these are useful in identifying what has been excluded or is missing in the process.

Energy decisions taken today have implications for present and future generations. It is important that these decisions are understood as public policy decisions and should be as fully informed as possible. Therefore, the research hopes to support and inform more inclusive and deliberative participation regarding energy technology choices for Thailand, given the significant implications of committing to a nuclear energy policy in terms or risks, costs and benefits.

1.7 Thesis structure

Chapter 1 of this thesis lays out the importance of the research topic that seeks to assess why nuclear power has been seen an attractive energy option for incorporating in Thailand's Power Development Plans. It does this by looking at who are the actors involved in process of knowledge production and who have influence over decisions to incorporate it. Among the network of actors, nuclear power has been contested as to whether or not it should proceed.

The first chapter provides the research roadmap consisted of main question and sub-questions, objectives, conceptual framework and methodology toward research findings. Chapter 2 of this thesis is based on literature review which provides historical background of nuclear industry, nuclear policy networks, nuclear discourses, and knowledge gaps that inform how nuclear power has been developed and evolved into Thailand's national energy planning process.

In order to answer the research questions, Chapter 3 explores key nuclear debates and contesting discourses of which nuclear actor-networks have involved in claiming it. Specifically, the nuclear debates and discourses that are contested on power demand and the role of nuclear, lessons learned from Fukushima nuclear accident, nuclear risks and its safety, and questioning the nuclear technology whether or not is can mitigate the climate change.

Chapter 4 focuses data analysis based on field work in Ubon Ratchathani province as potential site proposed for a nuclear power station. Finally, Chapter 5 concludes that deliberative environment for local community regarding proposed nuclear power plant project in Ubon Ratchathani province was insufficient and public engagement was needed to ensure the quality of decision making process.

CHAPTER II LITERATURE REVIEW

2.1 Introduction

First part of this section talks about history of nuclear industry in Thailand which can be traced back since 1950s. The Thai nuclear industry has evolved over time and incorporated in Thailand's PDPs. Second, known policy networks in nuclear industry in Thailand are identified to assess their role in producing nuclear knowledge and discourses. Third, the PDP as an arena where nuclear discourses are contested is discussed. Finally, knowledge gap in nuclear knowledge production is shown through examining relationship of nuclear actor-networks and politics that involved in producing the nuclear discourses.

2.2 History of nuclear industry in Thailand

Nuclear technology initially came to Thailand in the Cold War time through the "Atom for Peace" program promoted by the U.S. in President Dwight Eisenhower (1953-1961) administration. Thailand received technical support from international experts to lay foundation of nuclear knowledge and produce experts in this field. To realize the nuclear technology into one of the national development agenda, Thailand also established its national nuclear agency in late 1950s. Later on, the country passed the Atomic Energy for Peace Act, B.E. 2504 in 1961. After that the Office of Atomic Energy for Peace (OAEP) was established and later was renamed to Office of Atoms for Peace (OAP) in 2002. The OAP is operated under the Ministry of Science and Technology (MOST) and has responsibility to regulate on nuclear safety issue.

Thailand's economic transformation from subsistent agriculture to industrialization since early 1960s requires higher energy consumption to facilitate export oriented market economy. While Thailand's energy demand for economic growth was mainly met by imported petroleum. The first nuclear power plant project in Thailand was also explored since 1966 (IAEA, 2016b).

Peak oil in 1970-1980 effected Thailand economy and urged the country to look for alternative energy sources in order to decrease its major dependent on imported petroleum for economic activities. Admittedly, nuclear energy was suggested as *"one of the most promising sources for electricity generation for meeting the long range energy demand of the country"* (IAEA, 1989) (p. 29). However, construction of nuclear power plant requires numerous investment in order to develop substantial infrastructure, manpower, supporting manufacturing and service industries (component services), quality assurance capability, public utilities, legal context, construction

materials, science and technological bases and public acceptance that (IAEA, 1989) (IAEA, 1989) (p. 29). Adding to the oil crisis, Thailand government approved the first 600 MW Boiling Water Reactor (BWR) nuclear power plant site at Aow Pai, Chonburi province (Patchimpattapong, 2010). The nuclear power plant project was almost construct in early 1976 (IAEA, 1989) (p. 2), but then it was turned down indefinitely in 1978, principally due to concerns over the cost of the investment (Patchimpattapong, 2010); (IAEA, 2016b).

Increased energy demand of Thailand are shared by *"conventional"* energy sources such as series of large dams and coal-fired power plants came together with high voltage transmission network (Foran 2006:13–15 cited in (Middleton, 2016)) (p. 837). The national 'favoured technologies' namely lignite coal, hydropower that Thailand sought to diversity its energy sources were available domestic resources, before proven reserves of natural gas and condensate discovered in the Gulf of Thailand in the early 1980s and could be used in the country's energy mix (Middleton, 2016) (p. 837). But depleting rate of domestic natural gas source which share almost 70 per cent of Thailand's commercial energy is claimed that the country will need energy security by opening up to other potential energy options including nuclear power that continues to be in Thailand's national energy mix policy. At the same time, demand for energy in Thailand is forecasted to increase 7% in the next 20 years ("Asia's Nuclear Energy Growth," 2016), given the reason that Thai government is urged to diversify energy mix which nuclear being an option.

The Seventh NESDP (1992-1996) mentioned about nuclear power for electricity generation as part of the country power development goal, stating 'appropriateness of utilizing nuclear technology for economic, and suggesting to continue public relations for public understanding about the nuclear safety issue.'

In 2007, the National Energy Policy Council (NEPC) issued a resolution no. 9/2550 and agreed on *"complete version of nuclear infrastructure plan for electricity generation"* (NEPC, 2007). Relatedly, Thailand developed Power Development Plan 2007 upon the concern that the natural gas reserves is running out in country in less than 20 years as estimated in 2006 by the Department of Mineral Fuels (IAEA, 2013). For the first time, Thailand incorporated nuclear power plant in the PDP 2007 as one of alternative energy sources to reduce its dependency on fossil fuel (IAEA, 2013).

The PDP 2007 was revised to a second version which published in May 2009. The PDP 2007 (Revision 2: 2007-2021) indicates *"need for nuclear power plants in Thailand"* as an attractive alternative to respond the country's becoming limited in generating electricity in the long term (EGAT, 2009) (p. 33). The nuclear power plant projects of 2,000 MW were included into this power plan.

Under the framework of the Ministry of Energy's policies, the Electricity Authority of Thailand (EGAT) replaced the previous PDP 2007 revisions with *"green"* Power Development Plan 2010 (2010-2030) as to consider adding more *"green"* energy into to power plan, still including nuclear power (IAEA, 2013). The PDP 2010 was revised two times after the Fukushima Daiichi Nuclear Disaster in Japan (IAEA, 2013), hit by tsunami after the Tōhoku earthquake on 11th March 2011. Nuclear power plants plan was rescheduled commercial operation date (SCOD) further by 3 years from 2020 to 2023 as the PDP 2010 was revised to 2nd version. The PDP 2010 was revised and approved to the last 3rd version in June 2010 which postponed nuclear power projects plan for another 3 years from 2020 to 2026. The decision to postpone the nuclear power projects was made upon suggestion of the Ministry of Energy (MoEN) (EGAT, 2012) (p. 1).

During 2008-2011, Thailand revised the PDP many times as well as preparation work to *"go nuclear"* had been done during this period such as working on pre-project phase and feasibility study for preferred sites selection (IAEA, 2016b). Suggested by the International Atomic Energy agency (IAEA) that Thailand is ready to make *"knowledgably commitment"* for nuclear power following the report on Integrated Nuclear Infrastructure Review (INIR) Mission for Thailand conducted in December 2010 and the *"readiness report"* prepared by the Thai government in early 2011 but finally postponed the plan for nuclear power plants after the Fukushima nuclear disaster (IAEA, 2016b).

In late 2014, new PDP 2015 (2015-2036) was formulated given dynamic socio-economic toward ASEAN Economic Community (AEC) (EPPO, 2016). Main focus in the PDP 2015 is to reduce reliance on natural gas and increase so called *"cleaner fuels"* of which mentioned energy types in the plan are such as biomass, *"clean coal"*, nuclear and importing power from neighboring countries (GIZ, 2015) (p. 2). The PDP 2015 continues to include two nuclear power plants with total capacity of 2,000 MW scheduled at the end of the plan in 2035 and 2036, respectively (EGAT, 2015). The electricity generation from nuclear power will share 5% of the national energy mix.

In May 2016, new nuclear bill was proposed by the Ministry of Science and Technology to replace the old Nuclear Energy for Peace Act B.E. 2504 (1961). The military National Council for Peace and Order (NCPO) appointed National Legislative Assembly approved new Nuclear Energy for Peace Act B.E. 2559 (A.D. 2016) in May 2016 (Hopkins, 2016). The new nuclear law was given in effect on the 1st August 2016 and repealed previous laws including: 1) the Atomic Energy for Peace Act, B.E. 2504 (1961) and 2) the Atomic Energy for Peace Act (No. 2), B.E. 2508 (1965).
It is also important to note that the push for nuclear power plants in Thailand since 1960s to the present came under military governments.[1]

[1] Thailand Goes Nuclear: Considerations and Costs by Sheila Bijoor, Palang Thai, 7 August 2007. Retrieved from https://palangthai.wordpress.com/docs/

Table 2: Timeline of nuclear power plant plans in Thailand

1966	• Thailand's first nuclear power plant project was proposed by EGAT
1974	• Proposal of nuclear power plant project of 350-500 MW was approved in Aow Pai, Chonburi province • The project was shelved as natural gas costs drop
1977	• The project was re-proposed by EGAT and approved by the government • The project was pressured by global and public opposition and was canceled
1993	• Nuclear research reactor (5-10 MW) in Ongkarak District, Nakorn Nayok province was proposed by Office of Atomic Energy and Peace (OAEP)
1993-2003	• Ongkarak plans halted multiple times due to safety and environmental problems. 1 US-based General Atomics, contracted to build, threatens legal action for stall in plans
2007	• The 2007 National Power Development Plan (PDP 2007-2021) calls for nuclear energy by 2020. EGAT to invest six billion dollars to build 4,000 MW nuclear power plant • PDP 2007 revision 2 revised nuclear power plant to 2,000 MW in 2020 and 2021
2010	• PDP 2010 (2010-2030) included 5,000 MW of nuclear power plant
2011	• 11 March 2011, Fukushima nuclear accident raised global public concerned about nuclear safety issue • May 2011, cabinet approved PDP 2010 revision 2. Nuclear power plant was revised to 4,000 MW in 2023-2024 and 2027-2028 • 19 June 2012, cabinet approved PDP 2010 revision 3. Nuclear power plant was revised to 2,000 MW in 2026 and 2027
2015	• PDP 2015 (2015-2036) includes 2,000 MW of nuclear power plant in 2035 and 2036
2016	• Nuclear Energy for Peace Act B.E. 2559 (A.D. 2016) was approved by under National Council for Peace and Order (NCPO)

Source: Combined data from online presentations from
https://palangthai.wordpress.com/docs/;
http://www.fnca.mext.go.jp/mini/report/15/Country%20Report_Thailand.pdf

2.3 Known policy networks in nuclear industry in Thailand

Developed to be a distinguish high technology power utility, however, nuclear power is not above politics of knowledge production. Different actors from variety of backgrounds make claims to contest about it. Nuclear knowledge production in Thailand is primarily associated with arguments on electricity need to drive economic activity. The interest in nuclear power in Thailand emerged from engaging in geopolitics in the Cold War period in Southeast Asia. Thailand in 1960s was under military rule when the U.S.'s *"Atom for Peace"* program was introduced to the country. Adopting nuclear power program was political and economic strategy to gain assistance from the U.S. which led Thailand to initiate nuclear expert for its own through receiving technical training and advise from international experts. Alongside during the Cold War period, the country received financial assistance to develop infrastructure that lay foundation to transform itself to become an industrialized one.

Looking back through history of nuclear knowledge production in Thailand and looking through revival of plans in attempt to develop nuclear for electricity generation, it is found that different policy networks and their roles involved in producing different type of nuclear knowledge can be categorized as a group of epitomes. Each epitome group consists of members who have shared values and certain belief in their professional or careers to promote the knowledge they produce.
Contesting claims for expertise and legitimacy of knowledge on nuclear power in Thailand can be seen in 3 forms of competing knowledge including: Science expert knowledge produced by state; Science expert knowledge produced by civil society; and Situational or local knowledge.

2.3.1 Science expert knowledge produced by state

Nuclear is a complex technology that requires large support financially, technically, and legally to construct and maintain in order to monitor security. Policy networks that are established to provide expertise knowledge on nuclear power are closely linked in the top position at policy making level, usually supported and certified by the state as *"nuclear expert"* in providing specific technical knowledge. This nuclear expert network is such as government agencies, academic institutions and private sector. Resources to support promotion of nuclear within this network often get more subsidy from the government whereas non-technical nuclear network usually have different access to other resources or unevenly qualify to access to the same resources where the government has certain preferable selection criteria.

For example, the Electricity Generating Authority of Thailand (EGAT) involved in nuclear power planning process and conducted feasibility study for the first nuclear power project since 1967.

Various private sector actors, most notably Ratchaburi Power, have also promoted nuclear power. As noted in section 1.1, Ratchaburi is already invested into nuclear power in China.

Nuclear Society of Thailand consists of members from academic sector, private sector and interest individuals in providing an exchange knowledge and learning platform for which promote nuclear science, technology, research and applications to Thai public as well as right protection for radiation workers and the public in nuclear related matters. The organization supports human resource development activities in nuclear science and technology towards nuclear national nuclear power planning in nuclear medicine, agriculture, industry, environment, education, and power production. Knowledge production on nuclear science and technology to educate public is disseminated through documents, journals, CD-ROM, VDO, radio broadcasts, television, and website, including seminars and workshops.[2]

Thailand Institute of Nuclear Technology (TINT) is a governmental public organization and a research institution under the Ministry of Science and Technology. The organization is responsible for carrying out research and development programs on nuclear science and technology of the country. TINT provides nuclear knowledge for public education and acceptance on utilization of nuclear technology concerning socio-economic and the environment. Current administration of TINT also includes nuclear research reactor and other nuclear applications. TINT works closely, but independently, with the Office of Atoms for Peace (OAP), the nuclear regulatory body of Thailand and the International Atomic Energy Agency (IAEA).[3]

Expert knowledge is a type of knowledge which considered to engage those who are qualified by training or higher degrees in nuclear related field. Expert knowledge can claim an authoritative power engaging epitome members into high level planning and making policy on energy including incorporating nuclear as one of the option. To clarify the term of expert knowledge in nuclear knowledge production in this regards, it is established by collective of action of group that have shared interest, ideologies, and power in coming together to influence policy making and they are not neutral or scientific that occur by chance (Molle, 2008) (p. 132).

As Thailand has projected its natural gas production decline and power demand growth, the Thailand National Energy Policy Council was prompted to commission a feasibility study for a nuclear power program (Holger Rogner & Nam, 2014) (p. 329). The incorporation of nuclear power in Thailand's Power Development Plan since 2007

[2] More information about the organization is in http://www.nst.or.th/en/nst.html
[3] Nuclear in Thailand (Updated: 20 April 2009). Retrieved from https://nautilus.org/projects/by-name/aus-indo/aust-ind-nuclear1/ind-np-old/asean-nuclear-power/thailand/. (Last accessed, 19 January 2018)

involved network of key nuclear expert actors that have a long history and political connection in energy related field, including access to resources to implement the plan. The Energy Policy and Planning Office (EPPO) set up Nuclear Power Infrastructure Preparation Committee (NPIPC) on 2 March 2007. In the first 3 years from 2008-2010, NPIPC asked for approval of 1,800 million bath of which 75 million bath was used for set up Nuclear Power Program Development Office (NPPDO).[4]

Relatedly, the EGAT is the state-owned power utility that is responsible for national energy planning including energy demand forecast. The EGAT hired the U.S. consulting company Burns and Roe Asia Ltd to conduct feasibility study for nuclear power project. The company was ranked in 2007 by Engineering News Record as the 9th of 25 world leading companies in designing safe power plant that includes fossil power plant. The company is claimed to have a long history working with EGAT since 1980.[5] An article published in Nuclear Society of Thailand website said that the 2- years feasibility study timeframe from 2008 – 2010 cost over $38 million which the fund would also draw from the Energy Conservation Fund of Thailand and the EGAT.[6]

Expert network engaged in the nuclear feasibility study as Thailand revived the plan for nuclear which was proposed to start in PDP 2007. This includes Thailand's first nuclear study program at Faculty of Engineering, Chulalongkorn University. The program was created in collaboration with EGAT and OAEP in 1968 to support EGAT's engineers with orientation knowledge on nuclear for further education abroad specifically on nuclear power plant ("Department of Nuclear Engineering,"). In Early 1970s, the Department of Nuclear Engineering at Chulalongkorn University was created to offer degree in this field (Sirinart Laoharojanaphand et al., 2016).

As an academic institution, the program produces qualified graduates on nuclear physics focusing on nuclear security and safeguards. An article by (Gluckman, 2007) in *Forbes (September 8, 2007)* observed that the program *"'provides the students' only views of nuclear operations and models since its establishment."* In fact, the program sees the importance of equip students with practical knowledge for jobs where nuclear technology is applied in the country such as medical treatment, food preservation, and industry, besides the knowledge on nuclear power plant that has not yet been materialized to date. The department also provides training and collaborates in support of knowledge enhancement to government staffs (e.g. OAP, TINT, and EGAT) and private sector where nuclear knowledge in related field is required such as site selection for potential power plant and fundamental nuclear power information for public and community outreach.

[4] Derived information from http://www.terraper.org/web/th/node/327 and http://www2.eppo.go.th/nepc/kpc/kpc-118.htm

[5] The information was translated from Thai language which cited an article title "Burns and Roe Undertake Feasibility Study for Thailand's Nuclear Power Program" in www.pump-zone.com. This article in Thai language can be accessed at Nuclear Society of Thailand website. Retrieved from http://www.nst.or.th/article/article52/article5209.html (Last accessed, 6 September 2017)

[6] Ibid.

The expert collaboration in producing nuclear knowledge in Thailand is transferred, exchanged, disseminated with support from advanced nuclear international institutions such as: Korea Atomic Energy Research Institute, Korea; Korea Advance Institute of Science and Technology, Korea; Japan Atomic Energy Agency, Japan; Tokyo Institute of Technology, Japan; Tokai University, Japan; National Institute of Radiological Science (NIRS), Japan; Department of Oceanography, Florida State University, USA; Pacific Northwest National Laboratory, Department of Energy, USA.[7] Most of students graduated from this program led to professional in the government institutions such as the Office of Atoms for Peace (OAP), the Electricity Generating Authority of Thailand (EGAT), and number of them play important role in public and private universities in medical science and various industries.[8]

The nuclear expert from network of affiliate institutions continue work in nuclear power program and in many decision-making processes. Many committees were set up including work plan was approved to support nuclear power program by the Thai cabinet after the incorporation of the nuclear power in the PDP 2007 as following[9]:

- The Preliminary Nuclear Power Infrastructure Establishment Plan (NPIEP)
- The establishment of Nuclear Power Program Development Office (NPPDO) under the Ministry of Energy to coordinate the NPIEP implementation
- The work plan and budget for NPPDO and the NPIEP implementation during 2008-2010 (3 years), with an operating budget
- The Final Nuclear Power Infrastructure Establishment Plan (NPIEP)
- The appointment of the Nuclear Power Infrastructure Establishment Coordination Committee (NPIECC)

As Thailand planned on starting nuclear power program, activities in preparation toward nuclear power in *"Milestone 1"* which marked policy decision to "Go Nuclear" with knowledgeable commitment led experts within NPPDO in collaboration with MoEN, OAP and EGAT to organize study trips to learn about nuclear power program in China, Japan, Korea, including attending international conference at IAEA office in Vienna.[10] In the process of knowledge production, allocation of initial budget of 600 million baht to educate and create understanding among Thai people about nuclear power program was approved by Nuclear Power Infrastructure Preparation Committee

[7] Online presentation about Department of Nuclear Engineering
Faculty of Engineering, Chulalongkorn University, Thailand. Retrieved from https://www.iaea.org/nuclearenergy/nuclearknowledge/Events/2015/2015-07-28-31-TM-INMA/Presentation/10-Nilsuwaakosit-Chulalongkom.pdf. (Last accessed, 19 January 2018)
[8] Ibid.
[9] Extracted from online presentation, "Thailand's Preparation for Starting a Nuclear Power Program" by Mr. Pricha Karasuddhi, Technical Advisor Nuclear Power Program Development Office (NPPDO) Ministry of Energy. Retrieved from http://www-pub.iaea.org/mtcd/meetings/PDFplus/2008/35095/p35095/03_PRICHA%20IAEA%20WORKSHOP.ppt. (Last accessed, 19 January 2018)
[10] "IAEA Technical Meeting/Workshop on Topical Issues on Infrastructure Development 9-12 February 2010" by Mr. Chavalit Pichalai, Deputy Director Nuclear Power Program Development Office (NPPDO). Retrieved from http://www-pub.iaea.org/MTCD/Meetings/39798_presentations.asp; http://www-pub.iaea.org/mtcd/meetings/PDFplus/2008/35095/p35095/03_PRICHA%20IAEA%20WORKSHOP.ppt. (Last accessed, 19 January 2018)

that also set up working groups to study about nuclear safety, technical management and economy.[11]

Another key study in preparation for nuclear power in Thailand is Integrated Nuclear Infrastructure Review (INIR) 2010 which was prepared under IAEA guidance in evaluating its status on nuclear program. IAEA's review on the 2010 INIR report gave supportive comment that Thailand is ready to make a *"knowledgeable commitment"* to nuclear power.[12] The comment strengthens the expert knowledge production in support of the nuclear plans in the country as followed by a *"Readiness Report"* 2011 submitted to Thai government to make a decision to *"Go Nuclear"*. Then its original plans for nuclear power project was changed after the Fukushima nuclear accident.

