การสนับสนุนทางการเงินเพื่อการเปลี่ยนผ่านทางพลังงานโดยรายได้จากอุตสาหกรรมปิโตรเลียมและกองทุนพัฒนาไฟฟ้า: การอบรมและเสริมสร้างขีดความสามารถเกี่ยวกับพลังงานหมุนเวียนให้แก่ประชาชน

FINANCING ENERGY TRANSITION BY PETROLEUM REVENUES AND THE POWER DEVELOPMENT FUND: TRAINING AND CAPACITY BUILDING CONCERNING RENEWABLE ENERGY TO CITIZEN

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บทคัดย่อ

การจัดให้มีมีกระบวนการเรียนรู้เกี่ยวกับปรากฏการณ์การเปลี่ยนแปลงทางภูมิอากาศและการเปลี่ยนผ่านทางพลังงานให้แก่ประชาชนไม่ว่าจะเป็นการศึกษาในระบบหรือการศึกษานอกระบบนั้นมีความจำเป็นที่ต้องอาศัยทรัพยากรและการสนับสนุนทางการเงิน บทความวิชาการนี้มุ่งที่จะวิเคราะห์ให้เห็นให้ว่ารายได้ของรัฐจากอุตสาหกรรมปิโตเลียมที่รัฐได้รับจากผู้รับสัมปทานและผู้รับสัญญาและเงินที่ผู้รับใบอนุญาตประกอบกิจการไฟฟ้านำส่งเข้ากองทุนพัฒนาไฟฟ้าสามารถถูกใช้เพื่อให้การสนับสนุนทางการเงินแก่ประชาชนในการอบรมและเสริมสร้างขีดความสามารถให้ความรู้แก่ประชาชนเพื่อสร้างความรู้ความเข้าใจเกี่ยวกับการพลังงานหมุนเวียนทั้งมิติด้านเทคนิค การเงิน และกฎระเบียบ โดยได้พบว่ารายได้จากการสำรวจและผลิตปิโตรเลียมตามพระราชบัญญัติปิโตรเลียม พ.ศ. 2514 และเงินที่กองทุนพัฒนาไฟฟ้าได้รับตามพระราชบัญญัติการประกอบกิจการพลังงาน พ.ศ. 2550 สามารถถูกใช้เพื่อให้การสนับสนุนทางการเงินแก่การการพัฒนาโครงสร้างพื้นฐานด้านการศึกษาและจัดการอบรมที่ให้ความรู้เกี่ยวกับปรากฏการณ์การปลี่ยนแปลงทางภูมิอากาศและการใช้งานอุปกรณ์สำหรับระบบพลังงานหมุนเวียน บทความนี้เริ่มต้นจากการอธิบายถึงความจำเป็นของการศึกษาและการพัฒนาศักยภาพของคนในช่วงการเปลี่ยนผ่านทางพลังงาน ในลำดับถัดมา จะได้แสดงให้เห็นถึงความเป็นไปได้ที่จะรัฐจะจัดสรรรายได้จากอุตสาหกรรมสำรวจและผลิตโตรเลียมตามพระราชบัญญัติปิโตรเลียม พ.ศ. 2514 เพื่อการอบรมและเสริมสร้างขีดความสามารถ ส่วนที่สามจะกล่าวถึงความเป็นไปได้ที่ระบบใบอนุญาตและกองทุนพัฒนาไฟฟ้าตามพระราชบัญญัติการประกอบกิจการพลังงาน พ.ศ. 2550 ในการสนับสนุนทางการเงินแก่การอบรมและเสริมสร้างขีดความสามารถ

คำสำคัญ: พลังงานหมุนเวียน การเสริมสร้างศักยภาพ กองทุนพัฒนาไฟฟ้า

Abstract

Provision of educational processes to enhance citizen's knowledge on climate change and energy transition whether in the form of formal or non-formal education system need financial resources and supports. This academic paper analyzes how petroleum concessionaire and contractor-paid petroleum revenues and contributions that an electricity industry licensee paid to the power development fund can help finance renewable energy education and training programs for citizen. Benefited areas include technical, financial, and regulatory fields. It finds that petroleum revenues collected by the State under the Petroleum Act B.E. 2514 (1971) and contributions delivered to the power development fund under the Energy Industry Act B.E. 2550 (2007) can be used to finance education infrastructure development, as well as benefit training courses on climate change and utilization of equipment for renewable energy systems. It first discusses how providing training and capacity building is an essential step towards energy transition. In turn, it reveals how revenues from the petroleum upstream

industry carried out under the Petroleum Act B.E. 2514 (1971) can be transformed into financial resources for capacity building and training in an era of energy transition. The third section analyses how the electricity licensing systems, as well as the Power Development Fund under the Energy Industry Act B.E. 2550 (2007) can contribute to capacity building and training.

Keywords: Renewable energy, capacity building, Power Development Fund

Financing Energy Transition through Petroleum Revenues and the Power Development Fund: Training and Capacity Building concerning Renewable Energy to Citizen[1]

Introduction

Energy transition can be defined as the switch from an economic system dependent on specific energy sources and technologies to a different economic system.[2] In keeping the global temperature rise below 2 degrees Celsius, per the Paris Agreement, the switch focuses on transformation, from a system based largely on fossil fuels to one that enhances energy efficiency and is based on renewable energy.[3] The transformation does not mean immediate replacement of fossil fuels with renewable energies but the partial implementation of new renewable energy sources that can provide a transition until a permanent energy solution can be obtained.[4] As a party to the Paris Agreement, Thailand submitted its updated Nationally

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[1] This paper is developed from a workshop paper: *"Roles of Electricity General Authority of Thailand (EGAT) in Promoting Renewable Energy Industries through Technical Skills Training"*. The paper was prepared by the author for an international conference: *"Sustainable Livelihoods & Climate Change Workshop in Hanoi in 2019: Sustainable Livelihoods & Climate Change Regulation: Asian Approaches."* The conference was jointly organized by Institute of Legal Sciences of the Ministry of Justice (government of Vietnam), Hanoi Law University and Centre for Asia-Pacific Initiatives (University of Victoria, Canada) on the 4th of June 2019 at Hanoi Law University. The author would like to thank the Faculty of Law, Chulalongkorn University for financial support to attend the conference.

[2] Jorge Blazquez, Rolando Fuentes-Bracamontes, and Baltasar Manzano, "A road map to navigate the energy transition," Retrieved September 12, 2022 from https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/10/A-road-map-to-navigate-the-energy-transition-Insight-59.pdf.

[3] IRENA, Power System Flexibility for the Energy Transition, Part 1: Overview for policy makers, (International Renewable Energy Agency, 2018) p.10.

[4] John W. Sheffield, "Energy Security through Hydrogen" in John W. Sheffield and Çiğdem Sheffield (eds.), Assessment of Hydrogen Energy for Sustainable Development (Springer, 2007) p.6.

Determined Contribution ("NDC") on the 20th October B.E. 2563 (2020), expressing its intention to reduce its greenhouse gas emission by 20 percent from the projected business-as-usual (BAU) level by 2030.[5] The level of contribution could increase up to 25 percent, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity-building support.[6] The NDC further stresses that Thailand needs support to promote, develop and implement of formal and non-formal education and training programs, as well as to strengthen teachers and educators focusing on climate change at all levels.[7]

However, formal and non-formal education and programs for climate change need financial support. This paper attempts to analyze how oil revenues that a petroleum concessionaire and contractor paid under the Petroleum Act B.E. 2514 (1971) and contributions that an electricity industry licensee delivered to the Power Development Fund under the Energy Industry Act B.E. 2550 (2007) can help financing education and training programs on climate change and renewable energy. The paper finds that Petroleum Revenues collected by the State under the Petroleum Act B.E. 2514 (1971) and Contributions Delivered to the Power Plant and Power Development Fund under the Energy Industry Act B.E. 2550 (2007) can be used to finance education infrastructure development as well as training courses on climate change and utilization of equipment for renewable energy systems.

However, it argues that instead of being used to financially support education, petroleum revenues may be used by the government to finance other activities or projects. Moreover, a legal question arises as to interpret whether Section 97 paragraph 1 of the Energy Industry Act B.E. 2550 (2007) can permit use of the collected contributions for educational processes. It further argues that Section 97 paragraph 1 of the Energy Industry Act B.E. 2550 (2007) lacks clarity to serve a legal basis permitting use of deposited in the Power Development Fund to finance development of education facilities with capability to provide training on renewable energy deployment.

It begins by discussing how capacity building and training is an essential step towards energy transition. This section examines what people need to know, and available learning opportunities. The second section reveals how revenues from the petroleum upstream

[5] Office of Natural Resources and Environmental Policy and Planning, "Thailand's Updated Nationally Determined Contribution," Retrieved November 25, 2022 from https://unfccc.int/sites/default/files/NDC/2022-06/Thailand%20Updated%20NDC.pdf.

[6] *Ibid*.

[7] *Ibid*.

industry, carried out under the Petroleum Act B.E. 2514 (1971), can be transformed into financial resources for capacity building and training in an era of energy transition. The third section analyses how the electricity licensing systems, as well as the Power Development Fund under the Energy Industry Act B.E. 2550 (2007), can contribute to capacity building and training.

1. Capacity building and training in an era of energy transition

Education plays a key role in climate action, both in terms of raising awareness of the scale of the problem and in figuring out the best solutions.[8] Parties to the UNFCCC are bound to promote and cooperate in education, training and public awareness related to climate change, and to encourage the widest participation in this process, including that of the Non-Governmental Organizations.[9] In enhancing the implementation of the UNFCCC, the Paris Agreement requires Parties repeat the aforesaid commitment in Article 12. In fulfilling this commitment, a state party needs financial resources and allocation mechanisms that are capable of allocating financial resources for climate change education and training.

1.1 Knowledge enhancement for electricity generation in the 21st century: *a case study of Artificial intelligence & Peer-to-peer electricity trading*

Reflecting a centrally-planned economy, the Thai electricity industry is dominated by three state-owned electricity enterprises, namely the Electricity Generating Authority of Thailand (EGAT),[10] Metropolitan Electricity Authority (MEA),[11] and Provincial Electricity Authority (PEA).[12] EGAT is government vested with the authority to generate, acquire, transmit or distribute electrical energy to the MEA, PEA or other electricity authorities.[13] MEA is vested with the authority to distribute electricity supplied to it by EGAT within the Bangkok region.[14]

Operation of power plants in the 21st century can be technically benefited from deployment of technologies. EGAT, as a leading electricity operator in Thailand, has acknowledged potential roles of the Artificial Intelligence (AI) in the electricity sector.

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[8] United Nations, "Climate Change Education," Retrieved November 25, 2022 from https://unfccc.int/blog/climate-change-education.