In decision making about incorporating nuclear power in Thailand, expert knowledge production in this regard was facilitated and led by affiliation of policy makers which is considered a closed and dominated network of professions that led to narrow down choices of how decision on nuclear power should be made. Nuclear expert knowledge production in this regards that saw lacks of bottom-up approach where engaging more public representations such as from civil society groups and local communities maybe perceived as risk to face opposition, thus should be minimized. The creation of nuclear expert knowledge in Thailand shown a gap in knowledge that is widen by increase focus on who should be included in the expert network where the knowledge produced there is claimed an authoritative. People outside of the selected expert sphere are often discount from engaging in the creation of knowledge in the beginning. The selected expert in knowledge production therefore established to claim authoritative power towards plans for the nuclear power program for Thailand.

2.3.2 Science expert knowledge produced by civil society

For those who raise questions against nuclear energy, their concerns pointed out to long term hazardous impacts from the nuclear fuel cycle impacting the ecological systems, human health, as well as economic value which requires enormous costs of investment that involve government subsidy from public taxpayers' money in construction of the power plant toward the end of life cycle of the nuclear power plant and its radioactive spent fuel management.

National and local NGOs and local community around potential nuclear sites involved in monitoring the power policy and environmental issue provide critical perspectives to look at nuclear power and in contest with information provided by pro-nuclear. National

[11] "First Thai nuclear plant expected by 2020, The Money Channel, 6 September 2007". Retrieved from https://nautilus.org/projects/by-name/aus-indo/aust-ind-nuclear1/ind-np-old/asean-nuclear-power/thailand/. http://www-pub.iaea.org/mtcd/meetings/PDFplus/2008/35095/p35095/03_PRICHA%20IAEA%20WORKSHOP.ppt. (Last accessed, 19 January 2018)

[12] Country Nuclear Power Profile: Thailand (updated 2016) https://cnpp.iaea.org/countryprofiles/Thailand/Thailand.htm

and local NGOs that are identified their work in monitoring around energy issue including raising concerned questions about nuclear power.

Alternative knowledge which produced by groups outside of government constituency and its affiliated networks, contests with those considered authoritative ones. In questions of those claimed authoritative nuclear expert knowledge, civil society groups play a critical role in providing different point of views as well as alternative information or knowledge to public to engaging debates about the nuclear program in Thailand. This approach encourages bringing about inclusive and deliberative environmental governance in participation from public into the decision-making processes. Co-production of alternative knowledge by engaging in a credible and reliable set of data and perspectives of various independent experts facilitates the process of bringing voices and concerns of people about nuclear power to shed light on what are contested and falsified information and insufficiency points that has not been identified or emphasized. Thus, necessary to bring them out on the table and publicly debate it. In bringing up alternative knowledge production to contest with expert knowledge production, it challenges to narrow gaps in knowledge as would help encourage more discussion, debates into public sphere and further dissemination.

In Thailand context, whilst the government and network of nuclear experts envisage prospect of nuclear power program to move forward, alternative knowledge on nuclear is also produced to equip critical view to local people, stimulating them to engage in debating about it. In particularly, disseminating alternative knowledge is concentrated to local communities where potential sites for nuclear power plants were proposed. In light of simplifying technical knowledge for local people and increasing access to information, different forms of information were provided such as photo exhibition, VDO, reports, newsletter, meeting, and etc.

Criticizing about the cost of investment for nuclear power plant, alternative knowledge produced by NGO such as Greenpeace brought up the issue of economic aspect. Upon the reintroduction of nuclear power to Thailand, a 2007 research report on *"The Economics of Nuclear Power"* was launched by Greenpeace International which was also translated into Thai language. The report was co-produced by international energy and economic experts. Its main argument was impractical and uneconomical viable solution to deal with climate change.

Another report produced by Greenpeace is such as *"Radiation Reloaded: Ecological Impact of the Fukushima Daiichi Nuclear Accident"* based on scientific research in Fukushima prefecture after 5 years that the nuclear disaster happened. This study looks at impacts of the nuclear disaster on ecology due to radioactive contamination in the forests, rivers, floodplains and estuaries of Fukushima prefecture.[13] Another report was also produced by Greenpeace called *"Nuclear scars: The Lasting Legacies of*

[13] Radiation Reloaded: Ecological Impact of the Fukushima Daiichi Nuclear Accident. (2016). Retrieved from https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/gpj-_fukushima-radiation_reloaded_report_issue_040316_lr_2.pdf

Chernobyl and Fukushima" reviewed scientific studies an attempt to reveal health and social impacts from the nuclear disasters on impacted populations in the area.[14]

By reviewing science and expert knowledge produced by state, NGOs provide critical comment and produce argument in questioning about the nuclear power program. NGOs that produce alternative knowledge to contest with the state often seen as against nuclear group. The coalition of against nuclear network is often excluded in the official decision making processes.

The approach and process of alternative knowledge production as oppose to science and expert knowledge produced by state regarding nuclear power program in Thailand shown a process of inclusion and exclusion in using knowledge for decision making process. The alternative knowledge production, in order to remain credibility and independent engages *"state knowledge"* to produce their arguments for public debate.

2.3.3 Situational or local knowledge

There are many forms of knowledge. Situational or local knowledge is one of them. The different forms of knowledge are produced and represented by different actors. These knowledge are often contesting with one another to make its way to claim legitimacy, as (Middleton, 2014) explains that:

> *"There are many forms of knowledge, often with contested claims to legitimacy in the eyes of different actors, ranging from expert (or scientific) knowledge to practical, situational, or sacred forms of knowledge. In other words, how knowledge is framed and represented - and by whom - can reflect its claim to legitimacy."* (p. 5)

Situational or local knowledge can be referred to local people's first-hand experience interacting with natural resources in order to manage their own livelihood interests (Mira Käkönen & Hirsch, 2009) (p. 345). The situational or local knowledge is also associated to particular area where local people have the knowledge about it (Smith, 2011) (p. 595) from their everyday observations that also were passed on beyond the lifetime of the individual (Chan Sokheng et al., 2001) (p. 9).

Regarding nuclear power plant project in Ubon Ratchathani province, the feasibility study was conducted by outsider rather than engaging directly with local people and their local knowledge. The local knowledge that local people accumulate over the period of time and its dynamic contexts of their natural environment or surrounding is considered *"intimate knowledge"* as (Chan Sokheng et al., 2001) pointed out:

---

[14] Nuclear scars: The Lasting Legacies of Chernobyl and Fukushima. (2016). Retrieved from http://www.greenpeace.org/archive-international/en/publications/Campaign-reports/Nuclear-reports/Nuclear-Scars/

> *"One of the major strengths of local ecological knowledge is that it is based on everyday observations, which often reach beyond the lifetime of the individual. Such intimate knowledge about the local environment, and the resources contained within it, is virtually impossible to acquire through conventional research surveys, which very rarely cover even one complete annual cycle."* (p. 9)

Burns and Roe Asia Ltd. was hired to conduct feasibility studies for nuclear power plants in Thailand. The study indicated 5 shortlisted potential nuclear power plant sites. According to a news article by (Thongrung, 2010) in *The Nation* (September 21, 2010), the source from the Energy Ministry said Ubon Ratchathani and Nakhon Sawan were picked as the principal locations of five nuclear power plants.

Technical survey of the potential nuclear power plants were carried out in Sirindhorn District, Ubon Ratchathani province. But local people reported that they were not informed about the project in detail. Local and situational knowledge were technically excluded in the plans for nuclear power projects in this regards. Opposition of the local to the proposed nuclear power projects can also reflect what type of knowledge is legitimized, counted or discounted in the decision making processes. For example, local people experienced with impacts from Sirindhorn dams built in early 1970s located upstream of controversial Pak Mun dam built in 1990s are reminded in their concerns regarding Thailand's plans for 'mega project' like nuclear power plants in the area.

> *"Thailand had a poor record in protecting people affected by mega projects such as Sirindhorn and Pak Moon dams but was eager to adopt more sophisticated technology to produce electricity"* (Ashayagachat, 2011)

Through looking at Thailand's preparation to incorporate nuclear technology for electricity generation, situational or local knowledge of which local people attempt to engaging in their observations in the planning and decision making processes about this energy is seen disrupted to public acceptance. Local communities argued with the state that one-sided and limited information on nuclear was given to them ("Thai Local Communities: Nuclear Power Is Not An Option for Thailand," 2011).

Amidst contestation of different forms of knowledge to debate on sophisticated technology like nuclear power. Situational or local knowledge should be recognized as essential to ensure inclusive public participation where local concerned environmental, social, economic and cultural issues are taken into account. Relatedly, (Chan Sokheng et al., 2001) states that:

> *"In fact, it could be argued that local knowledge and scientific knowledge are basically the same; both attempt to make predictions based on careful*

observations. Whether such observations are undertaken by using expensive electronic equipment or the naked eye does not change their basic aim." (p. 9)

2.4 The Power Development Plan as an arena

Power Development Plan (PDP) is the arena where discourses take place to contest about nuclear power in Thailand. This section reveals roles of different actors and knowledge they produce in order to contest the preference scenario of energy planning for the future. For example, on one side, some actors say Thailand need more electricity. But on the other side, they say Thailand has too much power. These are competing discourses play out in the PDP arena.

Thailand's Power Development Plan (PDP) is the master investment plan for the country's power system development prepared by the state-owned Electricity Generating Authority of Thailand (EGAT) (Chuenchom Sangarasri Greacen & Greacen, 2012b). Based on the load forecast prepared by Thailand Load Forecast Sub-committee (TLFS) under the framework of the Ministry of Energy, the PDP 2007 and its revision versions, is concerned with ensuring reliable power needs, seeking to diversify power sources in order to reduce dependency on imported fossil fuel, purchasing power supply from neighboring countries and meeting envisaged increase of power demand. Previous PDPs before 2007 was a domination of specific professions and techniques in the planning with no public hearings at all (Foran, 2013) (p. 49).

The drafting of the PDP 2007 and in later PDPs organized public hearing. However, no public-wide participation in the planning before the PDPs were initiated. It is considered a top-down process and that nuclear power plant plans were pushed through in the end. Nuclear power reappeared in the national agenda as *"needed long-term energy supply"* (Wassana Nanuam & Wipatayotin, 2007). Conflict of interest and transparency issues were pointed at the EGAT as it is spearhead responsible for the country centralized energy utility system including planning, generation, operation, transmission and distribution – to implement these tasks according to the PDP under the supervision of the Ministry of Energy. As the largest state-owned enterprise in the power industry in Thailand, EGAT possesses value chain with total assets of THB900 billion (*Thai Power Excess Supply Lingers*, 2017) (p. 6). The PDP is then reviewed by a hierarchy of committees chaired by Energy Ministry Permanent Secretary before going through final approval process in charged by higher level decision makers in the National Energy Policy Council (NEPC) and once it is approved by the cabinet, there is no further review (Chuenchom Sangarasri Greacen & Greacen, 2012a) (p. 8). Further critics also highlighted that nuclear power was brought back during the political instability of the interim government of Prime Minister General Surayut Chulanont appointed after the coup took place on 19 September 2006, created limited political climate that restricted free public debate.

The followed PDP in 2010 which was revised 3 times continued to look for nuclear power projects. Under the Prime Minister Abhisit Vejjajiva government the PDP 2010 was introduced as "green PDP" by which promoting renewable energy along with the 15-Year Renewable Energy Development Plan (REDP 2008 - 20212). The ambition for

nuclear power plant in PDP 2010 first revision was increased to 5,000 MW. Then following the 2011 nuclear incident of Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi nuclear power plants in Japan and continuing intense public opposition concerning nuclear disaster risk, the government postponed nuclear power plants plan to review safety, legislation framework, regulatory framework and stakeholder involvement issues (EGAT, 2012)[15] The nuclear plan was reduced to 4,000 MW in the PDP 2010 second revision.

One year passed the Fukushima nuclear accident, the last and third revision of PDP 2010 was agreed by the National Energy Policy Council (NEPC) and then approved by the cabinet in June 2012 under the Prime Minister Yingluck Shinawatra[16] government that came into power from general election in July 3, 2011. The third-revised PDP 2010 (2012-2030) reasoning was claimed for responding to power demand forecast approved by Thailand Load Forecast Subcommittee (TLFS). The electricity demand was associated to number of infrastructure projects that the new government had plans to materialize.[17] The third PDP 2010 revision suggested a tendency to continue a favor for natural gas, coal, and nuclear which contradicted with the previously approved 20-Year Energy Efficiency Development Plan 2011 – 2030, proposed by the MoEN (Prasart Meetam & Kiatiprajuk, 2014). Specifically, it remained optimistic looking forward to nuclear power plants, despite scaled down the plans to 2,000 MW. Given expedited public hearing of the third PDP 2010 revision that was disclosed with a very little relevant information by only a few days before the hearing date took place (Prasart Meetam & Kiatiprajuk, 2014). In other word, its decision making process was technically narrowed down to limit active public participation.

Arguments on energy planning put forth to the most recent PDP 2015 (2015-2036) over the next 21 years timeframe. Its assumptions for electricity demand is based on expected GDP growth estimated by the office of National Economic and Social Development Board (NESDB). In the PDP 2015, one of the key assumptions and frameworks set target for reserve margin not less than 15 percent of the peak power demand (EGAT, 2015) (p. 2-4). But the national reserve margin in 2015 was already 25% more than that of PDP 2015, although decreased from 36% in 2001.[18] The reserve

[15] According to PDP 2010 rev. 3, aftermath of the Fukushima Daiichi Nuclear Power Plants accident, it prompted Thailand to revise the PDP 2010 to the second version and later revised it to the last third version. PDP 2010 (rev. 3) states that: *"PDP2010: Revision 2 was prepared and submitted to the NEPC, and accordingly was approved by the NEPC on 27 April 2011, and endorsed by the Cabinet on 3 May 2011 to shift SCOD of the first unit on nuclear power project forward by 3 years from 2020 to 2023 for the reasons of safety measures review, legislation framework, regulatory framework and stakeholder involvement review as well as additional supporting plans."* (p. 1)

[16] "Govt scales down nuclear plan". 11 June 2012. *Pattaya Mail*. Retrieved from http://www.pattayamail.com/business/govt-scales-down-nuclear-plan-13583. (Last accessed, 19 January 2018)

[17] Ibid.

[18] Grid-Parity Rooftop Solar Project (RRP THA 49087): Sector Overview. *ADB*. Retrieved from https://www.adb.org/sites/default/files/linked-documents/49087-001-so.pdf. (Last accessed 19 January 2018)

margin only set for a minimum percentage without a ceiling (Deetes, 2015). Critically, in some years the reserve margin is set double from the minimum line and set as high as 39.4% in 2024. The future installed capacity which will be doubled to 70,410 megawatts by 2036 as in the PDP 2015 is concerned by academics and civil society that Thailand's PDP process has historically over forecasting of energy demand that led to over-investment on large-scale energy projects that have implication to deteriorating the environment that will further leave burden to the public.

Since PDP 2007 to the current PDP 2015, nuclear power plants plan is maintained at the end. Public participation for the latest PDP 2015 was restricted to voice public concerns. It was formulated under political space limitation in which public hearing was held in August 2014 after three months since the coup took stage (Adam Simpson & Smits, 2016) (p. 303).

The table and graphic below show revisions of nuclear power in different PDPs. The first nuclear power plant in Thailand is expected by 2035 as indicated in nuclear milestones according to IAEA's guideline for nuclear infrastructure development program.

Table 3: Nuclear power plants revision and timeframe in Thailand's PDPs

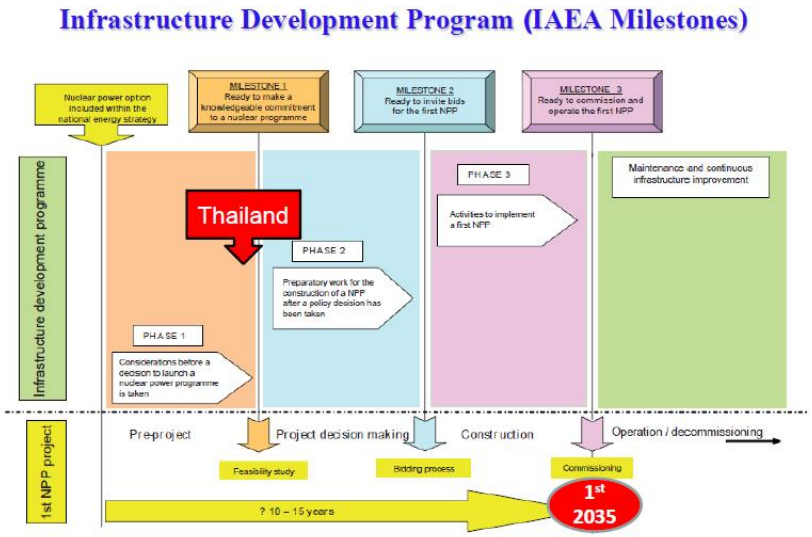
PDP 2007 (2007-2021)	2 x 2,000 MW in 2020 and 2021	Total 4,000 MW
PDP 2007 Revision 2 (2007-2021)[19]	2 x 1,000 MW in 2020 and 2021	Total 2,000 MW
PDP 2010 (2010-2030)[20]	5 x 1,000 MW in 2020-2021, 2024-2025 and 2028	Total 5,000 MW
PDP 2010 (2011-2030) revision 2	4 x 1,000 MW in 2023-2024 and 2027-2028	Total 4,000 MW
PDP 2010 (2012-2030) revision 3[21]	2 x 1,000 MW in 2026 and 2027	Total 2,000 MW
PDP 2015 (2015-2036)	2 x 1,000 MW in 2035 and 2036	Total 2,000 MW

[19] "Nuclear Power Plant Development in Thailand" by Supapol Ratanakorn, Assistant Director, Nuclear Engineering Division, Electricity Generating Authority of Thailand (EGAT), Jan15-16, 2013 Kuala Lumpur, Malaysia. Retrieved from https://www.engerati.com/sites/default/files/Supapol+Ratanakorn.1-17.pdf. (Last accessed, 19 January 2018)

[20] Ibid.

[21] Nuclear power plants plan was postponed for 6 years from the previous schedule in PDP 2010 (rev. 3) to promote public understanding of NPP and fill major gaps identified by INIR mission from IAEA. Also see: Thailand Country Report, the 15th FNCA Ministerial Level Meeting, 19 November 2014, Sydney, Australia. Retrieved from http://www.fnca.mext.go.jp/mini/report/15/Country%20Report_Thailand.pdf. (Last accessed, 19 January 2018)

Figure 1: Milestones of nuclear power program in Thailand



Source: http://www.nst.or.th/jnal/seta2016/04%20Mr.Pricha%20-%20Nuclear%20Power%20Development%20in%20Thailand%20new.pdf

Table 4: Planned nuclear power plants

Planned nuclear power plants				
Station/project name	Type	Capacity (MW)	Expected Construction Start Year	Expected Commercial Year
EGAT Nuclear Power Plant #1	LWR	1,000	2029	2035
EGAT Nuclear Power Plant #2	LWR	1,000	2030	2036

Source: IAEA 2016[22]

The PDPs which also plan for nuclear power plants have been questioned by academics and civil society upon *"closed"* participation process. The PDP was changed 7 times just within 8 years from 2007-2015. Reasoning behind the change each time was made with top-down approach.

[22] Extracted from "Country Nuclear Power Profiles: Thailand (updated 2016)". Retrieved from https://cnpp.iaea.org/countryprofiles/Thailand/Thailand.htm. (Last accessed, 19 January 2018)

It can be summarized that, PDP planning has evolved to organize public hearing, however, the process for engaging public participation is questionable for not genuinely coordinated to prior informing the public in order to integrate comments that satisfy public acceptance before the PDP is approved. Furthermore, the decision on whether or not Thailand should *"Go Nuclear"* was made among policy makers but not widespread public that were engaged and acknowledged about it. Thus actors involved in the PDP to debate about nuclear energy were limited to policy maker who initially proposed for it.

2.5 Knowledge gap

In contrast to other energy sources, like hydropower and coal, there is very little published research at present on the politics of nuclear power in Thailand, both historically and in the contemporary situation. Therefore, beyond the reports in the media, there has not been a systematic study on the actors involved and the policy networks that exist in both positioning to support it and against it. Including, how these actors work together within their networks.

Similarly, whilst the positions and statements of the pro- and against-nuclear groups are regularly reported in the media, there has not been a study analyzing how these discourses are constructed, and the associated knowledge production and power-relations around them. This is a significant knowledge gap when we try to understand why certain actors' arguments are considered legitimate within the policy process, and others discounted, given the high-level stakes around a decision whether Thailand should develop nuclear power or not.

Balancing the potential benefits and trade-offs of nuclear power is politics within processes of knowledge production, circulation and consumption. Framing the risks in nuclear from particular positions both favor and against it suggested gaps in knowledge and high stake entails in the energy type itself. For the country that is considering nuclear power as part of powering economic activities like Thailand amidst growing renewable energy options, nuclear power continues to face on-going debates about risks but remained as, *"an option in the long-term energy strategies for Thailand"* (Chongkum, 2003) (p. 3).

> *"The protest against government NPP plans in Southeast Asia, for instance in Indonesia, and Thailand, illustrate the problem of opacity in decision-making processes which breed skepticism amongst general public, which is both the beneficiary of energy plans and the victim of their negative consequences."* (Rajesh Basrur, Koh Swee Lean Collin, & Youngho, 2012) (p. 198)

Given that information about nuclear energy is often disclosed fragmentedly and incompletely to the public, including regarding individual proposed projects, it weakens the possibility of informed and inclusiveness in decision making processes. This

research therefore will address this gap of knowledge by systematically compiling and assessing the details for the proposed Ubon Ratchathani nuclear power plant.