[9] United Nations Frameworks Convention on Climate Change 1992, Article 6.

[10] Electricity Generating Authority of Thailand Act B.E. 2511 (1968), Section 6.

[11] Metropolitan Electricity Authority Act B.E. 2501 (1958), Section 6.

[12] Provincial Electricity Authority Act B.E. 2503 (1960), Section 6.

[13] Electricity Generating Authority of Thailand Act B.E. 2511 (1968), Section 6(1).

[14] *Ibid*, Section 6(2) and Section 8.

Commonly, AI is known to be the intelligence exhibited by machines and software, for example, robots and computer programs.[15] It generally refers to machines or programs with the ability to think on an independent level from their operator in order to make decisions independently.[16] As a type of AI, Machine Learning ("ML") is based on the use of statistics to give computers the ability to learn from data.[17] In practice, ML is most suited to prediction type problems.

Heading towards a digitalized power plant, it had studied and prepared EGAT's Digitalization Roadmap (to be used from B.E. 2561-2571 (2018 to 2028)). The ultimate goal of this Roadmap is to use AI to process the operation of a power plant.[18] According to EGAT, a digitalized power plant's operation is based on a digitalized system which is capable of automatically processing and analyzing. It relies on a big-data database.[19]

The dominant role of EGAT, MEA, and PEA does not mean that private operators and energy users are prohibited from competing in the electricity industry. From a regulatory perspective, electricity licensing systems, together with the third-party access regime under the Energy Industry Act B.E. 2550 (2007) enable locally-generated electricity traded on a P2P basis, as well as regulating smart metering services.[20] However, from a prosumer's perspective, a question arises, even if legal right to participate in the market and right of access to the electricity network are guaranteed by the law, is whether the people including energy consumers, technicians, and service providers have sufficient "capacity" or knowledge to exercise these rights. In the absence of knowledge and understanding on equipment required for renewable energy systems, the regulatory framework that has been developed to facilitate P2P electricity trading can become practically meaningless.

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[15] Arun Kumar and Murali Mohan, "Artificial Intelligence in Power Station," 5(1) International Journal of Engineering and Technical Research (IJETR) 37, 37 (May 2016).

[16] Ibid.

[17] Ravi Mahendra, "AI is the new electricity," Retrieved June 2, 2019 from https://www.smart-energy.com/industry-sectors/new-technology/ai-is-the-new-electricity/.

[18] EGAT, "Change: Moving Towards Digitalized Power Plant," Retrieved June 2, 2019 from https://www.egat.co.th/index.php?option=com_content&view=article&id=2957:20190320-art01&catid=49&Itemid=251.

[19] *Ibid*.

[20] Piti Eiamchamroonlarp, "Legal Challenges and Opportunities for Peer-to-Peer Electricity Trading in Thailand" Retrieved November 25, 2022 from https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=1001& context=ccla.

1.1.1 What do the people need to know and what are available learning opportunities?

The United Nations Educational, Scientific and Cultural Organization (UNESCO) was of the view that people may be unaware of most of the achievements, possibilities and prospects of solar technologies.[21] Training and information activities on equipment required for renewable energy systems should be made available for the general public through both formal and non-formal education. These learning activities can take place onsite at a school and online through digital devices.

1.1.1.1 Formal education: *Primary and Secondary Schools*

In relation to the formal education, an education can determine an objective, educational procedure, curriculum, period of study, measurement and evaluation as a condition of graduation[22]. The State can encourage teaching of renewable energy technologies in primary and secondary schools. Within the context of courses in physics, chemistry and technology, a scientific base on solar energy can effectively be introduced to the thinking of young students. In the very near future, these individuals will be the implementers of the large energy programs that are only currently being launched.[23] Related disciplines recommended to be taught for each renewable technology are exhibited in Table 1 below:

[21] Solar Energy Research Association, Networked Knowledge for Renewable Energies (FVS, Berlin, 2004) p.35.

[22] National Education Act B.E. 2542 (1999), Section 15 paragraph 1(1).

[23] *Supra note* 27 p.36.

Table 1: Related disciplines recommended to be taught for each renewable technology

Technology/ Related disciplines	Hydro-electric	Wind turbines	Photo-voltaic conv.	Solar therdyn.	Solar thermal	Geo-thermal	Biomass
Mechanics	●	●		●	●		
Geology	●					●	●
Atmosph. phys	●	●	●	●	●		●
Thermodyn.				●			
Thermal sci.				●	●	●	
Building eng.					●		
Chemistry			●	●	●	●	●
Chem. eng.			●	●			
Phys.of mat.	●	●	●		●		
Electro. phy.		●	●	●			
Electro. tech.	●	●	●	●			
Agronomy							●
Bio. eng.							●

Source: Networked Knowledge for Renewable Energies (2004)[24]

1.1.1.2 Non-formal education: *Online training courses*

In reality not everyone can practically attend formal education for AI learning or renewable energy deployment. A person desiring to become a prosumer may wish to simply acquire knowledge and skills relating to the recommended disciplines via online courses without going to a school or a formal education institute and does not need graduation. This method of education is called “non-formal education”. Under the Act for the Promotion of Non-Formal and Informal Education B.E. 2551 (2008), “non-formal education” means an educational activity which has an obvious target client group and education objective, and has flexible and various format, curriculum, method, and duration of course or training in accordance with the educational requirement and potential of such target group, and has an

[24] *Ibid.*

up-to-standard examination and assessment method to receive educational qualification, or to rank academic results.[25]

Online training courses on climate change and installation and use of equipment required for renewable energy systems can be organized and delivered by an educational establishment. These online courses can contain information on the disciplines exhibited in Table 1. Supported by communication technologies, learners can take online pre- and post-tests for evaluation purposes, and electronically gain educational qualifications from the online system. To develop and implement these online training courses, the organizer, such as an education institute needs financial resources including remuneration and benefits of the speaker, production costs, and marketing courses.