CHAPTER III EXPLORING KEY NUCLEAR DEBATES AND CONTESTING DISCOURSES

3.1 Introduction

This chapter answers the question: *"what are the contesting discourses in the following key debates: Power demand and the role of nuclear; Fukushima; Risk and safety; and Climate change?*" through points out nuclear power discourses in Thailand and identifies key actors involved in the debates, those promoting and opposing nuclear regarding its benefits and impacts. The debates about nuclear power commenced again in PDP 2007 when it was included in the national energy plan for the first time. Nuclear knowledge production by actors in the network is explained by roles in influencing decision making processes regarding plans for nuclear power in Thailand. However, this chapter argues that the current PDP planning process limits public participation. Indication of nuclear power in following PDPs showed on-going debates which have implications for discourse production and decision making on energy and technology option that are economically and environmentally accepted by public and supported the local needs. This chapter is structured around 4 main debates in section 3.2 Power demand and the role of nuclear; 3.3 Fukushima; 3.4 Risk and Safety; and 3.5 Climate change.

3.2 Power demand and the role of nuclear

Projection of future energy demand in the PDPs is a critical issue monitored by civil society. The study by independent energy experts, contrasts power demand forecast in PDPs, with extensive studies: the *"Proposed Power Development Plan (PDP) 2012 and Framework for Improving Accountability and Performance of Power Sector Planning."* It focuses on previous PDPs' assumptions of exponential growth of power demand, which *"calls for too many power plants, of the wrong kinds (overly risky, expensive, and socially and environmentally destructive)"*(Chuenchom Sangarasri Greacen & Greacen, 2012a) The studies also found the power demand estimated in PDP 2010 over-estimated demand by 13,200 MW. This suggests there is no (or little) need for additional hydropower, coal and nuclear power projects in the future (Deetes, 2015). Emphasizing these miscalculations of future power demand shed light on many unnecessary power projects, an article in *Bangkok Post* ("EGAT's nuclear power plans – a credit train wreck on the horizon," 2009) pointed out that:

> *"EGAT's nuclear power plant plans are predicated on assumptions of soaring demand for electricity."*

Power demand in Thailand has been debated both needed for energy security versus the country already has a lot of power supply and has over estimated for power demand growth. Actor-networks produced knowledge and discourses to support their claims which are contested about the role of nuclear power in Thailand's power demand scenario. The government view that nuclear power is an attractive option to meet

anticipated power demand growth. On the other hand, civil society view that nuclear power is not needed as the country already have too much power.

3.2.1 Thailand's needs nuclear for energy security

Thailand has limited energy resources. Its domestic energy production relies largely on Natural Gas 68%, Crude Oil 13% Lignite 9%, Condensate 8% and Hydro 2%. (EPPO, 2015). Its energy import proportion comprises of crude oil 59%, Coal 19%, Natural Gas 13%, Petroleum Products 7% and Electricity 2% (EPPO, 2015). The country is considered a net energy importer and will remain so in trying to meet exponential forecast of future energy demand (EPPO, 2015).

The country has realized it has become overly dependent on depleting domestic natural gas reserves (as of December 2014) - such as Bong Kot and Erawan gas fields - which are estimated to last for another 16 years (EPPO, 2015) (p. 44). In addition, it forecast that in the next 20 years, Thailand electricity demand will be increased and 70% comes from natural gas ("Asia's Nuclear Energy Growth," 2016), ("Emerging Nuclear Energy Countries," 2017).

There is a perceived risk of an energy crisis which link to the production of knowledge and discourses around it. For example, because of declining domestic energy production and due to over-reliance on natural gas and uncertainty about energy imports from neighboring countries give reasoning for Thailand's energy policy makers to revive nuclear power plans. Emphasizing supposed energy insecurity at the regional level, the tendency is to develop an *"attractive"* nuclear technology for many Southeast Asian states including Thailand. This is concerned with general dependence on fossil fuels in the region, and emphasising the need for more variety in their energy sources (Alistair D.B. Cook & Jamil, 2017) (p. 2).

Thailand's electricity generation predominantly relies on large-scale and centralized systems. Focusing on large-scale energy infrastructure for which baseload plants were designed for centralized electricity generation and distribution. Nuclear power technology is developed as one of the baseload plants that could operate *"full time"* to serve the energy grid (Talisayon, 1989) (p. 16). Nuclear power plants are used only for baseload, considering the long time needed to prepare for operation (Talisayon, 1989) (p. 17). In terms of cost-benefit and in comparison to other baseload plants, such as gas turbine and diesel plants, it is noted that nuclear power is the *"most lumpy"* – minimum plant size 600 MW - even when considering relatively low unit generating costs (Talisayon, 1989) (p. 17).

Continuing projections of escalating energy demand and keeping commercial electricity cost attractive for industries is widely debated. Nuclear power base-load plant is strongly favoured for its potential role to keep electricity generation available for 24 hours/day, according to Mr. Ratanachai Namwong, EGAT's deputy governor of power plant development in *Bangkok Post* reported by (Wangkiat, 2016) that:

> *"We need baseload power plants that can keep electricity available for 24 hours. Coal and nuclear can do that job. The capacity of renewable energy today is not stable enough to cover such high demand."*

Energy security rhetoric is conflated with being in the national interest. Nuclear power is one of the energy choices claiming *"benefits of Thai people"* (Chongkum, 2003) (p. 3). Supporting this claim, Sirinart Laoharojanaphand, vice-president of Nuclear Society of Thailand, as quoted in *Nikkei Asian Review* by (Hopkins, 2016) says:

> *"the nuclear option is reliable, affordable and clean"*

Despite strong assertions that nuclear power can supply Thailand's energy demand with at least 5% of the total energy mix, beginning in 2035 as indicated in PDP 2015, this vision is considered *"overly optimistic"* (Thai Power Excess Supply Lingers, 2017). Debates over whether growing energy demand should be met with large-scale, centralized and complex technology like nuclear power, have questioned key assumptions about nuclear power which underlie actor-networks' assertions about decision making in favour of nuclear power.

3.2.2 Thailand has too much power and does not need more

Thailand current reserve margin is over 15%, this has been criticized alongside over projections of future energy demand. That significantly more electricity will be needed in the future is based on assumptions that the economy will grow without interruption, which is considered not practical or realistic as (Chuenchom Sangarasri Greacen & Greacen, 2012a) study pointed out that Thailand's real economic status and electricity consumption fluctuated due to different factors involved - such as the Asian financial crisis in 1997, Bangkok flood in 2011, peak oil and political upheavals (p. 12) - and was impossible to predict.

Questioning Thailand's over-estimation of electricity demand and plans for nuclear electricity generation, Greenpeace put forward the argument that:

> *"nuclear power is not the answer for the country's power security. …but better energy management was needed" (Bangkok Post,* March 16, 2011*).*[23]

Further points in the debate were that a decentralized power system was safer and cheaper, renewable energy such as wind and solar technologies are increasingly more efficient for producing energy to meet future demand at lower cost than nuclear power. Reviewing and revising demand forecasts, promoting energy efficiency and more

[23] Thai civil groups fight against nuclear plants. *Bangkok Post*, March 16, 3011. Retrieved from https://facthai.wordpress.com/2011/04/04/thai-ngos-fight-nuclear-power-in-wake-of-meltdown-bangkok-post/. The original URL of this news article is http://www.bangkokpost.com/news/local/226890/thai-civil-groups-fight-against-nuclear-plants

renewable energy programs are also necessary and were recommended for the government to invest in (Pachaly, 2011).

> *"…the nuclear option has to be dropped from the Power Development Plan since the risk of nuclear energy is too high. Instead of going nuclear the government should review the demand forecasts and invest in energy efficiency and the promotion of renewable energies."*(Pachaly, 2011)

> *"... nuclear technology is expensive ... the government instead pursue several other technologies that are cheaper and safer."* (Wipatayotin, 2012)

Based on in-depth interviews conducted with academics, NGOs and local people for this research, they shared the following concerns.

> *"Electricity reserve is more than enough. Overestimated of power demand with unnecessary power projects create non-performing asset."* (MEE Net staff, interviewed on 7 July 2017)

> *"Over forecasting power demand in the PDP creates financial burden on people, taking from tax payers' money."* (Researcher at Energy Research Institute, interviewed on 15 July 2017)

> *"We produced energy scenario for Thailand in order to debate for alternative energy policy that is possible without nuclear."* (Greenpeace SE Asia staff, interviewed on 18 July 2017)

Nuclear power raises concerns and debates. It is contested with better management of current power supply can be done including investment on renewable energy at lower cost, so that Thailand does not need nuclear power. The country also have enough power yet over-estimated the power supply plan. It is concerned that adding nuclear power into energy supply mix can lead the country to over investment and leave burden for the public to pay the cost.

3.2.3 Discussion about the power demand and the role of nuclear

Power demand and the role of nuclear has been contested with energy security and overly energy supply from over projection of the power demand in PDP. While nuclear proponent see benefit of nuclear power for national energy security as a large-scale power plant that can operate 24 hours, civil society has argued that there is the need to have a better energy management such as energy conservation and decentralization of the power system to include more renewable energy with cheaper investment cost and improved and increased effectiveness of the power generation. Despite the argument from civil society on over projection in the recent PDP 2015, nuclear power is maintained at the end of the plan in 2035 and 2036. This time frame is suggested that renewable energy which is cheaper and faster to develop can play significant role than nuclear which is more expensive and required longer time to construct. The Thai government already revised Alternative Energy Development Plan (AEDP: 2012-

2022) to achieve 25% of renewable energy within 10 years. The development of renewable energy in Thailand is also increased by 3,000MW exceeding the plans for 2,000MW of two nuclear power project. The growing of renewable energy indicates the potential of decentralizing energy system and replacing nuclear power plans by which Thai government should consider.

3.3. Fukushima

Thailand' plans for nuclear power plant projects in the PDP faces many challenges. The Fukushima Daiichi nuclear power plant's accident following the huge eastern earthquake and tsunami that hit Japan in March 2011 refreshed debates over nuclear safety. On the one hand, highest safety standards are needed in respond to various nuclear accident scenarios. On the other hand, a concerned public have questioned safety management and the cost of having nuclear power plants.

3.3.1 Lessons can be learned for safer nuclear

The Fukushima nuclear disaster in 2011 caused the Thai government to review the nuclear power plant plans and postpone a decision on whether or not to embark nuclear power program. This postponement was to give time to further study and research nuclear safety, nuclear regulation and raise public acceptance.[24]

While there is an indefinite decision on nuclear power plant plans, lessons from the nuclear disaster in Japan have taken this as a case study to prompt Thailand's nuclear power program in the future on safety measures.[25] The magnitude of nuclear accident at the Fukushima Daiichi power plants continues to reveal impacts that need to be learned about. Thailand responded saying its nuclear power development program needed *"maximum safety"* and *"technological development"*, as (Pachaly, 2011) pointed out in the contested nuclear energy discourse.

> *"The Ministry of Energy asked the public not to prejudge nuclear power plants, based on the accidents in Japan, and not to get into the debate if Thailand should or should not go for nuclear, as Thailand's suitability for nuclear energy was still under investigation."*

Thailand acknowledgement of the severity of Fukushima nuclear incident, safety, security and safeguards are stressed in several government statements about strictly following IAEA standards. Three months after the Fukushima disaster, Thailand's statement at the IAEA Ministerial Conference on Nuclear Safety, 20-24 June 2011, Vienna, says:

---

[24] Statement by H.E. Mrs. Nongnuth Phetcharatana, Ambassador and Permanent Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the IAEA Ministerial Conference on Nuclear Safety, 20-24 June 2011, Vienna. Retrieved from http://www-pub.iaea.org/MTCD/meetings/PDFplus/2011/cn200/plenary/p_d2_thailand.pdf. (Last accessed, 19 January 2018)

[25] "Minister: Nuclear study should continue". No dated. *Pattaya Today*. Retrieved from http://pattayatoday.net/news/minister-nuclear-study-should-continue/. (Last accessed, 19 January 2018)

> *"The Fukushima accident and its possible long-term impacts have proved that the safety issue in peaceful uses of nuclear energy is no less important than security and safeguards, and therefore should be duly and adequately attended to. Given the trans-boundary effects of a nuclear accident, nuclear safety requires international and regional coordination and cooperation, as well as robust national implementation of safety measures in accordance with the IAEA."*[26]

In response to nuclear accidents and its trans-boundary impacts, Thailand encouraged *"prompt and systematic information sharing mechanism"* between IAEA and its state members.[27] The information regarding the Fukushima disaster provided and received under Emergency Notification Assistance Convention (ENAC) framework was one such action that Thailand provided to the general public, with hope that they would have *"correct understanding"* about the situation.[28]

Taking this further, Thailand government sees nuclear as an important addition to the future energy supply mix, aiming to decrease reliance on fossil fuel energy sources for meeting national energy needs. It encouraged preparations for improving for nuclear safety, security and safeguards. After the Fukushima disaster, aiming to build rebuild trust in nuclear safety for peaceful purposes by publicising efforts to strengthen *"nuclear safety capabilities"* at national level, by establishing the Nuclear Energy Study and Coordination Office under the Ministry of Energy, to undertake this task.[29] Taking into consideration the nuclear accidents that have happened in the past, including recent years, it has argued the Fukushima disaster was *"partially a result of human error"*, as the report for a New Energy Architecture: Thailand[30] says:

> *"Thailand should consider the recommendations made by the Fukushima Nuclear Accident Independent Investigation Commission (NAICC), with regard to the effective functioning of regulatory bodies."* (p. 44)

The Fukushima nuclear accident can be viewed as a resource for future design of technology to improve responses to nuclear accident that are in reality is unpredictable events that should be understood and prepared for, as each is unique.

> *"The Fukushima nuclear accident was unpredictable. The [nuclear] disaster caused by earthquake followed by tsunami stood higher than predicted back in time when the Fukushima nuclear power plant was designed. … It is impossible*

---

[26] Statement by H.E. Mrs. Nongnuth Phetcharatana, Ambassador and Permanent Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the IAEA Ministerial Conference on Nuclear Safety, 20-24 June 2011, Vienna. Retrieved from http://www-pub.iaea.org/MTCD/meetings/PDFplus/2011/cn200/plenary/p_d2_thailand.pdf. (Last accessed, 19 January 2018)

[27] Ibid.

[28] Ibid.

[29] Statement by H.E. Mr. Somsakdi Suriyawongse, Ambassador, Resident Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the 56th Regular Session of the General Conference of the IAEA, Vienna International Centre, Vienna, 17-21 September 2012. Retrieved from https://www.iaea.org/About/Policy/GC/GC56/Statements/thailand.pdf. (Last accessed, 19 January 2018)

[30] New Energy Architecture: Thailand. Prepared in collaboration with Accenture. October 2012. Retrieved from http://www3.weforum.org/docs/WEF_EN_NewEnergyArchitecture_Thailand_2012.pdf. (Last accessed, 19 January 2018)

> *to know exactly 100% for what [natural] disaster happened millions of year ago would not happen again. But prediction is based on scientific studies and proven statistics that traced back data into the time as much as possible in order to predict probability. Advance science and technology has been improved every day that would fill a [technological] void."* (Professor at Department of Nuclear Engineering, Chulalongkorn University, Interviewed on 7 July 2017)

Improving national policy and legislation on related matters of nuclear technology for safety and security along with developing human resource and raising public awareness and understanding are essential and recommended for countries interested in launching nuclear power programs.

Showing its political commitment for non-proliferation and to ensure nuclear safety, the Thailand Nuclear Energy for Peace Act B.E. 2559 (2016) was approved on 1st August 2016, reaffirming the importance of *"nuclear energy and radiation for the peaceful purpose"*.[31] This revision of national nuclear regulations was considered essential to support Thailand remaining up-to-date with international nuclear safety standards and instruments in a *"speedy manner."*[32]

Thailand's role in supporting nuclear energy for peaceful utilization, to rebuild general public confidence in nuclear safety after the Fukushima disaster, also includes *"transparent information sharing"* in preparation for a nuclear power development program for *"peaceful uses of nuclear energy"*[33] through promoting many collaboration programs at ASEAN regional level. It states that:

> *"Since the use of nuclear energy has been on the increase in various areas, it is important to promote trust and transparency in nuclear activities, as well as to build confidence in the safe, secure and peaceful use of nuclear energy, amongst countries in the region."*[34]

Thailand is a founding member of ASEAN Network of Nuclear Regulatory Bodies or Relevant Authorities (ASEANTOM). It aims to promote nuclear safety, security, and safeguards in Southeast Asia.[35] The ASEANTOM members, agreed on the following

---

[31] Under chapter 1 of general provisions in "Section 6" of Nuclear Energy for Peace Act B.E. 2559 (2016) (Unofficial Translation), states that: "The purpose of this Act is to regulate the activities associated with nuclear energy and radiation for the peaceful purpose, in order to adequately provide safety, security, and safeguards for public and environmental protection against harmful nuclear and radiation effects." Retrieved from http://www.oap.go.th/images/documents/about-us/regulations/unofficial-translation-nuclear-energy-for-peace-act-2016.pdf. (Last accessed, 19 January 2018)

[32] Thailand's Statement by Dr. Atchara Wongsaengchan, Secretary-General, Office of Atoms for Peace, at the 61th Regular Session of the General Conference of the IAEA, Vienna International Centre, Wednesday, 20 September 2017. Retrieved from https://www.iaea.org/sites/default/files/gc61-thailand-statement.pdf

[33] Statement by H.E. Mrs. Nongnuth Phetcharatana, Ambassador and Permanent Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the IAEA Ministerial Conference on Nuclear Safety, 20-24 June 2011, Vienna. Retrieved from http://www-pub.iaea.org/MTCD/meetings/PDFplus/2011/cn200/plenary/p_d2_thailand.pdf. (Last accessed, 19 January 2018)

[34] Ibid.

[35] Thailand's Statement by H.E. Songsak Saicheua, Ambassador and Resident Representative of Thailand to the IAEA, at the International Ministerial Conference on Nuclear Power in the 21st Century, Abu Dhabi, 30 October -

areas: (1) emergency preparedness and response, (2) environmental radiation monitoring, (3) nuclear security, and (4) nuclear safety.[36] This ASEANTOM network also draws upon the 1971 Treaty on Southeast Asia Nuclear Weapon-Free Zone (SEANWFZ) which emphasizes the peaceful use of nuclear material and facilities and none prejudice on "*the right of the States Parties to use nuclear energy in particular for their economic development and social progres*s" (Article 4).[37]

Another network to highlight the importance of nuclear safety at the regional level is ASEAN Network for Nuclear Power Safety Research (ASEAN2NPSR). This network was initiated by Thailand Institute of Nuclear Technology, it aims to expand research and human development cooperation on nuclear safety[38], which will support future nuclear power programs in Southeast Asia.[39] These networks, not only underlie building and expanding the culture of safety regarding nuclear applications, it includes desirable use of nuclear power in a peaceful manner.

3.3.2 Fukushima shows that nuclear can never be safe

Knowledge producing network around Fukushima and the discourse they produced have been contested. Actor-network also view Fukushima disaster that it was a *"wake-up call"* on nuclear safety. It emphasised that nuclear energy is an "*inherent[ly] danger[ous]"* technology (Wangkiat, 2016) which often that the government sees the need for nuclear security and safety mechanisms throughout its fuel process, so that any possible disaster may be mitigated. Thus, it can never be guaranteed for 100% safe. The Fukushima disaster can be viewed as a combination of the uncertainties of a natural disaster prone area and human decisions about siting in the first place. The combined dangers of a magnitude 9 Richter earthquake, a 14 metre high tsunami and nuclear catastrophe occurring together was *"underestimated"* as IAEA observed, with regard to regulations needed for *"sufficient protection"* to deal with these risks (Rajesh Basrur, Koh Swee Lean Collin, & Youngho, 2012) (p. 194).

Thailand's plans to incorporate nuclear power in its national fuel supply mix brings safety concerns to both state and civil society.

1 November 2017. Retrieved from https://www.iaea.org/sites/default/files/cn-247-thailand-statement.pdf. (Last accessed, 19 January 2018)

[36] Nuclear Safety and Cooperation in ASEAN. 28 October 2016 (p. 10). Retrieved from https://www.rsis.edu.sg/wp-content/uploads/2016/11/RT@SIEW-2016-final.pdf (Last accessed, 19 January 2018)

[37] Treaty on the Southeast Asia Nuclear Weapon-Free Zone. *ASEAN*. Retrieved from http://asean.org/?static_post=treaty-on-the-southeast-asia-nuclear-weapon-free-zone. (Last accessed, 19 January 2018)

[38] Statement by H.E. Mr. Arthayudh Srisamoot, Ambassador and Resident Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the 60th Regular Session of the General Conference of the IAEA, Vienna International Centre, Vienna, 26-30 September 2016. Retrieved from https://www.iaea.org/sites/default/files/16/09/thailand2016.pdf. (Last accessed, 19 January 2018)

[39] Thailand's Statement by Dr. Atchara Wongsaengchan, Secretary-General, Office of Atoms for Peace, at the 61th Regular Session of the General Conference of the IAEA, Vienna International Centre, Wednesday, 20 September 2017. Retrieved from https://www.iaea.org/sites/default/files/gc61-thailand-statement.pdf. (Last accessed, 19 January 2018)

Recognizing this, the Thai government is concerned about direct impacts of nuclear accidents on people's lives, through to food safety and health risks in the longer term, and these should have top priority in all country's nuclear crisis management plans.[40] At the same time, emphasizing this Fukushima nuclear disaster, it shows the inability to control future nuclear crisis even when such a scenario was anticipated.

Different types of knowledge produced by actor-networks invoked their views on the disaster exploded at the Fukushima Daiichi nuclear power plants.

Civil society in Thailand saw the nuclear catastrophe at Fukushima as a *"potential danger"* (Ashayagachat, 2011) for what could happen in Thailand with a different scenario in a natural disaster prone area, where state authorities' capacity for handling nuclear safety is of concern.

Furthermore, Fukushima disaster confirmed that nuclear safety can never be totally safe, and people are aware of the risks involved.

> *"When the Fukushima disaster happened, the debate that says nuclear is safe is over. The Fukushima disaster made the government then cut down nuclear power plant plans to 2,000MW in the PDP [2010 revision 3]. … Before the Fukushima disaster, nuclear technology was repeated in many official documents that it is safe. After the Fukushima disaster, the belief that nuclear is safe was collapsed. People who previously received information that nuclear is safe realized that it is not true. They disbelieve it anymore."* – Greenpeace Southeast Asia staff (interviewed on 18 July 2017)

> *"Fukushima disaster reminds us of nuclear insecurity. It's not just about tsunami and accident. The disaster that happened, even in Japan shows that consequence problems are difficult to deal with. The nuclear accident shows unimaginable loss. Yes, you can say that nuclear power is advance technology. It is the same advanced technology developed decades ago that went to explosion. No one knows when this technology will be triggered into a time bomb. … This is what we already know. It should be realized more that [nuclear disaster] problems remained to deal with like a vicious cycle."* – Local NGO in Ubon Ratchathani, no. 3# (interviewed on 28 June 2017)

The Fukushima nuclear disaster raises awareness on nuclear safety for both state and civil society. The government was urged by the disaster to reduce nuclear power plant plans and further emphasize the need to ensure safety. On the other hand, civil society is also concerned that accident-like Fukushima should be viewed as precautionary approach for Thailand regarding its plans for nuclear power.

---

[40] Statement by H.E. Mrs. Nongnuth Phetcharatana, Ambassador and Permanent Representative of Thailand to the International Atomic Energy Agency, Head of the Thai Delegation at the IAEA Ministerial Conference on Nuclear Safety, 20-24 June 2011, Vienna. Retrieved from http://www-pub.iaea.org/MTCD/meetings/PDFplus/2011/cn200/plenary/p_d2_thailand.pdf. (Last accessed, 19 January 2018)

3.3.3 Discussion how the Fukushima debate interact

Discourses produced by actors around nuclear disaster at Fukushima Daiichi has been contested. Before the Fukushima disaster, Thai government was enthusiastic to proceed construction of nuclear power plant. After the Fukushima disaster, the government decided to postpone the nuclear power plant plan to later years to review safety concerns raised by public in the country and international community. On the one hand, it shows that there is a stronger emphasis on nuclear safety. On the other hand, the Fukushima disaster shows severity of the technology through accident with long-term impacts to ecology and human health that investigation on this issue has been continued in Japan. Despite concerns from public about Fukushima negative impact, nuclear power has remained in the most recent PDP 2015. The interaction of actors involved in debate about Fukushima disaster is uneven where policy maker maintains nuclear in the national energy planning while there is a call from civil society and local people in Ubon Ratchathani to removed it.

3.4 Risk and Safety

The complexity of nuclear technology as large-scale power infrastructure requires stringent management to mitigate security risks. Different actors perceive risk and safety associated with nuclear power differently, they debate how risk should be dealt with - either it can be managed or it cannot be managed.

3.4.1 Risk from nuclear technology can be managed

Those actors such as Thai government that view nuclear power as an ‘improved safety’ technology are likely to support utilization of nuclear energy for peaceful purposes. Pro-nuclear groups emphasize benefits such as electricity generation, and emphasize the stringent safety and safeguards in place for operation, maintenance and decommission. *“Safety culture”* is emphasized as a key value to prevent potential harm related to nuclear utilization due to nuclear proliferation, nuclear accidents and disasters, and management of radioactive waste in the long-term. Perceptions of risks associated with nuclear technology that can be managed are framed in some of the following discourses.

Safety, security and peaceful implementation of nuclear power is an essential criteria for countries that own civilian nuclear power plants and for those interested in pursuing it in the future. Despite the major risks of the use of nuclear power for electricity generation laid out throughout the history of its technological evolution, risks stemmed from nuclear power is perceived and framed in various ways by different actors toward risks management of the existing nuclear power plants and new nuclear plans. Thailand faces a rough road ahead before its plans for nuclear power can be materialized (Rajesh

Basrur, Koh Swee Lean Collin, & Kemburi, 2012) (p. 12), given the opposition by a public concerned with its risks.

Prevention of risk is framed through supporting *"knowledgeable commitment"* to nuclear power, as suggested in the Integrated Nuclear Infrastructure Review (INIR) Mission for Thailand, conducted in December 2010 (IAEA, 2016b), which prepared a *"readiness report"* for the Thai government in early 2011, before Fukushima nuclear disaster, for nuclear plans in Thailand.

Minimization of risk is framed as guaranteed by *"advanced technology"* for those in favor of nuclear power. Public understanding about nuclear safety gained from lessons learned in other countries experienced with nuclear power is viewed as necessary. Relatedly, the *"appropriateness"* of utilizing nuclear power was stated in the Seventh National Economic and Social Development Plan (1992-1996) as part of the country's goal for economic development.

Unavoidable risk from nuclear power is stark. 'Nothing in the world is without risk' (Rajesh Basrur, Koh Swee Lean Collin, & Youngho, 2012) (p, 196). In this regard, nuclear power is framed as *"facing the trade-offs"* exchanging potential benefits, specifically in terms of commercial electricity generation which entails environmental costs affecting human health, through to dealing with various levels and forms of radioactive contamination.

Thailand submitted a statement on ASEAN candidacy for the United Nations Security Council on 30 April 2015 to address political commitments in four main areas regarding nuclear power including: 1) Nuclear Disarmament, 2) Nuclear Weapons Free Zones (NWFZs), 3) Non-proliferation and, 4) Peaceful Use of Nuclear Energy.[41] In the 2016 Nuclear Security Summit in Washington D.C., Thailand's statement also emphasized the need to build a global nuclear security culture.[42]

Safety culture is highlighted in promotion of peaceful use of nuclear energy. At the consultative meeting on *"[Draft] Study on Readiness Preparation for the Safe Utilization of Nuclear Energy for Electricity Generation"* on 27 March 2017 identified 19 key aspects of which are guidance of IAEA that need to be considered in preparation for nuclear power projects. These include: 1) National Position 2) Nuclear safety 3)

[41] Statement by His Excellency Mr. Chayapan Bamrungphong, Ambassador and Deputy Permanent Representative, Chargé d'affaires a.i. of the Kingdom of Thailand to the United Nations at the General Debate of the 2015 Review Conference of the Treaty on the Non-proliferation of Nuclear Weapons, New York, 30 April 2015. Retrieved from http://www.un.org/en/conf/npt/2015/statements/pdf/TH_en.pdf. (Last accessed, 19 January 2018)

[42] National statement: Thailand. 1 April 2016. *2016 Nuclear Security Summit*. Retrieved from http://www.nss2016.org/document-center-docs/2016/4/1/national-statement-thailand (Last accessed, 19 January 2018)

Management 4) Funding and Financing 5) Legislative Framework 6) Safeguards 7) Radiation protection 8) Regulatory Framework 9) Electric grid 10) Human resources development 11) Stakeholder involvement 12) Site and supporting facilities 13) Environmental protection 14) Emergency planning 15) Security and physical protection 16) Nuclear fuel cycle 17) Radioactive waste 18) Industrial involvement and 19) Procurement.[43]

The 18-month study from January 2016-July 2017, a collaboration project funded by EGAT and Thailand Research Fund, points out the importance of a *"safety philosophy"* regarding nuclear power. This is to be promoted through exchange learning activities to increase public understanding of nuclear safety, before a decision is made whether or not nuclear power will be chosen. The study mentions, after a decision for nuclear power is made, the need for continuity of promoting nuclear safety in the mandate for staff in all related agencies, to ensure safe utilization of the first nuclear power plant in Thailand.

Concerns about radiation release during operation of a nuclear power plant is regarded as minimal during normal operations. Large radioactivity releases that could occur during a nuclear accident, however, are regarded as *"low possibility"*. Risk in regards to accumulation of *"low level"* radioactivity, however, can cause damage to human health over the period of time with implications for gene mutation or cancer – was not regarded as relevant in this context.

> *"Nuclear is green energy emitting no carbon. Nuclear fusion is advanced technology than the old nuclear fission technology of which contaminated radioactivity is measured at harmful level."* – Consultative Meeting participant (27 March 2017)[44]

Nuclear safety is strongly debated due to its large-scale baseload power plant that runs full time in normal operation and required high safety management throughout the operation process.

> *"There was a debate about whether or not nuclear power is safe. Local people were given information that compare level of radiation outside of nuclear power plant and radiation level from x-ray machine. When people asked whether or not nuclear power plant is safe, nuclear proponent said that radiation from nuclear power plant is not a problem. Scientifically, it's true that radiation dose*

[43] International Atomic Energy Agency. (2015). Milestones in the Development of a National Infrastructure for Nuclear Power. Vienna: IAEA. Retrieved from http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1704_web.pdf (Last accessed, 19 January 2018)

[44] Summary note by the author from consultative meeting on "[Draft] Study on Readiness Preparation for the Safe Utilization of Nuclear Energy for Electricity Generation" on 27 March 2017 at Century Park Hotel, Bangkok.

> *received from the x-ray machine per year is more than radiation controlled outside nuclear power plant. But the way the information is communicated like this is distortion. It is not complete. The thing is that nuclear power plant is not the x-ray machine for health assessment. Local people were confused by the given information."* – Greenpeace Southeast Asia staff (interviewed on 18 July 2017)

In terms of radioactive waste management, the IAEA (2015) report identifies six different levels of radioactivity. Of which three levels of radioactive waste, including 1) low level waste (LLW) 2) intermediate level waste (MLW) and 3) high level waste (HLW), require particular consideration for nuclear power program infrastructure. The other three levels are exempt waste, very short lived waste and very low level waste (IAEA, 2015) (p. 56 - footnote). Especially for high level waste, deep geology disposal is the most common method recommended, although there is no disposal facility for it yet in operation (IAEA, 2015) (p. 57). Adding to the risks from nuclear waste, optimism about long term economic management for 50-100 years, is suggested for interim storage, either onsite or in dedicated facilities (Rethinaraj, 2012) (p. 83).

> *"Nuclear is the least harmful to the environment."* – Consultative Meeting participant (27 March 2017)[45]

Viewing risk and safety in nuclear that it can be managed suggested that safety culture is essential and must be put in pace to achieve this goal or can mitigate the risk. It is debated that, however, risk can extend in longer term from operating of the nuclear power plant despite safety measures.

3.4.2 Risk from nuclear technology cannot be managed

An insecure future is emphasized as a question for nuclear power, especially by those who view it as a dangerous technology whose risks cannot be avoided and are 'unimaginable'. Nuclear power has been critiqued for the high cost of investment, operations, risk management and radioactive waste management in the future. Although different safety methods for dealing with hazardous nuclear waste have been studied and implemented, there is no 100% guaranteed way to prevent radioactive leaks. Emphasizing the risks from nuclear power, anti-nuclear actors point out that nuclear safety is *"illusion"* which takes into account the cost of ensuring nuclear accident will not happen but is an unknown.[46]

---

[45] Summary note by the author from consultative meeting on "[Draft] Study on Readiness Preparation for the Safe Utilization of Nuclear Energy for Electricity Generation" on 27 March 2017 at Century Park Hotel, Bangkok.
[46] France 24 (2015, March 3). Nuclear energy under the microscope. Retrieved from http://www.france24.com/en/20110315-nuclear-energy-under-microscope-after-japan-crisis

Nuclear power has been justified as being environmentally *"green"*, however (Foran, 2013) points out further risk assessment of is needed:

> *"Meanwhile, Thailand's turn to nuclear power has been justified as "green" response to limiting greenhouse gas emissions. We need a better understanding of the risks and opportunities of nuclear power expansion in capacity-limited countries such as Thailand. Finally, those theoretically inclined will want a better understanding of the socio-political pathways by which new knowledge competes with existing discourses in struggles that may lead to less unsustainable policy and practice (Foran 2007).*" (Foran, 2013) (p. 68)

For large-scale electricity generation, nuclear power is *"not without serious and unavoidable environmental impacts"* (Talisayon, 1989) (p. 90). What we leave to future generations is safe management nuclear waste, for which methods and locations for permanent storage are a *"practically an insurmountable problem"* (Cooper, 1978 cited in (Talisayon, 1989), p. 91).

In having nuclear power, nuclear accidents and nuclear arms proliferation are concerns that the anti-nuclear network often points out. Primarily, these concerns come from memories of the devastating loss of life linked to nuclear bombs and radiation exposure in the past. Only 5-10 kg of Uranium 235 are required to make a nuclear weapon (Goldemberg et al. 1985 cited in (Talisayon, 1989), p. 91).

Considering previous accidents, nuclear safety has become an increasingly important issue resulting in increasing construction time and costs. The study *"The World Nuclear Industry Status Report 2014"* (Mycle Schneider et al., 2014) pointed out that:

> *"The reasons for gradually increasing construction times are not well understood. It is clear that continuously increasing safety requirements and, in some countries, lengthy legal cases due to public opposition have played a role. Growing system complexity as a consequence of the previous conditions is also likely to have affected construction times and costs."* (Mycle Schneider et al., 2014) (p. 32)

> *"Despite this nuclear power is built. It is a burden and not profitable. It is a stranded asset that we don't know who will have to pay in the future. … in Nakhon Sawan and Chainart [two of proposed nuclear sites] – located right on the Chao Phraya River bank, the villagers were worried with unclarified nuclear safety. The government engineer said it is 100% safe. But nuclear accident that happened around the world especially the case of Chernobyl still haunt people."* – Greenpeace Southeast Asia staff (interviewed on 18 July 2017)

Public health risks are a concern of civil society groups advocating sustainable energy, concerning release of radioactivity release from nuclear power operations. The credibility of radioactivity in safe levels remains questionable.

> *"Impacts of radiation from [nuclear] accidents were not explained by the [nuclear] proponent. They emphasize that radioactivity is under safety level but there was no evidence to clarify what they claimed. They keep talking about nuclear [power] produces low-carbon, nuclear is cheap. It is not true."* – Energy Watch staff (interviewed on 9 June 2017)

In terms of the claim that nuclear power is *"safer"* due to improvements in the new third generation nuclear technological. Most nuclear power plant in operation at present are still older second generation technology, such as used at Fukushima Diichi, which proved its safety has limitation in response to disaster risks from earthquake and tsunami wave in 2011. Newer, third generation technology has been mostly been built in China. In contrast, aging nuclear power plants are now being decommissioned and building new nuclear power plants face controversy about the size of the investment in many countries, including the biggest nuclear power country such as the U.S. commitments to phasing out the nuclear power due to the growing capacity of renewable energy are being made by such countries as Germany.

In the Thai context, safety culture is needed to promote and practiced. Whist nuclear technology is used in Thailand for industrial, medical, and agricultural sectors, current regulation framework to monitor use of nuclear technology and its safety has been their subject of complaints. Over the past 20 years, since the *"Cobalt-60"* case happened (also see (Rajesh, 2001)[47], there has been slow progress in regulating radioactivity. In addition, there are only limited empts to engage the public in drafting related nuclear laws. Despite this, the country has plans to incorporate nuclear power, raising many concerns on long-term risks.

This is also about economic risks, as well as nuclear power is not 'cheap energy'. Although promoted as *"low-carbon"* and justified as *"green"* technological choice for tempting the Thai government to pursue it for electricity generation. Advocates for renewable energy, specifically solar and wind, that have been developed in Thailand are already considerable and growing, well despite being promoted as being limited when compared to *"centralized"* energy systems, and have restricted advancement of renewable energy generation.

> *"…Globally, it is clear that the energy trend is moving toward renewable energy. Nuclear power creates problems that is complicated to be solved. It will leave burden to the next generation. Resources should be put into supporting development of renewable energy further."* – Energy Watch staff (interviewed on 9 June 2017)

[47] See also http://www.terraper.org/web/sites/default/files/key-issues-content/1283859223_en.pdf

The risks of nuclear power framed around ‘preventable scenarios’ should not be underestimated in anticipating possible disasters associated with the nuclear energy. Risks of nuclear power are framed within the politics of knowledge production, circulation and consumption, which influence debates about choice of *“green”* technology. Considering the risks of nuclear power, (Blowers, 2007) points to trade-offs such as the following:

> *“The danger is that by focusing on nuclear we refrain from recognizing the scale of the challenge we face and shirk our responsibility for dealing with it.”* (p. xviii).

Warning about downside of nuclear power further, described by Robert Jungk (1979), cited in (Nuttall, 2007):

> *“… A peculiarity of atomic development stems from the fact that it can be arrested only up to the point of no-return. Once that point is reached it is impossible to stop. This irreversibility is an entirely new phenomenon in history… When the number of installations and waste disposal units has passed a certain stage, the necessity for strict surveillance and control will leave their mark permanently on the political climate.”* (p. 224).

Nuclear power is contested issue. Different actors view nuclear power based on information produced and circulated by actor-networks they interact with.

3.4.3 Discussion how risk and safety debate interact

Risk from nuclear is contested with safety standards that can be controlled by human and risk that is seen as unknown future that is difficult to control. Actors who perceive risk that can be manage tend to view nuclear power as an attractive choice that can serve the demand for large-scale electricity. On the opposite side, although risk from nuclear can be dealt with at some point in nuclear operation, the magnitude of risk from nuclear can be intensified and extended onto the future that is more complicated to deal with. Thus risk from nuclear is something uncertain and difficult to handle no matter viewing it from which side. Actors make claim on how risk can be dealt with based on either their direct experience or perception of how it is important or how close it is to their life. The Thai government have shown the vision to deal with risk from nuclear through its political commitment nuclear safety to UN which includes 1) Nuclear Disarmament, 2) Nuclear Weapons Free Zones (NWFZs), 3) Non-proliferation and, 4) Peaceful Use of Nuclear Energy. Whilst Thai civil society have challenged the debate on perception of risk from nuclear that radiation issue has been emphasized as under safety control but the negative impacts of it has been little discussed by nuclear proponent. The debates about risk and safety from nuclear has shown little interaction by pro-nuclear and against nuclear actors. Despite the both sides of actor have acknowledged that there are risks from nuclear power, they tend to hold on different believe that risk can be manage by safety control which is in contrast to risk that is too complicated to be managed.

3.5 Climate change

Global climate change has become a real threat to human security and is a cross-cutting and pressing issue that global governments and their citizen have been urged to address and mitigate. Referring to nuclear power as a *"low carbon"* energy technology alternative to fossil fuels and comparing it with other emerging technologies such as solar and wind, has been part of a continuing debate about which way is more effective and sustainable to slow global climate change. At the same time, the increases demand for energy by the world's growing population also needs to be satisfied.

In Thailand, nuclear power is debated for both a solution to mitigate global climate change and on the other hand it is not. Nuclear actor-networks in Thailand contest with discourses and knowledge they produced to support their claims. At the international level, the nuclear discourse on global climate change was brought into a global meeting most recently at the 2015 United Nations Climate Change Conference (COP 21) in Paris, France. Whilst public concerns and the debate continue, renewable energy technology options are becoming more competitive. The research engages at this point in the discussion on how the nuclear discourse on climate change issue is framed by different actors about their preferred technological choice.

3.5.1 Nuclear is the answer to climate change

Green House Gases (GHG), in particular carbon dioxide (CO_2), warming the earth mostly comes from power generation sector. The nuclear technology has gained both attention and contestation when discussing technological options to mitigate climate change. Despite known risk legacies that remain and continue to be revealed from accidents, nuclear power is promoted as *"mature"* technology for electricity production in a time of climate crisis.

Discourses around the nuclear power for those who support it consider it as a *"low-carbon"* energy source and sometimes as *"green technology"* and *"green energy"* for climate change mitigation. Nuclear power is also described by pro-nuclear as a *"zero carbon"* emissions energy source. In addition, for pro-nuclear actors it is a *"reliable"* and *"predictable"* energy source for meeting growing energy demand from urbanization and economic activity. This language is also being used in Thailand such as *"environmental-friendly and emits no carbon".*

> *"Information according to the Ministry of Energy, it says that nuclear power would bring hope to the country. … To increase energy security, building nuclear power plant is necessary due to its large-scale infrastructure, low operating cost and stable which can run full-time to meet basic electricity need. It is also environmental-friendly and emits no carbon."* (iLaw, 2016)[48]

In line with global climate change concerns, Thailand in its Intended Nationally Determined Contribution (INDC) submission to the United Nations Framework

[48] Extracted and translated from an article in Thai language, title โรงไฟฟ้านิวเคลียร์ "ความหวัง" หรือ "หายนะ"? by iLaw, 18 May 2016. Retrieved from https://ilaw.or.th/node/4123

Convention on Climate Change (UNFCCC) on October 1, 2015, addressed its intention to tackle this problem by incorporating different policies into its INDC 2015[49], including:

- National Economic and Social Development Plans
- Climate Change Master Plan B.E. 2558–2593 (2015-2050)
- Power Development Plan B.E. 2558–2579 (2015-2036)
- Thailand Smart Grid Development Master Plan B.E. 2558-2579 (2015-2036)
- Energy Efficiency Plan B.E. 2558–2579 (2015-2036)
- Alternative Energy Development Plan B.E. 2558–2579 (2015-2036)
- Environmentally Sustainable Transport System Plan B.E. 2556–2573 (2013-2030)
- National Industrial Development Master Plan B.E. 2555–2574 (2012-2031)
- Waste Management Roadmap

In its INDC 2015 submission, the document says its national target is to reduce greenhouse gas emissions by 20 percent from the projected business-as-usual (BAU) level by 2030 and possibly by up to 25% depending on technology, financial resources and capacity building supports to align with the global agreement under the UNFCCC. The pro-nuclear view is that to achieve the country's commitment to limit its GHG production, having nuclear power program in the energy mix is required. Nuclear electricity is put in a narrative of international pressure to reduce carbon emission, useful and good energy choice for the future.[50] This narrative hints at what may be needed to align domestic energy demand scenarios, that have implication for transboundary climate change impacts, to international energy cooperation and environmental policies. Supporting nuclear power underlies the domestic and international responsibility of any state to act upon, if nuclear power plant were made a decision to be built.

Supporter of nuclear power continue with their claim that it is urgent to increase the role of nuclear power and for it to stay in energy mix along with other renewable energy sources.

Thailand's position on nuclear power plants referring to the latest PDP 2015 describes it as *"clean"* energy and is optimistic about the cost.