1.2 Maintaining and development education infrastructures

The United Nations Children's Fund (UNICEF) published a paper named *"It is Getting Hot: Call for Education Systems to Respond to the Climate Crisis"* in December B.E. 2562 (2019). This publication finds that Climate change is likely to add to these costs – both through direct losses and damages (e.g., on education infrastructure and on mortality of students) as well as indirectly (e.g., through missed school).[26] When combining these impacts, the total cost of climate change on education is likely to be in the scale of trillions of dollars because of the potential impacts occurring at various timescales and through multiple pathways.[27]

Costs associated with loss and damage to infrastructure have been routinely assessed in post-disaster needs assessments and similar exercises – partly in order to estimate the financial resources needed to bring back a location to at least its pre-disaster state.[28] In addition to these direct costs resulting from direct impacts of climate change, it is also important that the State acknowledges the indirect cost on education. In the context of nutrition, for example, global analyses suggest that the annual costs of malnutrition are US$3.5 trillion.[29]

In enhancing skills and knowledge relating to AI, machine learning, installation and use of equipment for renewable systems, maintaining and development education infrastructures which are affected by climate change, sufficient financial resources are needed. The next two

[25] Act for the Promotion of Non-Formal and Informal Education B.E. 2551 (2008), Section 4.

[26] UNICEF, "It is Getting Hot: Call for Education Systems to Respond to the Climate Crisis," Retrieved November 25, 2022 from https://www.unicef.org/eap/reports/it-getting-hot p.6.

[27] *Ibid.*

[28] *Ibid, p.* 32.

[29] *Ibid,* p. 33.

sub-sections will examine how the upstream petroleum industry and the electricity generation industry, which are two sectors directly contributing to greenhouse gas emission, can generate financial resources that can be utilized to fund capacity building activities, as well as to maintain and develop education infrastructure.

2. Petroleum revenues from the upstream petroleum industry

Under the current regulatory regimes, Thailand permits private participation in energy industries through the contractual system and the licensing system. Under the Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), a private oil company is required to enter into a petroleum authorization agreement with the Minister of Energy; whereas, a power producer is required by the Energy Industry Act B.E. 2550 (2007) to obtain an electricity license from the Energy Regulatory Commission.

2.1 A right to explore for and commercially produce petroleum and petroleum revenues

Most sovereign states[30] have claimed some manner of rights to the oil and gas deposits situated within their borders or located beneath their Continental Shelf to the outer limit of their Exclusive Economic Zone.[31] One important issue that the State has to determine is whether to retain ownership of natural resources including petroleum. It may allow the private landowner to have ownership of petroleum resources, as occurs in parts of the United States or it can retain ownership of such resources.[32] Most countries vest the ownership of petroleum occurring under natural conditions on the surface or in the subsoil in the State.[33] Under the state ownership regime, private companies or individuals cannot legally extract and sell petroleum without obtaining authorization from the government.[34]

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[30] For example, the United States and Canada recognise private ownership of underlying mineral. They still give effect to the Latin maxim, *cujus est solum, ejus est usque ad coelom ad infernos* (To whomsoever the soil belongs, he owns also to the sky and to the depths.)

[31] Greg Gordon, "Petroleum Licensing" in Greg Gordon, John Paterson, and Emre Üşenmez (eds), Oil and Gas Law – Current Practice and Emerging Trends (2nd ed) (2011) p.65.

[32] *ibid.*

[33] Bernard Taverne, "Petroleum, Industry and Governments: A Study of the Involvement of Industry and Governments in the Production and Use of Petroleum," Kluwer Law International (2nd edn., 2008), p.120.

[34] Yinka Omorogbe and Peter Oniemola, "Property Rights in Oil and Gas under Domanial Regimes," Property and the Law in Energy and Natural Resources, (OUP, 2010) p.116.

From a regulatory perspective, a modern upstream industry was established by the Petroleum Act B.E. 2514 (1971) (hereinafter "Petroleum Act"). According to the Petroleum Act, ownership of petroleum resources *in situ* is vested with the state.[35] Exploration and production activities are subject to an authorization[36] of the Ministry of Energy (originally the Ministry of Development).[37] In consistent with other modern petroleum concessions, duration of the exploration stage is limited and explicitly indicated in the agreement, but extendable by the Minister's discretion.[38] A concessionaire is subject to close monitoring of the Department of Mineral Fuel or the "DMF", a petroleum regulator. For example, work obligation (for exploration activities) is subject to an approval of the Director General of the DMF.[39]

In relation to fiscal components, a concessionaire is bound to pay royalty, special remuneration, and petroleum income tax. The royalty payment is based on petroleum which is sold or distributed in the form of cash, or in the form of kind (as permitted by the Minister of the Ministry of Energy).[40] Sliding scale rates from 5-15 percent are applied in the current petroleum fiscal regime.[41] A petroleum concession typically requires a concessionaire to pay special remuneration benefits on a progressive rate from 0 percent to 75 percent on windfall profits. The Petroleum Income Tax Act B.E. 2514 (1971) provides that the rate shall be less than 50 percent of net income but shall not exceed 60 percent of net income.[42]

However, it shall be noted that, as a consequence of an amendment of B.E. 2560 (2017), petroleum exploration and production activities can also be permitted by means of a

[35] Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), Section 23.