> *"Maintaining nuclear power plants at the end of plan due to its cleanliness and relatively low fuel cost. Encouraging the study on nuclear technology and safety. And, building public awareness on nuclear power plant."* (EGAT, 2015) (p. 5-3)

[49] Extracted from Thailand INDC Submission document, 1 October B.E. 2558 (2015) (p. 2). Retrieved from http://www4.unfccc.int/ndcregistry/PublishedDocuments/Thailand%20First/Thailand_INDC.pdf

[50] Derived from an article in Thai language, title "พลังงานนิวเคลียร์สามารถช่วยแก้ปัญหาภูมิอากาศ-พลังงานของประเทศไทย". Retrieved from http://www.energy.go.th/international/index.php?action_content=article-single&id=87

This official narrative supports nuclear power as clean. There is an assumption that, if without its large-scale base-load supply, meeting the *"top"* Climate Conference (COP 21) referring to Paris Agreement 2015 to cut global annual emission of GHG by 2020 is not achievable. Nuclear expansion to limit GHG emissions, according to Eom et al. (2013) in the 2014 IPPC Assessment Report, pointed out that construction of 29-107 of new nuclear power plants globally per year would be the average scenario. It says:

> *"such rapid transformations due to delays in near-term emissions reductions would pose enormous challenges with respect to the up-scaling of individual technologies. The study shows that depending on the assumptions about the technology portfolio, a quadrupling of the low-carbon share over 20 years (2030 – 2050) would lead on average to the construction of 29 to 107 new nuclear plants per year."* (IPCC, 2014) (p. 564).

Thai government also view nuclear power as a source of sustainable energy that can combat with global climate change as stated in the country's statement that:

> *"Nuclear power generates clean and low-carbon electricity that helps meet increasing global demand and provide a basic infrastructure for growth and prosperity. It could also contribute to sustainable development and mitigating climate change."*[51]

To cope with how humans can survive global climate change threats, decarbonizing energy technology proposes nuclear power as another optimistic source, but noted the need to be aware of risks. The Fifth Assessment Report 2014 prepared by the United Nations Intergovernmental Panel on Climate Change (IPCC), mentioned nuclear power:

> *"Nuclear energy is a mature low-GHG emission source of baseload power, but its share of global electricity generation has been declining (since 1993). Nuclear energy could make an increasing contribution to low-carbon energy supply, but a variety of barriers and risks exist (robust evidence, high agreement)."* (IPCC, 2014) (p. 517)

The 2015 Paris Climate Conference (COP 21) agreed that global climate change is a common concern, with a threatening impact on human societies, thus requiring urgent action. A handful scientists 'embraced' nuclear power as a climate change solution (Conner, 2015).[52] Controversially and undeniably, nuclear power faces a variety of challenges and the existing problem of accumulating radioactive waste is an issue that cannot be ignored.

---

[51] Thailand's Statement by H.E. Mr. Songsak Saicheua, Ambassador and Resident Representative of Thailand to the IAEA at the International Ministerial Conference on Nuclear Power in the 21st Century, Abu Dhabi, 30 October - 1 November 2017. Retrieved from https://www.iaea.org/sites/default/files/cn-247-thailand-statement.pdf. (Last accessed, 19 January 2018)

[52] Cooper, C. F. (1978). "What Might Man-Induced Climate Change Mean?" Foreign Affairs 56, no. 3 (April 1978): 500-20

In defense of nuclear power as the *"only"* effective or *"mature"* energy technology able to combat climate change, the problem lies with costs and public acceptance.

> *"Nuclear power is dispatchable and does not come with any associated emissions, but has significant cost and public perception challenges"* (IEA, 2016) (p.18).

In the following year, the International Atomic Energy Agency (IAEA) in support of the use of nuclear launched a report on Climate Change and Nuclear Power 2016. The report emphasizes the critical role of nuclear energy as one of the lowest GHG emission energy systems, together with hydropower and wind-based energy generation. This authoritative institution specializing in nuclear technology supports expansion of the role of nuclear technology so as to keep average temperature increases below 2˚C, in accordance to the Paris Agreement 2015. It also claims that sufficient uranium mineral resources are available and its cost plays a *"small fraction"* to the total cost nuclear electricity (IAEA, 2016a) (p. 3).

> *"Ramping nuclear to support 2˚C target will be difficult, but not impossible"* (Shropshire, 2017) (p. 5)

There are 31 countries worldwide with operating nuclear power plants and 448 existing reactors.[53] Electricity generation from nuclear power plants was 11 percent of the world's electricity production in 2014.[54] Nuclear power has seen as a 'weapon' for mitigation of climate change on one side. Those who oppose to it, are cautious about nuclear investment to a means of phasing out by other options. Each country has different national position about their future nuclear power plans.

For countries with aging nuclear power plants, considering extending the operational lifetime of old power plants, as well as replacing them with new ones, have been proposed as a alternate energy strategy for lowering carbon emissions from fossil fuel energy sources and meeting growing energy demand. Whereas other operating nuclear countries, such as Germany, aim to phase out nuclear power and increase new capacity from cost competitive renewable energy, such as solar (i.e. solar roof-top, solar farm) and wind turbines.

For countries where nuclear power plants have not yet been built, consideration and expectation for its potential large-scale production of commercial electricity generation have been wishful - mostly using the same reasons of national energy security, industrialization and energy consumption in other sectors. In addition, to being optimistic about the use of nuclear technology as a source of lower carbon energy technology some make calls for 'moral' attention to save humans from extreme climate change. But at the same time recalling risks associated with nuclear power, such as high financial investments, safe operations and nuclear waste management. There are more

---

[53] According to International Atomic Energy Agency PRIS Database, two nuclear power plants in Belarus are under construction status (last update on 2017-11-13). Retrieved from https://www.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=BY and https://www.iaea.org/PRIS/WorldStatistics/OperationalReactorsByCountry.aspx

[54] World Statistic: Nuclear Energy around the World. Retrieved from https://www.nei.org/Knowledge-Center/Nuclear-Statistics/World-Statistics.

than 20 countries that have a nuclear preparation program yet to be implemented and some countries have reached agreements with nuclear technology vendors (IAEA, 2011 cited in (IPCC, 2014), p. 120). Thailand has also been aspiring for nuclear power as attractive option to mitigate climate change. Nuclear power program in Thailand has been investigated but the timeline for start construction has been postponed.

In the midst of global climate change crisis, nuclear power is seen as a desirable source of energy production. However, this claim is also debated for other environmental reason as operating nuclear power plant have implications that contribute to climate change from its fuel cycle process.

3.5.2 Nuclear is not the answer to climate change

Having nuclear power in fuel mix to reduce GHG emission is contested. Radioactive risk and climate change itself may accelerate disasters of the nuclear power plants? Nuclear power is objected to as it should not be considered a viable option to deal with climate change. Due to its lengthy construction time, including regulatory and complex safety system to be put in place and other facilities foundation, which can take 10 years or more to complete. The average reactor construction time, according to (Mycle Schneider et al., 2017) is 10.1 years for the latest 51 units in ten countries since 2007 and with a large range from 4 to over 43 years (p. 15). The need to urgently reduce GHG emission by building a large number of nuclear power plants around the world, ironically does not make sense as the fastest option for slowing climate change. The anti-nuclear narrative highlights the relative cost for building nuclear power plants compared to the benefits and impacts it will bring.

> *"...if they will use nuclear power to reduce greenhouse gases, we will have to build new nuclear power plant at least one plant for every two weeks in order to reduce greenhouse gases. How can that be possible? Because it takes about 10 years to build the nuclear power plant."* – Greenpeace Southeast Asia staff (interviewed on 18 July 2017)

In terms of mitigating global climate change, in which low carbon energy technologies like nuclear power are considered as an option, the argument against nuclear power encourages public to look at the full process of energy generation, including mineral extraction and the logistics involved – not just the operation of nuclear power plants.

> *"...Nuclear energy could make an increasing contribution to low carbon energy supply, but a variety of barriers and risks exist. Those include: operational risks, and the associated concerns, uranium mining risks, financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and adverse public opinion."* (Mycle Schneider et al., 2014) (p. 73)

Table 5: Debates whether nuclear power is the answer to climate change[55]

Nuclear is the answer to climate change	Nuclear is not the answer to climate change
Electricity • High efficiency baseload power plants comparable to other baseload plants by fuel type such as coal, oil and natural gas) • Reliable and stable energy supply compare to intermittent renewables • Long-term operation (technical lifetime 30-40 years)[56]	**Electricity** • Centralized and baseload power plants like nuclear runs 24/7 is not flexible to respond variation of demands (i.e. nuclear as forte baseload plants cannot switch on and off in short notice like renewable energy (RE))[57] • Relying on large-scale power plants is risk to shortage of national's power supply in cases of emergency shut down. • RE expansion takes less time than new nuclear power plant construction.
Environment • Indirect carbon emission during the electricity generation • Area of physical land mass use required to construct nuclear power facilities per amount of its electricity production is less than RE expansion[58]	**Environment** • Nuclear power has long-term implication to human health and ecological impacts (i.e. exposure to radiation doses develop risk to cancer) • Unsolved toxic waste (i.e. deep geological depository site)
Safety • Inherent safety technology since 1950s • Improved technology than in the past nuclear power plants (i.e. Chernobyl)	**Safety** • *"Nuclear power plants are prone to shutdowns, over safety concerns"*[60] • Concerns on uranium enrichment (i.e. nuclear

[55] Compilation of these debates are extracted, rewrote and elaborated based on various available online documentations and references research by the author.
[56] IAEA. (2016). Climate Change and Nuclear Power 2016. (p. 83). Vienna: IAEA
[57] Fred Pearce. (2017, May 15). Industry Meltdown: Is the Era of Nuclear Power Coming to an End?. Retrieved from https://e360.yale.edu/features/industry-meltdown-is-era-of-nuclear-power-coming-to-an-end
[58] Fred Pearce. (2017, May 15). Industry Meltdown: Is the Era of Nuclear Power Coming to an End? (Ibid.)
[60] Carrington, D. (2016, September 15). Nuclear power is risky and expensive; here's a better idea. Retrieved from https://www.theguardian.com/uk-news/2016/sep/15/nuclear-power-is-risky-and-expensive-heres-a-better-idea

• Improved design and more flexible to serve different grid capacity (i.e. Small Modular Reactors (SMR)[59] • Long-term waste management (high-level radioactive waste depository has been investigated; recycle spent fuel to reduce high-level radioactive waste has been studied)	weapons proliferation, vulnerable to terrorism)[61] • Global warming is possible to increase uncertainties and risks of power plant safety control (i.e. hotter summers; prolonged droughts[62]; rainy storms; landslides, earthquake)
Cost • Considerably abundance of uranium[63] (i.e. available for the next 130-250 years[64]) • Nuclear electricity costs subtracts from a small component of uranium ore costs[65] • Nuclear power plants can be cost competitive by pricing externalities of GHG emissions[66]	**Cost** • Nuclear power is expensive (i.e. cost overrun issue due to increase safety; uranium fuel is costly and requires government subsidies[67]) • Cost of RE in compare with nuclear power is seeing an affordable trend

Disagreement concerning nuclear power not being an option to deal with climate change points out other associated environmental issues that need consideration. In Thailand, it is also contested that nuclear fuel cycle and construction of nuclear power plants associated with accumulating carbon foot-print that has implication to cause global climate change.

[59] IAEA's report on Climate Change and Nuclear Power 2016 says that "Small modular reactors with less than 300 MW(e) capacity could serve an important role in energy security as well as provide the flexibility to integrate with small and regional transmission and distribution systems with less developed infrastructures." (p.84)
[61] Ma'anit, A. (2005, September 1). Nuclear is the new black. Retrieved from https://newint.org/taxonomy/term/5065
[62] Ma'anit, A. (2005, September 1). Ibid.
[63] IAEA's report on Climate Change and Nuclear Power 2016 (p. 85)
[64] "IPCC, 2014: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change indicates the availability of uranium ore that: "Present uranium resources are sufficient to fuel existing demand for more than 130 years, and if all conventional uranium occurrences are considered, for more than 250 years." (p. 526)
[65] The IAEA's "Climate Change and Nuclear Power 2012" report cited in the "IPCC, 2014: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (p. 531)
[66] The 2014 IPPC Assessment Report (p. 517)
[67] Ma'anit, A. (2005, September 1). Ibid.

3.5.3 Discussion how climate change debates interacts

Actors shared concerns about nuclear power and its potential for mitigation of climate change. But nuclear power is a complex technology to construct, operate and maintain which required high safety standard. Whilst nuclear has been seen as “green” technology to mitigate climate change, it raises concern that risk from nuclear power can be intensified by the impacts of climate change from severe weather conditions such as extended drought and frequent storms that are harmful to the operation of nuclear power station. On the one hand, nuclear is supported as a “mature” technology to generate trust among public and amidst the debates for “low carbon” emission energy type. On the other hand, nuclear technology has been contested with its longer construction time associated with safety control which pose challenges to achieve climate change mitigation timely. It is important that actors have shared concern on climate change mitigation. However, they should further discuss the suitability of all type of energy technology that can operate more effectively like renewable energy in terms of meeting basic electricity demand while reduce GHG emission in compare with operation of complex technology like nuclear power.

3.6 Summary

Key actors involved in producing nuclear discourses are linked together across the scales from national to international or global levels. Actor-networks’ claim both agree and disagree with nuclear power by using produced knowledge to debate. At the national level, nuclear power is contested as positive option for producing large-scale electricity but it is recalled safety and security as essential component in consideration for utilizing nuclear technology for peaceful purpose. On the other side, the view from civil society present concerns about safety and risks that come with nuclear power as a complex issue to handle in the longer term which associate to transboundary environmental impacts and link to human health in the end. At the international level, Fukushima disaster and global climate change both bring together nuclear actor-networks to debate about the future of utilizing this technology. The discourses produced around nuclear power as presented in this chapter reveal the power of its own networks that can shape public understanding about consideration of energy technological choice and impacts it entail.

CHAPTER IV POTENTIAL NUCLEAR POWER PLANT SITE IN UBON RATCHATHANI PROVINCE

4.1 Introduction

This chapter presents findings based on field work in one of the proposed nuclear power plant sites in Kham Kuean Kaew Sub-district, Sirindhorn District, Ubon Ratchathani province. Based on observation, focus group discussions, in-depth interviews and informal interviews with local people particularly in two key villages nearby the technical survey of nuclear power project site Hua Sa Pan and Kham Kuean Kaew, the research found that there are many concerns toward the nuclear power project. Nuclear power information disseminated in the local area as very limited in engaging local participation. Relatively, various views regarding decision making process whether or not nuclear power project should be built were responded by local people which also shaped by discourses produced and disseminated by different policy networks and strategies. Findings from the field work in this chapter includes: 1) Background to project; 2) Livelihoods in community; 3) Information availability; 4) Key concerns; and 5) Participation and community strategy.

4.2 Background to project

EGAT hired a U.S. consulting firm Burns and Roe Asia Ltd. for a 20-month study of nuclear power projects in Thailand starting in 2008. The feasibility study timeframe was two years from October 2008 – May 2010.[68,69] The feasibility project was a 2-year study of placement, technology and scale for Thailand's first nuclear power plant.[70] It was reported to cost around $38.3 million, in which $21.4 million would come from the Energy Conservation Fund of Thailand and the remaining from EGAT (Industrial info, 2008).[71]

The Thailand Research Fund funded a research paper in Thai language by (Chaikan, 2011) on *"Lessons from Nuclear Power Plants and the Participation of People Sector in Japan"* which shows a preparation processes for nuclear power project in Thailand which divided into 3 phases including: 1) Readiness preparation process during 2007-2011; 2) Regulatory preparation and bidding process for nuclear power plant construction during 2011-2014; and 3) Nuclear power plant construction during 2014-2017. According to Burns and Roe Asia's study, it identified 14 nuclear power plant

[68] 2014 – Asian Nuclear Power Outlook (February 17, 2014), p. 16. NERA Economic Consulting. Retrieved from http://www.stratcoms.com/downloads/NERA_Nuclear_power_industry_in_Asia_with_a_view_to_the_future.pdf
[69] Patchimpattapong, A. 2010. Thailand Thailand's Nuclear Power Plant Feasibility Study, Thai Professionals Conference (TPC 2010) Monday, June 5, 2010 (Power Point slides)
[70] (p. 16) Source: 2014 – Asian Nuclear Power Outlook (February 17, 2014). NERA Economic Consulting. Retrieved from http://www.stratcoms.com/downloads/NERA_Nuclear_power_industry_in_Asia_with_a_view_to_the_future.pdf
[71] Burns and Roe Undertake Feasibility Study for Thailand's Nuclear Power Program, 11 November, 2008. Retrieved from http://www.industrialinfo.com/news/abstract.jsp?newsitemID=141031

sites which prioritized 6 candidate sites in coastal provinces of south Thailand. Local people in these areas strongly opposed the project. EGAT then reported new sites which considered 3 main feasibility issues including: 1) Engineering; 2) Environment; and 3) Economics.

The EGAT concluded the top five candidate sites respectively as stated below:

1) Sirindhorn district, Ubon Ratchthani province;
2) Phnom Rok sub-district, Ta Tako district, Nakon Sawan province;
3) Mai Rood sub-district, Klongyai district, Trad province;
4) Kanthulee sub-district, Tachana district, Surathani province; and
5) Lamae district, Chumpon province

Out of these top five candidate sites, the key targeted areas were in Ubon Ratchathani and Nakonsawan (Chaikan, 2011) (p. 95).[72] Ubon Ratchathani province in northeast Thailand was the first candidate from the 5 shortlisted provinces. The proposed nuclear power plants location is adjacent with two villages Hua Sa Pan and Kham Khuean Kaeo in Kham Khuean Kaeo sub-district, Sirindhorn district, Ubon Ratchathani province within Sirindhorn dam territory. Due to the nuclear power plant site near Thai-Lao border, it also raise international concern (Simon S. C. Tay & Paungmalit, 2012) (p.96). However, the plan for nuclear power plant in Thailand has been postponed since the Fukushima nuclear disaster in 2011. The locations for two nuclear power plants in the current PDP 2015 are being kept secret (Rujivanarom, 2016).

Regarding the unclear nature of the nuclear power plant site, it caused concern among local people in Kham Khuean Kaew sub-district where the geological study was conducted. Local people perceived that the proposed location is not suitable for the local area.

> *"The villager who was hired to be a security guard in Sirindhorn dam told about a geological study for nuclear power plant. The villagers were surprised that they will build nuclear power plant. They understood that it has to be built close to large river or the sea where less density of population. The villagers disagree if it will be built here. It is not suitable."* – Kam Khuean Kaew Sub-district Administrative Office (Aor Bor Tor) representative

The concern of the nuclear power site is also related to the four significant water sources including Sirindhorn dam reservoir, Lam Dom Noi River, Mun River and the Mekong River, which implies direct ecological and health risks to local communities.

[72] Extract from a research paper "Lessons from Nuclear Power Plants and the Participation of People Sector in Japan" [Thai language], funded by Thailand Research Fund.

4.3 Livelihoods in community

Kham Kuean Kaew sub-district, Sirindhorn District, Ubon Ratchathani province covers an area of 163.8 square kilometer (102,375 rai) with 16 villages under its administration.[73] According to Department of Administration Registration of Sririndhorn District (as of 16 March 2015), the population in Kham Kuean Kaew sub-district was 10,597 and 2,993 households.[74]

Local livelihoods or main occupations in Kham Kuean Kaew sub-district depends on both rain-fed and irrigated water for agriculture and farming. Main crops that people grow include rice, rubber tree and cassava. Some villagers also earn income from fishing and aquaculture, raising animals (i.e. cow and chicken), collecting non-timber forest products (i.e. mushroom and other wild products), local tourism (i.e. rafting on Lam Dom Noi River and in Sirindhorn reservoir), producing local products (i.e. fishing trap and bamboo chicken coop) and laboring jobs.

Photo 2. Fishing trap (Source: Downloaded from Kham Kuean Kaew Administrative Office website at http://www.kkk.go.th/gallery.asp)

[73] Extracted and translated data in Thai language by the author from Kham Kuean Kaew Sub-district Administrative Office website http://www.kkk.go.th/articledetail.asp?id=7397

[74] Ibid.

Photo 3. Bamboo chicken coop (Source: Downloaded from Kham Kuean Kaew Administrative Office website at http://www.kkk.go.th/gallery.asp)

Kham Khean Kaew village and Hua Sa Pan village are under Kham Kuean Kaew sub-district. The two villages are located nearby the potential nuclear power plant site about 1-3 km away. Local livelihoods in these villages share some similarities. The villagers make a living by earning income from various occupations and make use of land and water resources. But the key difference between these two villages is land ownership. Kham Khean Kaew village land is permitted with Nor Sor 3 land title deed which is certified for the use of land although the title deed type has not yet been measured by the Land Department for exact boundaries. In contrast, Hua Sa Pan village does not have Nor Sor 3 land title deed but they are allowed to live and make use of the land. This point out one of potential impacts that the villagers are concerned differently in respond to the proposed nuclear power project. The community information is as summarized in the table as below.

Table 6: Community information of Kham Khean Kaew village and Hua Sa Pan village

	Kham Khean Kaew village, Moo 1, Kham Khean Kaew sub-district, Sirindhorn district, Ubon Ratchathani province	**Hua Sa Pan village, Moo 2, Kham Khean Kaew sub-district, Sirindhorn district, Ubon Ratchathani province**
Village size	About 1,000 rai	About 700 rai

Population	643 people (218 households)[75]	858 people (343 household)[76]
Type of land ownership	Villagers hold Nor Sor 3 land title.	Villagers don't have Nor Sor 3 land title. But they are allowed to make use of the land.
Livelihoods and income sources	Rice farming, rubber tree plantation, cassava plantation. Some villagers earn income from local rafting business on Lam Dom Noi River.	Fishing, non-timber forest collect, sell labor. Some villagers earn income from local rafting business on Sirindhorn reservoir.

Livelihoods of these two communities rely on the agricultural land and water source from natural water courses and Sirindhorn reservoir. Despite the difference in land ownership between these two villages, the risk of decreased income and economic opportunities is a major concern if the nuclear project goes, which may result in the relocation of some villagers. The location of the two villages, which are close to the potential project site, is also considered high risk for local residents to live nearby the power plant.

Further from these two villages, local people also make a living from Sirindhorn reservoir. Apart from using water in the reservoir for agriculture, there are animal grazing, fishing, and tourism that are allowed in this area. Major water sources are thus an important concern for the consideration of nuclear power plant projects to local people.

[75] Data in Thai language extracted from Kham Kuean Kaew Sub-district Administrative Office website http://www.kkk.go.th/articledetail.asp?id=7397

[76] Data in Thai language extracted from Kham Kuean Kaew Sub-district Administrative Office website http://www.kkk.go.th/articledetail.asp?id=7397

Photo 4. Local people use some area in Sirindhorn dam reservoir as grazing land when the water in the reservoir was low. (Photo credit: Tipakson Manpati, 27th June 2017)

Photo 5. Local fishing is allowed in Sirindhorn dam reservoir. (Photo credit: Tipakson Manpati, 27th June 2017)

Photo 6. Local fisherman from a village nearby Sirindhorn dam reservoir. (Photo credit: Tipakson Manpati, 27th June 2017)

Potential impacts to local community from the risk of nuclear power plant is larger than where it is located in Kham Kuean Kaew sub-district. Local people should be able to deliberate about the informed nuclear power project more extensively and beyond Thai national territory because the risk of nuclear radiation and its environmental and health impacts is both sensitive to local population and international communities. Specifically, where water networks in the area as potential source of cooling down reactor plant are connected tributary Lam Dom Noi River and Mun River which converge into the transboundary Mekong River suggesting that untreated contaminated radiation water can be carried onto by these streams to other downstream communities.

4.4 Information availability

It was found that the information about nuclear projects and the nuclear knowledge that local people received from different nuclear networks was disproportionate. Seminars and study trips to learn about nuclear energy which were organized by EGAT were limited in invitation. Some people in particular government official at the village, sub-district and district levels were selectively invited to join. Some ordinary villagers learned about the nuclear power project from their community leader and some learned from other villagers.

Some people learned about the nuclear power project from NGOs. The NGOs provided critical information about nuclear such as negative impacts of nuclear power and major nuclear accidents that happened in other countries such as Chernobyl in Ukraine (former Soviet Union); Three Mile Island in the United States of America and more recently in Fukushima, Japan. The local people who received information on negative impacts of nuclear power plants from NGO have questioned the safety standard controls of nuclear power, specifically since if nuclear accidents occur in more developed countries, they can also happen in Thailand where safety culture is a worrisome issue.

Information regarding nuclear safety is contested among those who received information from government and NGOs. Some people were told by the government official that they don't have to worry about radiation because if the nuclear power project is built within 1-3 km from their village, the radiation will be in controlled to a safe level and so that they don't have to move. However, many villagers don't know yet about the size of the area needed for the nuclear power plant construction, waste storage area and water supply amount required for cooling the reactors. Critisim of nuclear power projects have been voiced by some villagers as well.

The dissemination of nuclear information was disproportionate in different levels of groups of people. Negative impacts of nuclear power were not emphasized by government sector but was more positive while information from NGOs provided criticism of the project to local people for their decision making.

> *"We don't focus on giving information that [we] produced to the government. We do study on what the government don't talk much about and so disseminate the information to people. Especially people in target [nuclear potential site] area. This allows social process for people to contest about [nuclear] discourses. We don't just rely on government [for information]."* – Energy Watch (interviewed on 9 June 2017

As local people learned about the nuclear power project, they debated and questioned that if built, what impacts will it have on their community. The villagers in Kham Kuean Kaew village and Hua Sa Pan village debated about the nuclear power upon which learning about both side of impacts on nuclear energy were revealed among them when sharing information.

> *"I received information from EGAT that [nuclear power project] would be built. Because I am a village committee member, I was usually invited to the meeting regarding this [nuclear] issue. I received information about positive and negative impacts about building [nuclear] power plant. If you say nuclear power is scary. It is [because of] heat. For me, I received many information from them [EGAT]. Including from television and other source. Considering positive and negative [impacts] of it, I want it to be built."* – Male participant, Kham Khuean Kaew village, No. 3# (Focus group on 14 July 2017)

> *"I received information many times and there was not a problem. But for elderly people who ages more than 50 year-old, they don't know much what was going in the surrounding of the village. Supposed, if we want nuclear, they would agree. … But when I joined [nuclear seminar], they didn't say when the [nuclear] power plant would be built. Maybe in the next 10 years but we don't know exactly."* – Female participant, Hua Sa Pan village, No. 4# (Focus group on 14 July 2017)

> *"[Ordinary] people don't receive the information. They were not invited to study trips, meetings or seminars; mostly only the community leaders were,*

including [those who are] village healthcare volunteer." – Male participant, Hua Sapan village, no. 5# (Focus group on 14 July 2017)

Regarding geological studies of the potential nuclear power plant, it was conducted in EGAT's land. Villagers in both Kham Kuean Kaew and Hua Sa Pan were not clearly told about the study. They didn't know about the survey at the beginning, but they were told by the villagers who were hired by a company to guard the survey area that it was a study of ground structure without further detail.

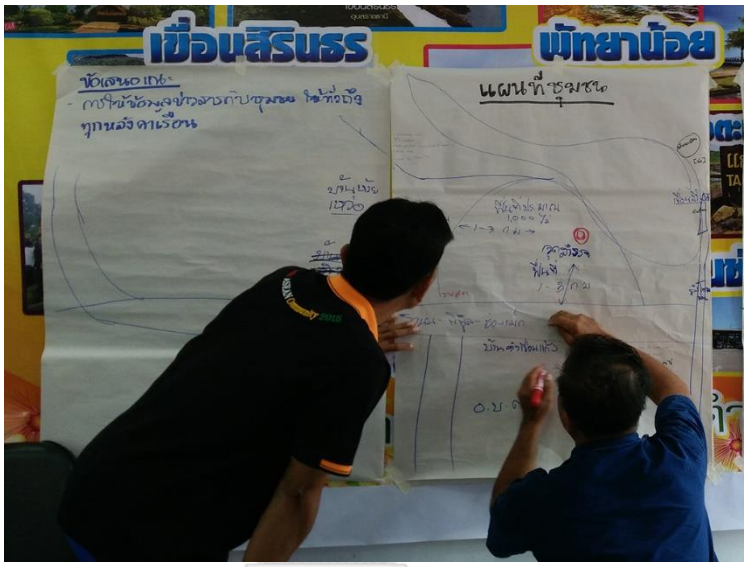


Photo 7. Community mapping of Kham Khean Kaew village and Hua Sa Pan village. (Photo credit: Tipakson Manpati, 14th July 2017)

The villagers were also confused about unclear information regarding their future whether or not nuclear power project would be built. During a focus group discussion organized on 14 July 2017, a question was asked to participants about if they received information about relocation. Conversations of the participants showed that there was unclear information where the nuclear power plant will be located. The conversation is described below:

Question: *Did you have information about relocation?*

Not really. But they talked about positive and negative impacts. – Female participant, Hua Sa Pan village, No. 4# (Time stamp 15:07)

"I support it. I got the information from them that within 1 km [from nuclear power plant site], we don't have to move out. Kham Kuean Kaew village in Moo 1 is nearest [to nuclear power plant site]. Kham Kuean Kaew is the nearest next to where it will be built. It is the information from EGAT staff. For Moo 2 [Hua Sa Pan village] is a bit further [from nuclear power plant site]." – Male participant, Kham Khuean Kaew village, No. 3# (Time stamp 15:16)

"Did they specify where they will build the nuclear power plant?" – Female participant, Hua Sa Pan village, No. 4# (Time stamp 15:56)

"I heard from the government agency that nuclear power plant would be built in EGAT's disposal land within Sirindhorn dam area where they conducted geological study. Because it is with[in] Lam Dom Noi river area that has water supply to power plant." – Male participant, Kham Khuean Kaew village, No. 3# (Time stamp 16:00)

Photo 8 and 9. Technical survey on geological structure for nuclear power plant in Sirindhorn dam area about 1-3km from Kham Khuean Kaew village and Hua Sa Pan village. (Photo credit: Tipakson Manpati, 25th June 2017)

The villagers also did not have clear information about nuclear project whether or not they will have to be relocated or where that site would be located. Compensation is also a concern as a number of villagers in Hua Sa Pan village do not have physical land title deeds.

"The villagers asked about whether or not they will receive 1 million bath per person if the project is built. They said that the money will be community fund which will have committee members to manage it. I also asked if [nuclear power plant] is built, where the nuclear waste will be kept. Representative of Office of Atoms for Peace said that they haven't decided. I was confused because they think about building it but don't know yet about waste management…." – Male participant, Hua Sapan village, no. 6# (focus group on 14 July 2017)

Local people also learned about nuclear power project in the area from the news related to the Fukushima disaster through a local movement group that came out to voice concerns that nuclear accident happened in Fukushima could also happen in Thailand

if it is built. This nuclear accident raised concerns to local people on how Thailand will be able to prevent such kind of catastrophe.

> *"If there was not a Fukushima [nuclear disaster] I think most villagers would not know about [nuclear] information. Because related agencies didn't provide detail to villagers. No seminars on the ground participated by villagers to learn about nuclear power. … When the Fukushima happened, it raised awareness to the villagers. They talked about why nuclear power plant would be built and they were not told about it. …People in Ubon Rathathani that opposed it came out and took the villagers to learn about [nuclear] information from different places so that they know more what it is about. The information from the agencies directly responsible for [nuclear] was very limited."* – Kam Khuean Kaew Sub-district Administrative Office (Aor Bor Tor) representative

The limited and unclear information about potential nuclear power plants in Ubon Ratchathani received by villagers suggests that inform of credible information from all networks was needed to engage public discussion and debates on nuclear.

4.5 Key concerns

Water supply is a major concern of the local people as it is an essential source for living. Apart from the reason that strong geological foundation as there was no historical record of earthquake in the area, water supply is an important element for the cooling process of the nuclear power plant reactor of which can be potentially transferred from Sirindhorn dam reservoir. In addition, the water supply near Sirindhorn dam reservoir such as Mun River, Lam Dom Noi River, and Mekong River can be potentially utilized for the cooling process of the nuclear reactors.

Despite the water supply being a key for nuclear power plant operation for electricity generation, water from potential supply sources are also used for making local livelihoods. The water is concerned for sufficient allocation for different purposes as well as quality of water.

> *"It is quite clear that Ubon Ratchathani has potential of geological structure for potential nuclear site. But it is not clear yet about the water as we didn't study whether the water is enough. For the electricity demand in Ubon Ratchathani, it is not enough…. Now we have to buy electricity from Laos."* – Professor at Faculty of Engineering, Ubon Ratchathani University (interviewed on 12 July 2017)

> *"At least it has to be water source. Because the nuclear power plant is big. The nuclear reaction process needs water to cool down in the power plant in order to boil the water and run turbine. Thus the water source has to be large. It is important to consider the use of water in that area and the water supply such as if that area need water for agriculture? How much water supply is left for generating electricity? What are other impacts to ecology, animals and plants? Of course, [cooling process] it releases heat. Therefore, impacts of high temperature water have to be treated before going to be released outside. Also*

> *the transmission line and capacity to connect with high voltage electricity in the area of power plant has to be distant from community. Nuclear also need the area for spent fuel storage."* – Researcher at Energy Research Institute (interviewed on 15 July 2017)
>
> *"Some villagers don't have land to grow food. They depend on fishing in the dam reservoir to provide their family. If the nuclear power plant is built, there will be many impacts as consequences. It is unimaginable."* Kam Khuean Kaew Sub-district Administrative Office (Aor Bor Tor) representative (interviewed on 26 June 2017)

Concern on meeting energy demand pointed out by EGAT staff's reasoning that despite available wind and solar energy, electricity production from these types of power technology is expensive and not stable compared to nuclear power.

> *"Every second, we need electricity in the system. [The] main operating power plants are from coal and natural gas. Suppose, these main fuel sources are scarce and increase import expenses in the future. Can we bear with it? Therefore, nuclear power is an option. It is the kind of power with heat that generate electricity. Investment cost seems high, but electricity cost per unit should be considered, if not regard the environmental and other issues, it is cheap and can produce electricity for 24 hours. In my opinion, if we consume energy in this [present] level, we will have to make decision whether or not to go nuclear. If the answer is to not build it, it is okay. But we will have to buy [electricity]."* – Sirindhorn Dam staff (interviewed on 27 June 2017)
>
> *"If [domestic energy resource] is gone in the next 20 years, we will have to buy it. We will be poorer if we don't have our own [resource]. We will have to spend more [money] to buy [other resource]. I don't expect that nuclear power plant will happen in my generation. Everyone wish our country for prosperity. But someone is afraid, the other is not. Likewise, I am afraid that my children will not have food to eat and place to live. I think if we can make nuclear, our children should be fed well."* Kham Kuean Kaew village head (Phu Yai Baan) (interviewed on 27 June 2017)
>
> *"People will have cheap electricity and there will be fund for community around the power plant within the distant of 5 km. Maybe for nuclear, they will announce the area for entire district."* – Kham Kuean Kaew Sub-District head (Kamnan) (interviewed on 12 July 2017)

In the news, nuclear power is described as *"friendly to the environment and emits no carbon"*[77] but risks of nuclear power to the environment is a key concern as people consider the long-term health impacts extending into the next generation.

[77] Derived and translated from a new article in Thai language, title: โรงไฟฟ้านิวเคลียร์ "ความหวัง" หรือ "หายนะ"? by iLaw, 18 May 2016. Retrieved from https://ilaw.or.th/node/4123

> *"[If there is nuclear power] people may be able to stay but they have to always be vigilant and alert on health. I rather not have it built. Because we don't know what will happen to us and our children in the future. Though we will be gone, our children life will change with unknown of severe diseases."* – Kam Khuean Kaew Sub-district Administrative Office (Aor Bor Tor) representative (interviewed on 26 June 2017)

> *"It is not cost-effective giving focus on environmental dimension. ... Environment is tangible problem to be concerned. Leading to social problem due to stress of nuclear safety. ...It is complicated technology and difficult to manage. If it is not in control, radiation leak is unseen leading to unseen consequences. It is dangerous. ...Ubonratchathani and northeast region has potential for solar energy."* (Professor at Department of Social Sciences, Faculty of Liberal Arts, Ubon Ratchathani University, interviewed on 12 July 2017)

Apart from health, nuclear power posts danger to the local economy related to local livelihood that is dependent on agriculture.

> *"The reason that I don't want nuclear is because our country is based on agriculture. If there is radiation leak and contamination, we cannot eat rice that we produce. The radiation is invisible."* – Male participant, Hua Sapan village, no. 6# (focus group on 14 July 2017)

> *"If built [nuclear power plant] it will produce nuclear waste many tons per year. Where will it be disposed? It is dangerous with radioactive."* – Kam Khuean Kaew Sub-district Administrative Office (Aor Bor Tor) representative (interviewed on 26 June 2017)

Local people's concerns should be engaged in decision making process regarding potential nuclear power project from the perspective of deliberative environments which have direct impact on local people's health and well-being.

4.6 Participation and community strategy

Ubon Ratchathani was ranked one of the most potential sites for nuclear power plant construction during the time of the Power Development Plan 2010. Some people were able to participate in government seminars and some joined with NGOs in other separate seminars or meetings to learn about nuclear power project. They had mixed responses to the nuclear power plant plans upon which information were available to them as former Director of Kham Khuean Kaew Sub-district Administrative Office was quoted that nuclear power is *"not that scary"* and also mentioned that negative impacts were not yet provided.[78]

[78] Derived and translated from a new article in Thai language, title: เปิดยุทธการ 'ลึกแต่ไม่ลับ' นำ 'โรงไฟฟ้านิวเคลียร์' สู่ 'ชุมชน' by MGR Online, 22 March 2011. Retrieved from http://www2.manager.co.th/daily/ViewNews.aspx?NewsID=9540000036707

Before the Fukushima disaster, the Thai People's Anti-Nuclear Network in Ubon Ratchathani province launched an open letter to the then Abhisit Vejjajiva government through provincial governor to oppose nuclear power plans in Ubon Ratchathani. The letter stated that in the case of nuclear accident, Ubon Ratchathani province of an area of 18,906.1 square kilometers including neighboring provinces such as Siaket and Amnat Charoen would be decimated in the event of a nuclear reactor meltdown. The letter urged the government to provide both side of information of impacts of nuclear power to public and let local people make their own decision about nuclear power project, as they live in the area and will be impacted.[79]

The Thai People's Anti-Nuclear Network in Ubon Ratchathani province, which was also endorsed by local people from the Assembly of the Poor from Pak Mun dam and Sirindhorn dam, submitted a letter of complaint to the National Human Rights Commission of Thailand on 8 February 2011 to request an investigation on nuclear power project in the province. Three key points were stated in the letter: 1) the amount of 205 million bath was spent for public relations for public acceptance. It was one-sided information for selected group of people and public relations movement did not engage true public participation; 2) Nuclear power plants caused severe impacts that threat to human health and the environment such as the Chernobyl nuclear accident and; 3) site selection in Ubon Ratchathani was not transparent. It said that the suitability of the site was selected because of low resistance from population but neglected other important issues such as biodiversity, tourism, city and border area, as well as transportation matter and nuclear waste management.[80] Relatedly, news articles on *Manager Online* (July 10, 2011) said that the government spent the amount of 1,800 million bath for nuclear public relations purposes without fully explaining details.[81]

In response to the tragic Fukushima nuclear disaster, NGOs organized a forum to discuss issues of the situation. One of the key messages by communities from provinces identified as potential nuclear site which included Ubon Ratchathani perceived about *"high risks"* from nuclear technology and nuclear disaster like Fukushima *"could occur without any warnings, threatening lives of local residents"*.[82] One month after the Fukushima disaster, Thai People's Anti-Nuclear Network released an open letter dated on 27 April 2017 to the then Abhisit Vejjajiva government to remove nuclear power plant projects from Thailand's Power Development Plans.[83]

---

[79] Derived and translated from a new article in Thai language, title: เสียงคนอีสาน: คนอุบลค้านโรงไฟฟ้านิวเคลียร์ by Prachatai, 24 January 2011. Retrieved from https://prachatai.com/journal/2011/01/32763

[80] Derived and translated from a new article in Thai language, title: จม.จาก "นศ.-ประชาชนจ.อุบลฯ" ถึง "กรรมการสิทธิฯ" ชี้ไม่เอาโรงไฟฟ้านิวเคลียร์ by Prachatai, 14 February 2011. Retrieved from https://prachatai.com/journal/2011/02/33120

[81] Derived and translated from a new article in Thai language, title: ความเหลื่อมล้ำและไม่เป็นธรรมในวงการโรงไฟฟ้านิวเคลียร์โลก-ไทย by Prasart Meetam on MGR Online, 10 July 2011. Retrieved from http://www.manager.co.th/daily/ViewNews.aspx?NewsID=9540000084629

[82] Derived and translated from a new article in Thai language, title: Voices from Thai Local Communities: Nuclear Is Not the Option for Thailand, 16. March 2011. Retrieved from https://th.boell.org/en/2011/03/16/voices-thai-local-communities-nuclear-not-option-thailand

[83] Derived and translated from a statement in Thai language, title: จดหมายเปิดผนึกเครือข่ายประชาชนคัดค้านพลังงานนิวเคลียร์ ถึง นายกรัฐมนตรี อภิสิทธิ์ เวชชาชีวะ on 27 April 2011. Retrieved from http://webcache.googleusercontent.com/search?q=cache:oVfRDdvuVOQJ:www.livingriversiam.org/3river-thai/news-article/thaidam_n27.doc+&cd=1&hl=en&ct=clnk&gl=th

The Fukushima disaster continues to remind local people in Ubon Ratchathani of risks of nuclear power. Public participation of local people on whether or not nuclear projects should be built marks as essential step towards more inclusive power development plans in Thailand.

> *"Nuclear that were built caused impacts to people's livelihoods from the beginning as it took large area for the project. This is what people can understand from other country's experience. Toxic Cobalt case and [industrial] waste from Map Ta Put, Rayong province also brought the problem to be visible. This problem is related to community's rights for their living and economic. …The policy has to engage people participation in decision-making (on energy planning). It starts with inform clear* information." – Professor at College of Medicine and Public Health, Ubon Ratchathani University (interviewed on 15 July 2017)

> *"I think electricity system should be changed rather than building nuclear power plant. The system should increase electricity from other [energy] sources. More solar and biomass is still limited. If we change the system by increasing solar and biomass into the system would be better."* – Male participant, Hua Sapan village, no. 6# (focus group on 14 July 2017)

> *"Thailand should not do nuclear. The government must support people to be able to produce alternative energy or invest more on this. The government have not done enough. They say [alternative] energy is small and unstable. All [type of energy] has impact. Solar energy does too. But the extent of impacts is reduced and for management."* – Local NGO in Ubon Ratchathani, no 3# (interviewed on 28 June 2017)

Engaging in deliberative environmental concerns of the people is needed as it has impacts on their dependent natural resource-based livelihoods. Furthermore, community strategy in participating making decision on nuclear power suggests that other energy options considered less harmful rather than nuclear power should be explored.

4.7 How the community has engaged in nuclear debates about the location of the project

As Kham Kuean Kaew sub-district in Ubon Ratchathani province was listed as one of the top five candidate sites for nuclear power station, local people in the area engaged in their debates both support and against it. Some villagers in Kham Khuean Kaew village and Hua Sapan village who support the nuclear power project said that the proposed location near Sirindhorn dam reservoir has enough water to supply the nuclear power plant. However, they see the importance of radiation control that it has to be ensured for local communities. The villagers were told that there was no historical record of earthquakes in the area and the rock foundation at the site is strong enough to place large-scale nuclear power station. But for those villagers who disagree, they said that climate and population living in the area must be taken into account to consider a

nuclear power station. They argued that hotter weather in summer as well as possible unprecedented floods and shortage of water add more risk to nuclear power in Kham Kuean Kaew sub-district.