[36] Under the current regime, a concession shall be awarded to an area having possibility of Petroleum Geological Region's Commercial Discovery appears higher than that of Possibility of Thailand's Commercial Discovery.

[37] *Ibid*, Section 22(1) and Section 23.

[38] Notification of the Ministry of Energy re: Form of Petroleum Concession B.E. 2555 (2012), Clause 3.

[39] *Ibid*, Clause 4(2).

[40] Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), Section 82 and Section 83.

[41] Notification of the Ministry of Energy re: Form of Petroleum Concession B.E. 2555 (2012), Clause 10.

[42] Petroleum Income Tax Act B.E. 2514 (1971), Section 20.

production sharing contract ("PSC")[43] and a service agreement ("SA")[44].[45] A PSC contractor is required to submit work programs and budget for an approval by the Director-General of the DMF and is required to pay special remuneration benefits[46] and royalty at the rate of 10 percent of the total production.[47] Actual operational costs shall be recovered from the total production but shall not exceed 50 percent of the total production.[48] The remaining petroleum shall be treated as profit oil.[49]

Subject to the cabinet's approval, a SA can be awarded by the Minister of the Ministry of Energy.[50] According to the Petroleum Act, ownership of the product produced shall remain that of the State; however, a SA contractor may be assigned to sell or dispose of the produced petroleum.[51] Operational costs shall be borne by a contractor.[52] In return, a contractor shall earn a service fee which is payable in cash or in kind.[53]

2.2 Transformation of petroleum revenues into capacity building

Despite a concessionaire's duty to hire or train a person having Thai nationality, it appears reasonable to ask a question on management of the collected petroleum wealth. Under the petroleum fiscal regime discussed in sub-section 2.1 the government earns revenues from the concessionaire through, for example, royalty payments or petroleum taxes, and other special remuneration. These petroleum revenues should be converted into public services or

[43] A production sharing agreement will be awarded to an area having possibility of Petroleum Geological Region's Commercial Discovery appears higher than that of Possibility of Thailand's Commercial Discovery.

[44] A service agreement will be awarded to an area: (1) having accumulated production volume together with having value of remaining average volume of reserved crude oil in that Area more than four million barrels of oil per one production well or; (2) having volume of reserved natural gas more than three trillion cubic foot as well as having accumulated production volume together with having value of remaining average volume of reserved natural gas in that Area more than four trillion cubic foot per one production well.

[45] Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), Section 23.

[46] Notification of the Ministry of Energy re: Form of Production Sharing Agreement B.E. 2561 (2018), Clause 11.

[47] Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), Section 53/6.

[48] *Ibid*, Clause 5(1)(b).

[49] *Ibid*, Clause 5(1)(c).

[50] Petroleum Act B.E. 2514 (1971) (as amended in B.E. 2560 (2017)), Section 53/10.

[51] *Ibid*, Section 53/11(1).

[52] *Ibid*, Section 53/11(2).

[53] *Ibid*, Section 53/11(4).

infrastructures. For example, collected petroleum wealth should be allocated and spent for better public education, thus broadening chances of Thai people to be hired by oil companies.

Natural resource wealth, especially oil and gas, possesses enormous potential to alleviate poverty in developing countries and to promote sustainable development and prosperity.[54] To ensure this transformation, the World Bank has explained that the State plays a central role. As displayed in Figure 1, the World Bank adopted the Natural Resource Management ("NRM") value chain to display the key sequence of steps that a resource dependent country must undertake in transforming its natural resource rents into developmental riches.[55] The value chain encompasses sector organization and the award of contracts; regulation and monitoring of operations; collection of taxes and royalties; revenue distribution and management; and sound and sustainable policies.

Natural resource potential	→			**Sustainable development**
Sector organization and contract awards →	Regulation and monitoring of operations →	Collection of oil and gas revenues →	Revenues distribution and management →	Sound and sustainable policies

Figure 1: The NRM Value Chain[56]

Once the State has collected oil and gas revenues, it is responsible for distributing and managing the wealth. In essence, these activities involve three aspects. The first is formulating macro-economic policy responses to mitigate any negative impact from exchange rate appreciation; secondly, making savings decisions; and thirdly, judiciously allocating public expenditure.[57] Ultimately, the State should spend oil and gas revenues for sustainable

[54] Charles P. McPherson, "Necessary but not sufficient: anti-corruption and transparency legislation," 7(3) JWELB (June 2014) 180, 180.

[55] Naazeen H. Barma, Kai Kaiser, Tuan Minh Le and Lorena Viñuela, Rents or Riches?: The Political Economy of Natural Resource-Led Development, (The World Bank 2012) p.5.

[56] Eleodoro Mayorga Alba. A Comprehensive Integrated Approach to Developing Extractive Industries, Washington, DC: World Bank 2009, p. 3.

[57] *Ibid* 14.

development investments.[58] These investments are, for example, social infrastructure and physical infrastructure.[59]

From Figure 1, the collected petroleum revenues, for example those collected from PTT Public Company Limited (PTT) and other privately-owned oil companies, can be converted into capacity building and skill development of Thai workforce though public education infrastructure and better learning opportunities. This possibility does not axiomatically mean the collected petroleum revenues will be allocated to finance provision of educational processes to enhance citizen's knowledge on climate change and energy transition whether in the form of formal or non-formal education system.