> *"If they build nuclear power plant here [in Kham Khuean Kaew sub-district], anything could happen. Because it is in Lam Dom Noi River and [Sirindhorn] dam reservoir area. There are probable risks such as earthquake or land collapse, water shortage, explosion and heavy rainfall that can break the dam. I remember that in 2012, there was a heavy rain and water level in the dam was very high. The dam opened all 8 sluice gates to discharge the water. Imagine, there were heavy rainfall for 14 days, the dam would collapse and unable to supply water to nuclear power plant. It will be the end."* – Hua Sa Pan former school teacher, no. 3# (interviewed on 26 June 2017)

In response to EGAT's conclusion for nuclear siting in Ubon Ratchathani that looks at 1) Engineering; 2) Environment; and 3) Economics, this location was contested among the local communities. They engaged in the debate about the benefits and risks consequences from nuclear in relation to the local environment from their daily life observations.

4.8 Summary

In response to the question: "*How these knowledge and discourses shaping the decision on whether Thailand should proceed with a nuclear power station in Ubon Ratchathani province?"* this chapter found that engaging public participation was limited as local people in the potential nuclear power plant site received a disproportionate amount of nuclear project information. Local communities shared concern on potential impacts of nuclear power plant to water sources they depend on for making livelihoods that can also extend to international communities. Key concerns exist regarding the water source that the power plant poses a risk to at the convergence of tributary rivers and transboundary Mekong River that could be potentially utilized for operating the nuclear power plant. Local communities engaged with nuclear debates in the wider public through releasing open letters to request information and voice their concerns. Strategy to raise public debates about nuclear power is also through submission of a letter of complaint to the National Human Rights Commission and organizing public seminar to investigate and contest the plans for nuclear power. Through the lens of deliberative environmental governance, findings in this chapter suggest that the informing of credible information from all sectors that produced nuclear knowledge is needed along with engaging local people's concerns for debate about the knowledge and in decision making for their own community whether or not nuclear power station should proceed in Ubon Ratchathani province.

CHAPTER V CONCLUSION

5.1 Introduction

Nuclear power project plans in Thailand remain an aspirant option for the country fuel supply mix. Public concerns and debates on nuclear power in Thailand increased after the Fukushima disaster 2011. This chapter intends to discuss the relationship influences of nuclear knowledge which is produced, disseminated and consumed by actor-networks through the lens of a particular and deliberate environment. This chapter concludes that insufficient public deliberation in the nuclear debates suggests an inequality of participation that effects the quality of public engagement in the decision making process about whether or not nuclear power station should be proceeded in Ubon Ratchathani province.

5.2 Discussion

5.2.1 Research questions and findings

Nuclear power is a sensitive topic for the public to debate. It has been presented as an attractive option to reduce dependency of fossil fuel-based energy sources and a dangerous technology to be precaution and can be intensified through the addition of nuclear accidents and weapons. In responding to the main question of this research which asks: "*Through the lens of deliberative environmental governance, what knowledge and discourses are shaping the decision on whether Thailand should proceed with a nuclear power station?"* this research found that there is progressive interaction amongst actors which shared concerns about the role of nuclear and climate change mitigation and nuclear safety from different perspectives. Considering nuclear power through the lens of deliberative environment, arguments are produced in both favour and disagree for certain benefits and impacts it entails. Nuclear knowledge is produced by actor-networks with which discourses are established and contested to shape public understanding on the technology where the contested arena for decision making is significant factor in terms of process, quality and scale of participation for the debates of actors.

In response to the first sub-question of *"Who are the key actors involved in producing nuclear knowledge and discourses?"* this research found that key actors contesting in producing nuclear knowledge and discourses shared common concerns regarding consequences of employing nuclear power in Thailand. However, arenas for debating nuclear concerns by actors on topics such as the Power Development Plans, seminars, meetings and field trips were organized in a limited way, which can exclude a variety of actors within the organizational and local levels to deliberate their contesting point of views. This means that actors within organizations do not always fully represent the view of the organization they are with. There are contesting views among actors within the organization although personal view for the organization tend to be align more than not. Recognizing that actor-networks have layers of viewpoints within their own

organizational entity helps grounded us to the reality that there are dynamic and evolving organization of knowledge produced and contested. The contestation of knowledge can also be influenced by actor-networks outside of the organization.

In responding to the second sub-question: *"What are the contesting discourses in the following key debates: Power demand and the role of nuclear; Fukushima; Risk and safety; and Climate change?*" this research explored nuclear discourses that are produced around power demand and the role of nuclear; Fukushima; Risk and safety; and Climate change which reveals gaps in knowledge for exist in each actor-network. They use produced knowledge and claim it in favour of their own debates either in promoting or opposing nuclear power regarding its benefits and impacts. For example, debate about power demand, nuclear discourse such as saying nuclear power is 'cheap' is contested with 'cost overrun' issue due to requirement of high safety standard adding to the cost-effective in nuclear power plant construction. The research found that actors are linked together to produce knowledge and claim it in their favour based on their interest about nuclear power as energy option. For example, on the one hand an actor who views nuclear power as an 'improved' safety technology acknowledges the risks that come with nuclear but with a positive attitude that it can be managed. On the other hand, an actor who views nuclear power as threat because of the risk associated with it is beyond prediction and can accumulated over time. Despite actors involved in nuclear debate have shared concerned on operating nuclear, they often see it from their own perspective and interest on the choice of technology they perceive the benefit from.

In respond to the last third sub-question of *"How these knowledge and discourses shaping the decision on whether Thailand should proceed with a nuclear power station in Ubon Ratchathani province?"* this research found that local communities have disproportionate and limited access to nuclear power project information from the state. Community leaders were invited to seminars, meetings and study trips organized by EGAT while others learned about nuclear power project plans from national and local NGOs. Despite local community possessing direct experience and local knowledge about the area, they did not engage in the feasibility study on nuclear power plant siting in Kham Khuean Kaew sub-district. This shows a one-sided information trend from nuclear proponents claiming expertise study about potential nuclear power plant project that have impacts to local communities. There was unclear information about proposed nuclear power plant site in terms of construction area and time frame that caused confusion among local community members regarding whether or not there will be relocation on their communities. Since after the Fukushima nuclear disaster and the postponement of nuclear power project in Thailand, there has not been further activity about nuclear siting in Kham Khuean Kaew sub-district, but local people remain unclear with concern about the future of nuclear power project. This suggest either the lack of access to official information or the undisclosed official information to the local people that limits public debate and participation in decision making about nuclear power in Thailand.

5.2.2 Key concepts

This research explored problems on nuclear knowledge production, circulation and consumption in Thailand including the potential project site in Ubon Ratchathani with

four key concepts including: 1) Science, technology and society 2) Policy networks 3) Politics of scale and 4) Discourses and knowledge production. These concepts revealed interaction of nuclear actor-networks as well as inclusion and exclusion of actors in the decision-making process about incorporating nuclear power plant plans in Thailand's Power Development Plan.

5.2.2.1 Science, technology and society

The type of technology have certain impacts to society. Considering nuclear power for national supply mix in Thailand, it raises questions about meeting future energy need and long term environmental consequences to human well-being. With the country relying on 70% natural gas and foreign fuel sources that will be declined, nuclear power stations will lead Thai society into a new pathway of environmental management, if they proceed. Policy network plays important role in decision making on choices of energy technology as it links to interest of epitomic group and anticipated benefit in the future.

Science expert knowledge produced by state is established through policy networks. They are closely linked and usually supported with government agencies, academic institutions and private sector. The state often has authoritative power also through producing nuclear knowledge that can claim legitimacy in the debate. EGAT is the state-owned power utility of Thailand that hired a U.S. consulting firm Burns and Roe Asia Ltd. to conduct feasibility study of nuclear power projects from 2008-2010. This was a form of claiming legitimacy of expert knowledge. Heightening this claim, the Thai government prepared Integrated Nuclear Infrastructure Review (INIR) in December 2010 and readiness report suggested that the country was ready to *"go nuclear"* which IAEA's comment that Thailand is ready to make *"knowledgeable commitment".* Funding for these studies was reported to come from the Energy Conservation Fund of Thailand and EGAT. It shows that the state has interest to proceed with nuclear power plants plan. But after Fukushima disaster the plan to *"go nuclear"* was postponed. This was shaped by a combination of risk concerns from unexpected natural disaster and public pressure.

Science expert knowledge produced by civil society in questioning nuclear knowledge produced or claimed by state suggest risks of employing nuclear technology to society due to long term environmental impacts associated with nuclear fuel cycle. When Thailand revealed plans to embark nuclear power plant in Power Development Plan 2007, report on *"The Economics of Nuclear Power"* was launched by Greenpeace International which contested to nuclear industry knowledge on economic viability and climate change mitigation. Another report produced by Greenpeace is such as *"Radiation Reloaded: Ecological Impact of the Fukushima Daiichi Nuclear Accident"* based on scientific research in Fukushima prefecture after 5 years that the nuclear disaster happened. This study looks at impacts of the nuclear disaster on ecology due to radioactive contamination in the forests, rivers, floodplains and estuaries of

Fukushima prefecture.[84] Another report was also produced by Greenpeace called *"Nuclear scars: The Lasting Legacies of Chernobyl and Fukushima"* reviewed scientific studies an attempt to reveal health and social impacts from the nuclear disasters on impacted populations in the area.[85] It is often seen that knowledge produced by civil society is against nuclear knowledge produced by state. But critical studies from civil society is a form of engaging state knowledge to public debate and participation for choice of energy technology that they should involve in making decision with the state in transparent and democratic manner. These reports are the form of production of knowledge to raise public awareness about the impacts of nuclear power.

Situational or local knowledge is closely link to experience of day-to-day life of local people in certain area. The form of knowledge accumulated from local people's interaction with natural resources for their livelihood interest (Mira Käkönen & Hirsch, 2009) (p. 345) can pass on beyond generation (Chan Sokheng et al., 2001) (p. 9) that maybe unfamiliar to outsider and should not be disregarded as a 'informal' form of knowledge. Local livelihoods of Kham Kuean Kaew and Hua Sa Pan communities shared concerned with water sources from Sirindhorn dam reservoir connected with Lam Dom Noi River, Mun River and the Mekong River for potential utilization for proposed nuclear power plant project. Local people depends on the water sources from daily consumption to agriculture, fishing and tourism business. But local people were not engaged in technical study for the project site as the project will have impact on their life. This is the gap where local knowledge from the communities' livelihoods should be engaged for their participation in making decision on whether or not nuclear power station should be proceeded.

5.2.2.2 Policy network

Since the period of the Cold War in the 1950s, nuclear actor-networks in Thailand started to form through an introduction of the U.S.'s Atom for Peace program. Thailand receive technical support from international experts to develop national institution of nuclear expert namely Office of Atomic Energy for Peace (OAEP) which renamed to Office of Atoms for Peace (OAP) in 2002, as well as related regulation such as the first Atomic Energy for Peace Act, B.E. 2504 in 1961. To expand expertise in this field, academic institution was also founded i.e. Department of Nuclear Technology, Chulalongkorn University in the 1970s. At the policy making level, government agencies and academic institution are linked as supporting in expertise for decision making on nuclear field. NGOs/CSOs also form epitomic expertise in questioning about nuclear power proposed by state and its partners. But NGOs/CSOs are often seen as against nuclear either excluding from or influencing how decision making for nuclear power is shaped by the state. Local people in the area of proposed nuclear power plant projects are key stakeholders in the decision making. Deliberation on local livelihoods and the environment surrounding with local people are concerned. However, they have

[84] Radiation Reloaded: Ecological Impact of the Fukushima Daiichi Nuclear Accident. (2016). Retrieved from https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/gpj-_fukushima-radiation_reloaded_report_issue_040316_lr_2.pdf

[85] Nuclear scars: The Lasting Legacies of Chernobyl and Fukushima. (2016). Retrieved from http://www.greenpeace.org/archive-international/en/publications/Campaign-reports/Nuclear-reports/Nuclear-Scars/

limited access to information about making decision which usually comes from state. What we have learned about policy networks and how they operate is uneven power of actors that includes and excludes them in making decision. More likely for those who have close link to the state can access more information by participating in organized events to share concerns.

5.2.2.3 Politics of scale

Actor-networks interact in making claims on nuclear power plant project in Ubon Ratchathaini province through different channels that they have access to, and this was found to be disproportionate. This interaction often linked with hierarchy of positions for exercising power or involvement in activities to pursue decision making for certain goals. There are inclusion and exclusion within interaction of actors to achieve particular goals. The interaction of EGAT with international expert Burns and Roe Company which was hired to conduct feasibility study for nuclear project from 2008-2010 drawn funding from the Energy Conservation Fund of Thailand and EGAT. In other word, this expert study is linked with taxpayer money from the Energy Conservation Fund that should be disclosed to public for consultation. But the money from the Energy Conservation Fund for this purpose was criticized by NGOs/CSOs that it was misused. Seminars, meetings and study trips on nuclear power that co-organized by government agencies (i.e. MoEN, OAP and EGAT as discussed in section 2.3.1) participated by limited number of local government official and community leaders. Dissemination of nuclear power project information from government and its related agency to the proposed project in Ubon Ratchathani thus was selective for public participation that can engage concerns. Ordinary villagers either had different access to nuclear information such as through their leaders who were invited to seminar, meeting and study trips or from other villagers and NGOs to be informed about the project. This saw a gap in knowledge where actor-networks have different access to information and power to make decision. Usually higher positions have more access to information that may not necessarily be diffused to grassroots to engage their concerns and in decision making process. It is the politics of national development that often-local communities have been pushed to sacrifice through uneven decision making power. Distribution of impacts that local communities will have to bear with indicate that local people are often have to sacrifice their livelihoods in the name of national development.

5.2.2.4 Discourses and knowledge production

Nuclear discourses are explored around four main areas including: Power demand and the role of nuclear; Fukushima; Risk and safety and; Climate change. In knowledge production, circulation and consumption, nuclear discourses played out by actor-networks to claim the debates they desire about nuclear power in Thailand including the proposed project in Ubon Ratchathani province. Discourses are claimed and contested by actor-networks involved in the debates to make way into decision making process about whether or not nuclear power station should be proceeded.

Discourses produced around power demand are contested between the need for nuclear energy for meeting anticipated increase of power demand and overestimated of Thai power production and projection. In the study *"Proposed Power Development Plan*

(PDP) 2012 and Framework for Improving Accountability and Performance of Power Sector Planning" by Chuenchom Sangarasri Grecen and Chris Greacen found that the PDPs were made with assumptions for too many power plants including nuclear power with over-estimated demand - have implication to environmental destruction.

Discourses produced around Fukushima are contested between lessons learned for safer nuclear use and that there can never be 100% guarantee for nuclear safety. The Thai government responded to the Fukushima disaster by postponing the nuclear power plans further in order to review safety concerns. In this regard, the highest safety standard for nuclear energy is promoted by the government that considers nuclear for energy supply mix with reasoning it as a security source of power for substituting depleting fossil fuel. In contest to this, concerns on nuclear power pointed out that it can never be safe as it is inherently a dangerous technology on its own type. The Fukushima nuclear disaster in 2011 was catastrophe of such danger that is difficult to predict.

Discourses produced around risk and safety are contested with different perception of risk by actors. The debate around risk can either be managed or it cannot. Viewing nuclear power as 'improved technology', implies that risk associated with it can be dealt with which emphasis on safety culture for potential harms that nuclear can cause. But risk in nuclear is also viewed that it cannot be managed because of long term impact that have implications to the environment and human health from the radiation that can reveal over the period of time. Thus the risk is this regards is unavoidable or difficult to manage.

Discourses produced around global climate change say that nuclear power is the answer to it but the other say it is not. *"Low carbon"* discourse is used that nuclear is viable and reliable energy as alternate source to fossil fuels and competing with other new emerging renewable energy such as solar and wind. Nuclear has gained attention for mitigating the global climate change crisis with another discourse as it has become 'mature' technology for producing electricity. But at the same time, nuclear has historically recorded of accidents that is treat to lives at the genetic level. Thus, nuclear power is contested with complex issue of radioactive risk that climate change itself may accelerate disasters of the nuclear power plants. Reducing GHG emission with nuclear power plants is also argued due to its lengthy construction time and the need to ensure safety will likely to increase the construction cost and management associate with it.

5.3 State of Knowledge in 2007 and 2017

In 2007 2,000MW of nuclear power was incorporated into the PDP 2007 for the first time given the reason that the country anticipated power demand rise and needed to diversify energy option for energy security from over reliance on natural gas reserves. The PDP then revised to new versions and changed to new PDP that increased the capacity of nuclear power up to 5,000MW in PDP 2010. But there has been a question about pursuing nuclear as renewable energy options such as wind and solar continue to grow. In addition, considering Thailand's 20-year Energy Efficiency Development Plan

(EEDP: 2011-2030), it argued that by implementing this plan it can save the energy with 15% reserve margin it can also remove 5 nuclear power plants.[86]

From 2007 to 2017, there were report of 17 locations[87] for nuclear power plants including in Kham Kuean Kaew sub-district, Ubon Ratchathani province. But there has not been revealed a definite decision from the government about nuclear power plant location until today.

Over the past decade, the national-level government research revealed that Thailand was ready to make *"knowledgeable commitment"* to proceed with nuclear power. But building nuclear power plant can take a decade and required 1,000 engineers to work in this phase, according to IAEA expert.[88] Despite Thailand has remained two nuclear power plants in PDP 2015 imply that the country is interested to pursue nuclear, it is unknown about when there will be public involvement to make a decision on national position on nuclear power.

Civil society research revealed that Thai PDPs have been over-forecasted of energy demand and Thailand does not need nuclear power plants. There is also a noticeable growing trend of renewable energy. But what is not known yet is whether or not the latest PDP 2015 that is being revised will remain nuclear power. Because it is reported that the new PDP will make changes on energy consumption pattern.[89]

Local civil society and community in Ubon Ratchathani province revealed rejection of the sitting location of nuclear power plant in Kham Khuean Kaew sub-district concerning local dependency on water supply sources for cooling nuclear power plant. It is not known how many nuclear power stations is proposed in Kham Khuean Kaew sitting and how much water supply the nuclear power plant will required. It is known that this area has history of displacement of local communities from Pak Mun dam and Sirindhorn dam before which also indicates water management conflicts with local communities.

The research on Fukushima nuclear disaster found that the Fukushima nuclear power plant was designed to resist 5.7 metres of water in height[90] but the magnitude 9 Richter earthquake, created an underestimated 14 metre high tsunami. This underestimation of disaster was both siting location and the historical records of tsunami in the East coast of Japan. It is considered to be a combination of natural and man-made that led to Fukushima disaster with triple reactor core meltdowns.[91] The impact of Fukushima is known as the worst nuclear accident since Chernobyl nuclear accident. It will take at

[86] Sinaran Online, 04/03/2012. Retrieved from https://sinaran.news/th/3087
[87] Status of Nuclear Energy Project in Thailand. Retrieved from https://www.iaea.org/NuclearPower/Downloads/Infrastructure/meetings/2012-03-20-23-TM-Vienna/22.pdf
[88] Cambodia and Thailand edging closer to nuclear power. 30 May 2016. Retrieved from http://www.straitstimes.com/asia/cambodia-and-thailand-edging-closer-to-nuclear-power
[89] New PDP accounts for disruptive forces. 22 January 2018. Retrieved from https://www.pressreader.com/thailand/bangkok-post/20180122/281960313170939
[90] Japan underestimated tsunami risk to nuclear plant, says UN watchdog. 1 January 2011. Retrieved from http://www.thejournal.ie/japan-underestimated-tsunami-risk-to-nuclear-plant-says-un-watchdog-147221-Jun2011/
[91] Radiation Reloaded: Ecological Impacts of the Fukushima Daiichi Nuclear Accident. Retrieved from https://www.greenpeace.org/japan/Global/japan/pdf/GPJ-Fukushima-Radiation-Reloaded-Report.pdf

least 30 to 40 year to clean up[92] radioactivity contamination as a result of Fukushima disaster leaving unknown health risk and ecological impact to future generation.

5.4 Conclusion

Proposed nuclear power plant project in Ubon Ratchathani posted many debates. Local communities in Kham Kuean Kaew and Hua Sapan shared key concerns on well-being and local resources such as water for cooling nuclear reactor as they depend on it for making local livelihoods. Some local people support the idea of having nuclear power plant as they perceive for more economic activities in the area as well as social welfare. But they also see that nuclear power plant should bring more job opportunity to local people while operating nuclear power plant requires controlled number of trained staffs and experts to work inside the power plant to monitor highest safety. Some people disagree with the proposed nuclear power plant project. They are concerned that there will be more negative impacts effecting their livelihoods without clarity about future relocation sites and whether or not it will take place in their community.

Local people are concerned about risks from nuclear. They perceive impact from radiation on local resource and health. If the nuclear power is built in the local area, magnitude of risk is close to the community location. Risk in this sense is unevenly distribution which put pressure on local community to live or deal with it.

In conclusion, insufficiency of public deliberation in the nuclear debates suggests inequality of participation that effects the quality of public engagement in decision making process about whether or not nuclear power station should be proceeded in Ubon Ratchathani province. This research found that deliberative environment is essential to engage local participation in decision making process as potential impacts from operating nuclear power plant have direct impact to their health and local resources they depend upon.

5.5 Recommendations

5.5.1 Recommendations for knowledge institutions

- In the past 10 years from 2007 to 2017, we have heard nuclear in Thailand (and keeps postponing). But with more significant improvement and continue to grow by 3,000MW of renewable energy capacity. Thailand's total installed solar PV generating capacity was increased up to 2,753MW in 2016.[93] Thailand's total installed wind electricity generating capacity by 2015 was 233.9MW.[94] In other words, renewable energy has surpassed the plans for

[92] Dying robots and failing hope: Fukushima clean-up falters six years after tsunami. 9 march 2017. Retrieved from https://www.theguardian.com/world/2017/mar/09/fukushima-nuclear-cleanup-falters-six-years-after-tsunami
[93] IRENA (2017), Renewable Energy Outlook: Thailand, International Renewable Energy Agency, Abu Dhabi (p. 31). Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA_Outlook_Thailand_2017.pdf
[94] IRENA (2017), Renewable Energy Outlook: Thailand, International Renewable Energy Agency, Abu Dhabi (p. 34) Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA_Outlook_Thailand_2017.pdf

2,000MW nuclear power plants. Therefore, the nuclear has been quite ineffective. Renewable energy should be supported more to decentralized energy system in Thailand.