A big challenge arises to determine whether the state will allocate and distribute petroleum revenues for sustainable development or what are available mechanisms for enhancing governance in the petroleum sector.[60] Many countries have mismanaged the collected petroleum revenues, either through corruption or inadvertently through misguided spending choices.[61] Instead of being used to financially support education, petroleum revenues may be used by the government to finance armed conflict.[62]

Therefore, it is also important for citizen of a petroleum producing county to have capability to exercise practical control their government. They should be empowered to influence the government to make a decision for their own good for example allocation of petroleum revenues for education development. This question triggers a broad question on democratization.

3. Power Plant and Power Development Fund

Prior to B.E. 2550 (2007), the Thai legal system had not adopted a piece of legislation serving a systematic legal basis for electricity licensing. The National Executive Council Order No.58 B.E. 2515 (1972) only states that electricity is a business which has impacts on the well-

[58] *Ibid* 18.

[59] *ibid*.

[60] For further discussion on this issue please see: Piti Eiamchamroonlarp, "Combating corruption in the Petroleum Sector: Implementation of Extractive Industries Transparency Initiative (EITI)" (2015) 4(2) Ramkhamhaeng Law Journal p. 35.

[61] UNESCO, "Turning the 'resource curse' into a blessing for education," Retrieved December 22, 2022 from https://unesdoc.unesco.org/ark:/48223/pf0000220443.

[62] *Ibid*.

being of the people and security of the state and, is prohibited unless an authorization is given by the Minister. Laws establishing and empowering independent state agencies with the capacity to grant electricity licenses were absent. The Energy Industry Act B.E. 2550 (2007) established the electricity licensing system. Under this legal framework those who desire to generate, transmit, or sell electricity are required to obtain an electricity license from the Energy Regulatory Commission ("ERC").[63]

3.1 A right to generate electricity and a duty to pay contributions to the Power Plant and Power Development Fund

As a consequence of the promulgation of the Energy Industry Act B.E. 2550 (2007), state-owned enterprises like EGAT, MEA, and PEA are no longer the only "key operators" who can produce and sell electricity in Thailand. From an academic point of view, the regulatory reformation enacting the Energy Industry Act B.E. 2550 (2007) has contributed to the liberalization of the electricity sector in Thailand.

According to the Energy Industry Act B.E. 2550 (2007), a private company may apply for a electricity generation and power plant construction license.[64] The Energy Regulatory Commission ("ERC"), an independent regulatory, is responsible and is vested with discretionary powers to grant the licenses.[65] Under this regulatory regime, Gussing Renewable Energy ("GRE") obtained electricity licenses from the ERC to construct and operate a carbon-neutral waste gasification plant in Nong Bua, Nakorn Sawan Province. The plant uses about 24 tons of biomass – waste from the cassava root and palm oil industries to produce electricity for about 3,000 homes.[66] It was reported that the town attracted 50 new businesses and 1,500 new jobs by transforming the area into a green energy hub, all the while cutting carbon emissions by 90 percent.[67]

In September B.E. 2562 (2019), National Energy Policy Committee ("NEPC") approved a plan endorsing "community-based power plant for grassroots economy". The plan aims to stimulate local communities to generate its own electricity by relying on local resources, for example agriculture products. To implement the aforesaid plan, ERC promulgated the ERC

[63] Energy Industry Act B.E. 2550 (2007), Section 47 and 48.

[64] Energy Industry Act B.E. 2550(2007), Section 47 and Section 48.

[65] *Ibid.*

[66] Bangkok Post, "Austrian renewable model gets local try," Retrieved June 2, 2019 from https://www.bangkokpost.com/news/environment/1607310/austrian-renewable-model-gets-local-try.

[67] *Ibid.*

Regulation on Electricity Procurement from Very-Small Power Producers (The Community-Based Power Plant for Grassroots Economy Project) in April B.E. 2563 (2020). Under this regulation, the locally-generated electricity will be purchased by the government at the guaranteed price to ensure financial viability of the project. A community-based power plant will be treated as a very small power producer having generation ("VSPP") (having generation capacity not exceeding 10 MW[68]). The government will purchase the electricity from biomass, biogas, hybrid of biomass and biogas as well as solar power at the guaranteed price (under the Feed-in-Tariff: "FiT"). Two types of project owners are the public-private entity and the local-community enterprise (having at least 200 families).

In March B.E. 2564 (2021), ERC promulgated its Regulation on Electricity Procurement from Very-Small Power Producers (The Community-Based Power Plant for Grassroots Economy Pilot Project). This regulation enabled a VSPP to sell electricity generated from biomass and biogas to MEA and PEA under a power purchase agreement.[69]

The abovementioned electricity procurement from community-based power plants reveals how energy policies and regulatory regimes can be developed to support a local community. Unlike an upstream petroleum project, or a coal-fired power plant which are typically owned and operated by "big" players such as state-owned enterprises, a community-based power plant can be owned and operated by local people. In the other words, existence and benefits of the project are not only restricted to employment but by being an owner of a power plant. Under the Local-Community Promotion Act B.E. 2548 (2005), a local-community enterprise is:

> *"...an enterprise owned by a local community for product manufacturing, services, or other activities which is jointly operated by a group of people sharing a way of life, whether being a juristic person or not, with objectives on generating revenues..."*[70]

[68] Energy Regulatory Commission Regulation on Electricity Procurement from Very-Small Power Producers (The Community-Based Power Plant for Grassroots Economy Project) 2020, Clause 3.

[69] Energy Regulatory Commission Regulation on Electricity Procurement from Very-Small Power Producers (The Community-Based Power Plant for Grassroots Economy Pilot Project) 2021, Clause 3.

[70] Local-Community Promotion Act B.E. 2548 (2005), Section 3.

After its registration at the Department of Agricultural Extension,[71] a registered community-based enterprise can apply for an electricity license from the ERC in accordance with the Energy Industry Act B.E. 2550 (2007) and relevant regulations, and enter into a power purchase agreement to sell electricity from biomass, biogas, hybrid of biomass and biogas at the guaranteed price. Tangible benefits of a power project go beyond employment. Local people, as the owner of the plant, can earn income from the generated and sold electricity. On the other hand, they may earn income from supplying renewable resources to the power plant.

3.2 Transformation of contributions paid by electricity producers to the Power Development Fund

The Energy Industry Act B.E. 2550 (2007) requires establishment of the Power Development Fund in the Office of ERC. Money kept in the Fund shall be used for the following objectives: capital to support substantial extension of electricity service provision to various localities so as to decentralize prosperity to provincial areas; to develop the local communities affected by the operation of a power plant; to promote the use of renewable energy and technologies in the electricity industry operation that have less impact on the environment, with due consideration on the balance of natural resources; and to create fairness for power consumers.[72]

3.2.1 Electricity Licensee's duty to deliver contributions

Electricity industry licensees are required by the Energy Industry Act B.E. 2550 (2007) to deliver contributions to the Fund in accordance with the regulations prescribed by the ERC under the policy framework of the NEPC under Section 11 (10).[73] The ERC made an announcement on the 16th of February B.E. 2560 (2017) calling for electricity generation licensees to deliver contributions from the date of commercial delivery of electricity to the Fund on a monthly basis.[74] Rate of contributions are based on types of fuels used for electricity generation as shown in Table 2 below:

[71] *Ibid*, Section 5.

[72] Energy Industry Act B.E. 2550 (2007), Section 93.

[73] *Ibid*, Section 96 paragraph 1.

[74] Notification of Energy Regulatory Commission on the Electricity Generation Licensee's Duty to Deliver Contributions to the Power Development Fund (No.2) B.E. 2559 (2016), Clause 3.

Table 2: Rates of Contributions to be paid by Electricity Generation Licensees[75]

Types of Fuels	Satang/Electricity Unit generated monthly
Natural gas	1.0
Fuel oil and diesel	1.5
Coal and lignite	2.0
Renewable resources: wind and solar	1.0
Renewable resources: hydro	2.0
Waste heat	1.0
Other types of renewable resources for example biogas biomass, residues, municipal waste, industrial waste, and others	1.0

In addition to imposing a duty upon the electricity generation licensee, the ERC made an announcement in B.E. 2560 (2017) calling the electricity supply licensee to deliver contributions to the Fund to increase knowledge, awareness and participation of the society calling electricity supply licensees to declare its electricity supply data as well as to deliver contributions to the Fund on a monthly basis.[76] This announcement separates the electricity supply licensee into two groups: (1) EGAT, MEA, and PEA; and (2) other electricity supply licensees. For the former, amount of the contribution is amount of electricity supply units (kVA) timed by 0.002.[77] For the latter, the contributions shall be calculated on the net supply units (calculated by amount of electricity supply units (kVA) minus purchased electricity units) timed by 0.002.[78]

3.2.2 Use of the Fund for capacity building

A legal question arises as to interpret whether Section 97 paragraph 1 of the Energy Industry Act B.E. 2550 (2007) can permit use of the collected contributions for educational processes that promote the use of renewable energy and technologies for electricity industry

[75] *Ibid.*

[76] Notification of Energy Regulatory Commission on the Electricity Supply Licensee's Duty to Deliver Contributions to the Fund to Increase Knowledge, Awareness and Participation of the society B.E. 2557 (2013), Clause 4 paragraph 1.

[77] *Ibid*, Annex (Reporting Form I.).

[78] *Ibid* Annex (Reporting Form II).

operation that have less impact on the environment[79] as well as to increase knowledge, awareness and participation of the society and people in power-related issues[80]. According to these objectives, it is possible that the Power Development Fund can be used to finance or financially support online training courses on renewable energy and climate change.

According to the Regulations of Energy Regulatory Commission on Criteria and Allocation Methods of the Contributions Deposited in the Power Development Fund for Increasing Knowledge, Awareness and Participation of the Society B.E. 2559 (2016), the following entities can apply to use the Fund: a state agency, an education institute, a cooperative, a non-profit organization, a press agency, and other agencies prescribed by the ERC.[81] An applicant is required to submit a project proposal to the Office of ERC in accordance with the guidelines announced by the Office of ERC.[82]

One good example of how the contributions deposited in the Fund can be used to enhance people's capacity in matters relating to climate change and renewable electricity is a free massive open online course (MOOC) jointly developed and taught by the Energy Research Institute of Chulalongkorn University and Faculty of Law of Chulalongkorn University called: "Where does electricity come from?". This course was financially supported by the Power Development Fund.