5.5.2 Recommendations for nuclear policy networks

- Nuclear power project information was not availability to local grassroots community member, but mostly at the level of community leader with reportedly one-sided information. Nuclear policy network such as policy maker should ensure to engage all community member to be informed about the project in all aspects of the impacts and for community participation in decision making whether or not nuclear power station should be proceeded in Ubon Ratchathani.
- Nuclear power is a complex issue and raises many concerns, nuclear policy networks such as NGOs/CSOs should mediate between local community and policy makers to debate about it in order to engage more community participation and in decision making processes.

5.5.3 Recommendations for communities

- Communities should engage their debates on nuclear information into their community meeting with which all community members should be able to discuss and get update about the nuclear information with one another to further plan for pubic participate in decision making with policy makers.

5.6 Further research questions

- What strategy do local communities use to manifest their participation in nuclear policy making?
- How do local communities' strategy shape nuclear policy making in Thailand through the lens of deliberative environmental government?

REFERENCES

Adam Simpson, & Smits, M. (2016). Transitions to energy and climate security in Thailand. In R. E. Looney (Ed.), *Handbook of Transitions to Energy and Climate Security* (pp. 296-311). Abingdon: Routledge.

Alistair D.B. Cook, & Jamil, S. a. (2017). Nuclear Energy Security and the Policy Environment in Southeast Asia. In Nur Azha Putra & M. Caballero-Anthony (Eds.), *Mapping State and Non-State Actors' Responses to Nuclear Energy in Southeast Asia*. Hackensack and London: World Scientific.

Ashayagachat, A. (2011, 17 March 2011). Thailand 'must scrap nuclear projects'. Retrieved from https://www.pressreader.com/thailand/bangkok-post/20110317/283407713245232

Asia's Nuclear Energy Growth. (2016). Retrieved from http://www.world-nuclear.org/information-library/country-profiles/others/asias-nuclear-energy-growth.aspx

Blowers, A. (2007). Preface. In D. Elliott (Ed.), *Does Nuclear Power Have a Place in a Sustainable Energy Future?* Hampshire and New York: Palgrave Macmillan.

Chaikan, C. (2011). *Lessons from Nuclear Power Plants and the Participation of People Sector in Japan*.

Chan Sokheng, Chhuon Kim Chhea, Sintavong Viravong, Kongpeng Bouakhamvongsa, Thavone Phommavong, Ubolratana Suntornratana, . . . Tien, D. V. (2001). *Fish migrations and spawning habits in the Mekong Mainstream – a survey using local knowledge*. Retrieved from http://www.sethathirath.com/Mekong_fish_atlas_4.1/CONTENT/MAIN_TXT/PDF_mix.pdf

Cherid, K. (2012). Status of Nuclear Energy Project in Thailand Retrieved from https://www.iaea.org/NuclearPower/Downloads/Infrastructure/meetings/2012-03-20-23-TM-Vienna/22.pdf

China, Thailand Agree to Nuclear Energy Cooperation. (2017, 5 April 2017). Retrieved from http://www.world-nuclear-news.org/NP-China-Thailand-agree-to-nuclear-energy-cooperation-0504174.html

Chongkum, S. (2003). Role of Nuclear Energy in Thailand. (GENES4/ANP2003). Retrieved 22 February 2018, from Office of Atoms for Peace https://www.ipen.br/biblioteca/cd/genes4/2003/papers/1228-final.pdf

Chuenchom Sangarasri Greacen, & Greacen, C. (2012a). *Proposed Power Development Plan (PDP) 2012 and a Framework for Improving Accountability and Performance of Power Sector Planning*. Retrieved from https://www.internationalrivers.org/sites/default/files/attached-files/pdp2012-eng.pdf

Chuenchom Sangarasri Greacen, & Greacen, C. (2012b, 15 October 2012). A Proposed Power Development Plan for Thailand 2012. Retrieved from https://www.internationalrivers.org/resources/a-proposed-power-development-plan-for-thailand-2012-7693

Death, C. (2015). Four Discourses of the Green Economy in the Global South. *Third World Quarterly*. doi:10.1080/01436597.2015.1068110

Deetes, P. (2015, 19 May 2015). The Hidden Cost of Thailand's Electricity. Retrieved from https://www.bangkokpost.com/print/565867/

Department of Nuclear Engineering. Retrieved from http://www.ne.eng.chula.ac.th/wp/index.php/department/

EGAT. (2009). *Thailand Power Development Plan 2008-2010 (PDP 2007: Revision 2)*. EGAT.

EGAT. (2012). *Summary of Thailand Power Development Plan 2012- 2030 (PDP 2010: Revision 3)*. Retrieved from http://www.egat.co.th/en/images/about-egat/PDP2010-Rev3-Eng.pdf

EGAT. (2015). *Thailand Power Development Plan 2015-2036 (PDP 2015)*. Retrieved from http://www.egat.co.th/en/images/about-egat/PDP2015_Eng.pdf

EGAT's nuclear power plans – a credit train wreck on the horizon. (2009, 5 November 2009). Retrieved from https://www.pressreader.com/thailand/bangkok-post/20091105/283038345618608

Emerging Nuclear Energy Countries. (2017, January 2018). Retrieved from http://www.world-nuclear.org/information-library/country-profiles/others/emerging-nuclear-energy-countries.aspx

EPPO. (2015). *Energy Statistic of Thailand 2015*. Retrieved from http://www.eppo.go.th/info/cd-2015/Energy%20Statistics%20of%20Thailand%202015.pdf

EPPO. (2016). *Thailand Power Development Plan*. Retrieved from http://www.eppo.go.th/index.php/en/policy-and-plan/en-tieb/tieb-pdp

Foran, T. (2013). Action-Research to Improve Electricity Planning: Experience from Thailand. In Kanokwan Manorom, Louis Lebel, & R. Daniel (Eds.), *Governing the Mekong: Engaging in the Politics of Knowledg* (pp. 49-69). Selangor: Unit for Social and Environmental Research (USER).

GIZ. (2015). *Thailand: Renewable Energy Policy Update*. Retrieved from http://www.thai-german-cooperation.info/download/20150520_pdp_re_%20policy%20factsheet.pdf

Gluckman, R. (2007, 8 September 2007). Going Nuclear. Retrieved from https://www.forbes.com/global/2007/0917/140.html#1b05c9d37ef0

Holger Rogner, & Nam, K. Y. (2014). Nuclear Power Development in Asia. In Minsoo Lee, Donghyun Park, & H. Saunders (Eds.), *Asia's Energy Challenges: Key Issues and Policy Options* (pp. 324-361). London and New York: Asian Development Bank and Routledge

Hopkins, D. (2016, 20 June 2016). Thailand's Nuclear Plans Inch Forward With New Bill. Retrieved from http://asia.nikkei.com/Politics-Economy/Economy/Thailand-s-nuclear-plans-inch-forward-with-new-bill

IAEA. (1989). *Energy and Nuclear Power Planning Study for Thailand. International Atomic Energy Agency*. Vienna: IAEA.

IAEA. (2013). Country Nuclear Power Profiles 2013 Retrieved from http://www-pub.iaea.org/MTCD/Publications/PDF/CNPP2013_CD/countryprofiles/Thailand/Thailand.htm

IAEA. (2015). IAEA Nuclear Energy Series. No. NGG-3.1 (Rev. 1): Milestones in the Development of a National Infrastructure for Nuclear Power. Retrieved from https://www-pub.iaea.org/books/IAEABooks/7812/Milestones-in-the-Development-of-a-National-Infrastructure-for-Nuclear-Power

IAEA. (2016a). *Climate Change and Nuclear Power 2016*. Vienna: IAEA.

IAEA. (2016b). Country Nuclear Power Profiles: Thailand. Retrieved 22 February 2018, from IAEA https://cnpp.iaea.org/countryprofiles/Thailand/Thailand.htm

Ian Scoones, Peter Newell, & Leach, M. (2015). The Politics of Green Transformations. In Ian Scoones (Ed.), *The Politics of Green Transformations*. Oxon & New York: Routledge.

IEA. (2016). *Thailand's Electricity Security Assessment 2016*. Retrieved from Paris: https://www.iea.org/publications/freepublications/publication/Partner_Country_Series_Thailand_Electricity_Security_2016_.pdf

iLaw. (2016, 18 May 2016). โรงไฟฟ้านิวเคลียร์ "ความหวัง" หรือ "หายนะ"? Retrieved from https://ilaw.or.th/node/4123

IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change*. Retrieved from Cambridge and New York:

James Keely, & Scoones, I. (1999). *Understanding Environmental Policy Processes: A Review, IDS Working Paper 89*. Retrieved from https://www.ids.ac.uk/files/dmfile/wp89.pdf

Jansanoff, S. (2004). Ordering Knowledge, Ordering Society. In S. Jansanoff (Ed.), *State of Knowledge: The Co-production of Science and Social Order* (pp. 13-45). London and New York: Routledge.

Jonh Dore, L. L., Francois Molle. (2012). A Framework for Analysing Transboundary Water Governance Complexes, Illustrated in the Mekong Region. *Journal of Hydrology*.

Louis Lebel, Po Garden, & Imamura, M. (2005). The Politics of Scale, Position, and Place in the Governance of Water Resources in the Mekong Region. *Ecology and Society, 10*(2).

Middleton, C. (2014, 4-5 December 2014). *The Politics of Uncertainty: Knowledge Production, Power and Politics on the Mekong River.* Paper presented at the International Conference on Development and Cooperation of the Mekong Region, Seoul National University.

Middleton, C. (2016). Sustainable Electricity Transition in Thailand and the Role of Civil Society. In U. O. S. Hans Günter Brauch, John Grin, Jurgen Scheffran (Ed.), *Handbook on Sustainability Transition and Sustainable Peace*. Mosbach: Springer.

Mira Käkönen, & Hirsch, P. (2009). The Anti-Politics of Mekong Knowledge Production. In Francois Molle, Tira Foran, & M. Kakonen (Eds.), *Contested Waterscapes in the Mekong Region* (pp. 333-350): Earth Scan.

Molle, F. (2008). Nirvana Concepts, Narratives and Policy Models: Insights from the Water Sector. Retrieved from http://www.water-alternatives.org/index.php/allabs/20-a-1-1-8/file

Mycle Schneider, Antony Froggatt, Julie Hazemann, Tadahiro Katsuta, M.V. Ramana, Juan C. Rodriguez, . . . Freeman, S. D. (2017). *The World Nuclear Industry Status Report 2017*. Paris: A Mycle Schneider Consulting Project.

Mycle Schneider, Antony Froggatt, Yurika Ayukawa, Shaun Burnie, Raffaele Piria, Steve Thomas, . . . Suzuki, T. (2014). *World Nuclear Industry Status Report 2014*. Paris, London, Washington, D.C.: A Mycle Schneider Consulting Project.

Nuttall, W. J. (2007). Nuclear Renaissance Requires Nuclear Enlightenment. In D. Elliott (Ed.), *Nuclear or Not? : Does Nuclear Power Have a Place in a sustainable Energy Future?* Hampshire and New York: Palgrave Macmillan.

Pachaly, J. (2011, 24 March 2011). Debates About the Nuclear Future in Thailand. Retrieved from https://th.boell.org/en/2011/03/24/debates-about-nuclear-future-thailand

Patchimpattapong, A. (2010). Thailand's Nuclear Power Plant Feasibility Study from Nuclear Society of Thailand http://www.nst.or.th/n-power/1-Nuclear.pdf

Peterson, J. (2003). 'Policy Networks'. Institute for Advanced Studies.

Prasart Meetam, & Kiatiprajuk, S. (2014). Energy Inequity Making Thailand's National Development Unsustainable. Retrieved from http://www.socialwatch.org/es/node/15822

Rajesh Basrur, Koh Swee Lean Collin, & Kemburi, K. M. (2012). Nuclear Energy and Energy Security in Asia: Through the Human Security Lens. In K. S. L. C. Rajesh Basrur (Ed.), *Nuclear Power and Energy Security in Asia*. London and New York: Routledge.

Rajesh Basrur, Koh Swee Lean Collin, & Youngho, C. (2012). Post-Fukushima: Whither Nuclear Energy? In K. S. L. C. Rajesh Basrur (Ed.), *Nuclear Power and Energy Security in Asia* (pp. 194-202). London and New York: Routledge.

Rajesh, N. (2001). Radioactive agenda: The Nuclear Industry in Thailand. *Watershed, 7*(1), 35-49.

Rethinaraj, T. S. G. (2012). *Nuclear Power and Environment Impact: Risk vs. Perception*. London and New York: Routledge.

Rujivanarom, P. (2016, 27 June 2016). Thailand's Immediate Energy Dilemma - Nuclear and Coal Debated. Retrieved from http://www.nationmultimedia.com/news/national/aec/30289172

Sangkhamanee, J. (2010). *The Hydraulics of Power and Knowledge: Water Management in Northeastern Thailand and the Mekong Region*: Australian National University.

Shropshire, D. (2017). Nuclear Post COP21: International Workshop on Advanced Reactor Systems and Future Energy Market Needs. Retrieved from https://www.oecd-nea.org/ndd/workshops/arsfem2017/presentations/2_SHROPSHIRE_NEA%20Workshop%20Adv%20Reactors%20-%20IAEA%20PESS%20long%20version.pdf

Simon S. C. Tay, & Paungmalit, P. (2012). Critical Environmental Questions: Nuclear energy and Human Security in Asia. In Rajesh Basrur & K. S. L. Collin (Eds.), *Nuclear Power and Energy Security in Asia* (pp. 90-111). Oxon and New York: Routledge.

Sirinart Laoharojanaphand, Chainarong Cherdchu, Tatchai Sumitra, Wanwisa Sudprasert, Nares Chankow, Kanokrat Tiyapan, . . . Bhanthumnavin, D. (2016). The Recent Status of Nuclear Technology Development in Thailand. *E-Journal of Advanced Maintenance (EJAM), 8*(1).

Siripirom, P. (2014). Nuclear Safety Activities in Thailand. Retrieved from https://ansn.iaea.org/Common/Topics/OpenTopic.aspx?ID=14445

Smith, T. A. (2011). Local Knowledge in Development (Geography). *Geography Compass, 5*(8). doi:10.1111/j.1749-8198.2011.00443.x

Sneddon, C. (2003). Reconfiguring Scale and Power: The Khong-Chi-Mun Project in Northeast Thailand. *Environment and Planning A, 35*, 2229-2250. doi:10.1068/a35299

Talisayon, S. D. (1989). *Designing for Consensus: The ASEAN Grid*. Pasir Panjang: Institute of Southeast Asian Studies.

Thai Local Communities: Nuclear Power Is Not An Option for Thailand. (2011, 22 March 2011). Retrieved from https://www.boell.de/en/navigation/asia-thai-local-communities-nuclear-power-is-not-an-option-for-thailand-11558.html

Thai Power Excess Supply Lingers. (2017). Retrieved from https://www.dbs.com.sg/treasures/templatedata/article/generic/data/en/GR/072017/170717_insights_thai_power_excess_supply_lingers.xml

Thongrung, W. (2010, 21 September 2010). Nuclear power plants moved out of South Retrieved from https://www.pressreader.com/thailand/the-nation/20100921/282548719606294

Wangkiat, P. (2016, 28 August 2016). Power Play Tackles Hearts and Minds. Retrieved from https://www.bangkokpost.com/print/1072704/

Wassana Nanuam, & Wipatayotin, A. (2007, 4 September 2007). PM Details Plans for N-power. Retrieved from https://www.pressreader.com/thailand/bangkok-post/20070904/281492156932928

Wipatayotin, A. (2012, 4 November 2012). Anti-nuclear Group Warns Against Rush to Reactor. Retrieved from https://www.pressreader.com/thailand/bangkok-post/20121104/281603827728333

Yoo, Y. (2013). *Renewable Energy Development and Environmental Justice in Thailand: Case Studies of Biomass energy Projects in Roi-Et and Suphanburi Provinces.* (Master), Chulalongkorn University, Bangkok.

APPENDIX

Appendix 1: Research questionnaires

TOPIC 1: Power Development Plan (PDP) • The role of nuclear power as one of the energy mix in the PDP • What are anticipated benefits or risks to incorporate nuclear power in Thailand energy system? • What make Thailand beneficial to incorporate nuclear power?
TOPIC 2: Potential benefits and risks sharing <u>Benefits</u> • What knowledge do you produce about the nuclear and the purpose? • How do you communicate the knowledge your produce? How the knowledge is received? How do you know that? <u>Risks</u> • What risks do you consider in decision-making processes in considering to incorporate nuclear in Thailand energy system? • Who are at risk? • How those risks can be managed?
TOPIC 3: Fukushima 2011 nuclear incident • What issues from the Fukushima incident do you think about when considering to incorporate nuclear power in Thailand energy plan decision making processes?
TOPIC 4: Potential nuclear power plant site in Ubon Ratchathani province • What are factors involved in considering suitable site for nuclear power plant?

Cross-cutting question • Do you think Thailand should do nuclear, under what condition?

Appendix 2: Interviewees

Appendix 2.1: Experts

List of interviewees	Location	Date of interview
1. Energy Watch	Bangkok	9th June 2017
2. Energy Research Institute, Chulalongkorn University	Bangkok	3rd July 2017
3. Department of Nuclear Engineering, Faculty of Engineering Chulalongkorn University	Bangkok	7th July 2017
4. Mekong Energy and Ecology Network (MEE Net)	Bangkok	7th July 2017
5. Greenpeace Southeast Asia	Bangkok	18th July 2017
6. Local NGO in Ubon Ratchathani, No. #1	Ubon Ratchathani	25th June 2017
7. Local NGO in Ubon Ratchathani, No. 2#	Ubon Ratchathani	25th June 2017
8. Sirindhorn dam staff 1#	Ubon Ratchathani	27th June 2017
9. Local NGO in Ubon Ratchathani, No. 3	Ubon Ratchathani	28th June 2017
10. Ubon Ratchathani Rajabhat University professor	Ubon Ratchathani	29th June 2019
11. Department of Social Sciences, Faculty of	Ubon Ratchathani	12th July 2017

Liberal Arts, Ubon Ratchathani University		
12. Faculty of Engineering, Ubon Ratchathani University	Ubon Ratchathani	12th July 2017
13. Sirindhorn dam staff 2#	Ubon Ratchathani	13th July 2017
14. College of Medicine and Public Health, Ubon Ratchathani University	Ubon Ratchathani	15th July 2017

Appendix 2.2: Focus group

List of participants	Location	Date
1. Female participant, Kham Khuean Kaew village, no. 1#	Kham Khuean Kaew Sub-district Administrative Office, Sirindhorn District, Ubon Ratchathani	14 July 2017
2. Male participant, Kham Khuean Kaew village, no. 2#	As above	As above
3. Male participant, Kham Khuean Kaew village, no. 3#	As above	As above
4. Female participant, Hua Sa Pan village, no. 4#	As above	As above
5. Male participant, Hua Sapan village, no. 5#	As above	As above
6. Male participant, Hua Sapan village, no. 6#	As above	As above
7. Male participant, Hua Sapan village, no. 7#	As above	As above
8. Male participant, Hua Sapan village, no. 8#	As above	As above
9. Male participant, Hua Sapan village, no. 9#	As above	As above

10. Male participant, Hua Sapan village, no. 10#	As above	As above
11. Male participant, Hua Sapan village, no. 11#	As above	As above

Appendix 2.3: In-depth interviewees

List of interviewees	Location	Date of interview
1. Hua Sa Pan villager, no. 1#	Ubon Ratchathani	25th June 2017
2. Hua Sa Pan villager, no. 2#	Ubon Ratchathani	25th June 2017
3. Kam Khuean Kaew Sub-district Administrative Office, representative (Aor Bor Tor)	Ubon Ratchathani	26th June 2017
4. Hua Sa Pan village head (Phu Yai Baan)	Ubon Ratchathani	26th June 2017
5. Hua Sa Pan former school teacher, no. 3#	Ubon Ratchathani	26th June 2017
6. Kham Kuean Kaew village head (Phu Yai Baan)	Ubon Ratchathani	27th June 2017
7. Kham Kuean Kaew Sub-District head (Kamnan)	Ubon Ratchathani	12th July 2017

Appendix 2.4: Informal interviewees

List of interviewees	Location	Date of interview
1. Rafting business owner, no. 1#	Ubon Ratchathani	26th June 2017
2. Villager around Sirindhorn dam reservoir, no. 1#	Ubon Ratchathani	26th June 2017

3. Villager around Sirindhorn dam reservoir, no. 2#	Ubon Ratchathani	27th June 2017
4. Villager around Sirindhorn dam reservoir, no. 3#	Ubon Ratchathani	27th June 2017
5. Fisherman in Sirindhorn dam reservoir, no. 1#	Ubon Ratchathani	27th June 2017
6. Fisherman in Sirindhorn dam reservoir, no. 2#	Ubon Ratchathani	27th June 2017
7. Rafting business owner, no. 2#	Ubon Ratchathani	13th July 2017
8. Villager around Sirindhorn dam reservoir, no. 4#	Ubon Ratchathani	13th July 2017
9. Villager around Sirindhorn dam reservoir, no. 5#	Ubon Ratchathani	13th July 2017
10. Villager around Sirindhorn dam reservoir, no. 6#	Ubon Ratchathani	13th July 2017

VITA

Miss Tipakson Manpati graduated with B.A. in Mass Communication from Chiang Mai University in 2006. She is from a Phutai ethnic community in Kalasin Province. She has worked on several projects related to cross-border environment, human rights and development in the Mekong Region.