The course allows any person to gain an understanding on electricity generation overview of Thailand.[83] The course covers knowledge on technical aspects of electrical energy as well as regulatory aspects of green electricity businesses in Thailand.[84] Interestingly, in order to obtain a certificate of completion, an attendee must attend at least 80 percent of the course activities and must achieve at least 50 percent of the post-test examination.[85]

Taking this MOOC into account, one sees that non-formal education delivered through online platforms can be supported by electricity producers and suppliers. When the Fund is

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[79] Energy Industry Act B.E. 2550 (2007), Section 97 paragraph 1(4).

[80] *Ibid*, Section 97 paragraph 1(5).

[81] Regulations of Energy Regulatory Commission on Criteria and Allocation Methods of the Contributions Deposited in the Power Development Fund for Increasing Knowledge, Awareness and Participation of the Society B.E. 2559 (2016), Clause 12.

[82] *Ibid*. Clause 14.

[83] Chulalongkorn University, "CHULA MOOC2012: Where does electricity come from?" Retrieved November 25, 2022 from https://mooc.chula.ac.th/courses/227.

[84] *Ibid.*

[85] *Ibid.*

used to finance development of a training course on renewables, it can be said that an electricity producer that generates electricity from fossil fuels such as lignite and natural gas has contributed to financing energy transition especially as relates to capacity building.

However, utilization of the contributions deposited in the Power Development Fund is only an example of how the contribution can be used to finance climate change and renewable energy deployment education for citizen. To enhance capacity building process for the citizen during the energy transition era, these contributions should be allocated to finance development education infrastructure with capability to provide training on climate change and renewable energy deployment.

For example, there shall be a training center that is equipped with solar systems, wind generation equipment and geothermal options.[86] It should all students to gain hands-on learning environment, which demonstrates and operates under the latest in sustainable energy technology.[87]

A question arises as to determine whether Section 97 paragraph 1(5) of Energy Industry Act B.E. 2550 (2007) can be interpreted to allow use of the deposited contributions for this infrastructure development financing. The provision emphasizes awareness and participation of the people in renewable energy without referring to infrastructure development.[88] Lacking this clarity, the deposited money may not be used for infrastructure development. In addition, a by-law promulgated by virtue of Section 97 is unable to go beyond the existing text of Section 97 of the Energy Industry Act B.E. 2550 (2007). Hence, in order to lawfully utilize the deposited contributions, it appears reasonable to amend Section 97 of the Energy Industry Act B.E. 2550 (2007) to go beyond awareness and participation of the people in renewable energy to include education infrastructure development.

Conclusion

This paper finds that the Petroleum Act B.E. 2514 (1971) and the Energy Industry Act B.E. 2550 (2007) can serve as legal bases for private participation in the petroleum and the electricity sectors. Oil companies can obtain rights to explore for and produce petroleum

[86] Delaware Tech, "The Sustainable Energy Training Center," Retrieved December 2022, 22 from https://www.dtcc.edu/about/college-initiatives/energy-education/sustainable-energy-training-center

[87] *Ibid.*

[88]The Fund shall be used for the following activities: to increase knowledge, awareness and participation of the society and people in power-related issues.

resources either in the form of a petroleum concession, a production sharing contract, and a service contract; whereas, power companies can obtain electricity licenses from the ERC. The authorized operators and investors can gain fair profits from their investment and, simultaneously, contribute to energy security of the country.

However, from a prosumer's perspective, a question arises, even if legal right to participate in the market and right of access to the electricity network are guaranteed by the law. The question is whether the people have sufficient "capacity" or knowledge to exercise these rights. The dynamics of technological advancement has given rise to benefits to the energy sector, for example oil and gas exploration technologies, energy storage for electric vehicles, or smart electricity transmission lines ("smart grid"). On the other hand, technological advancement can inevitably trigger challenges to the workforce. In the absence of knowledge and understanding of equipment required for renewable energy systems, the regulatory framework that has been developed to facilitate P2P electricity trading can become practically meaningless.

Formal and non-formal education and programs for climate change need financial support. This paper finds that oil revenues that a petroleum concessionaire and contractor paid under the Petroleum Act B.E. 2514 (1971) and contributions that an electricity industry licensee delivered to the Power Development Fund under the Energy Industry Act B.E. 2550 (2007) can be allocated and spent to finance training and education necessary for enhancing the people's capability. Oil revenues can be allocated to support development of education infrastructure. Contributions delivered to the Power Development Fund can be used by an education institute to develop and deliver an online training course on renewable energy. These two examples reveal how "power producers" that exploit hydrocarbon resources and generate electricity from fossil fuels such as lignite and natural gas can contribute to financing energy transition especially, especially as relates to capacity building.

This paper suggests that, to broaden or enhance possibilities of the use of collected petroleum revenues for education on climate change and renewable energy deployment, democratization is needed. Going beyond legal texts, citizen of a petroleum-producing country should be practically empowered with practical power to influence a decision making of the government.

Moreover, this paper recommends that Section 97 paragraph 1 of the Energy Industry Act B.E. 2550 (2007) should be dynamically interpreted can permit use of the collected contributions in the Power Development Fund for educational processes which emphasize

promotion of the use of renewable energy and technologies for electricity industry operation that have less impact on the environment. However, in order to lawfully utilize the deposited contributions, it appears reasonable to amend Section 97 of the Energy Industry Act B.E. 2550 (2007) to go beyond awareness and participation of the people in renewable energy to include education infrastructure development.

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