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The definitive version is available at

<http://dx.doi.org/10.1080/14615517.2017.1364019>

Investigating the effectiveness of mandatory integration of health impact assessment within Environmental Impact Assessment (EIA): a case study of Thailand

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ABSTRACT

The effectiveness of the integration of Health Impact Assessment (HIA) and Environmental Impact Assessment (creating an Environmental and Health Impact Assessment' (EHIA) process) is investigated, drawing on an example of a mandatory requirement in the power plant project sector in Thailand. The analytical framework is based on that outlined in Chanchitpricha and Bond (2013), focusing on procedural, substantive, transactive and normative effectiveness criteria, and the evaluation served also to critique this framework in practice. Using documentary analysis and interviews, it was found that a sample of EHIA's are partially effective from the four perspectives of effectiveness. The findings suggest that integrating HIA and EIA still has a long way to go to achieve effective practice. Insufficient resources have been allocated to deliver the level of public participation expected in the regulations, or a sufficient standard of EHIA practice and monitoring. The existing analytical framework was found to be inadequate for transactive effectiveness, and a new criterion added: *T5 - Availability of human resource* in EHIA practice. Recommendations are provided to support the practical integration of HIA into EIA practice in Thailand.

Keywords: Health in EIA, HIA, mandatory EHIA, effectiveness, power plant development, EHIA in Thailand

1. Introduction

Health impact assessment has been mandatorily integrated into the EIA process in Thailand since 2009 (Ministry of Natural Resources and Environment 2009). The term ‘environmental and health impact assessment (EHIA)’ has been used in the Thai context since 11 project types were listed as being subject to EHIA (Ministry of Natural Resources and Environment 2010a, Ministry of Natural Resources and Environment 2010b), before rising to 12 project types in 2015 (Ministry of Natural Resources and Environment 2015). Of these, thermal power plant project developments are one of the project types that have required EHIA.

The HIA concept was firstly introduced in Thailand in 2001 by the Health System Research Institute (HSRI) (Phoolcharoen et al. 2003), and then it was added to the National Health Act B.E.2550 (2007). It was still considered a new tool in the Thai context, particularly to EIA practitioners and authorities, when EHIA was first implemented legally in Thailand in 2009 (Ministry of Industry 2009, Ministry of Natural Resources and Environment 2009). Accordingly, it was suggested that more knowledge and understanding on HIA practice should be developed among relevant stakeholders and practitioners (Chanchitpricha 2012).

Siwaraksa et al. (2004) had previously raised concerns that there are shortcomings in the ability of some authorities to implement HIA requirements, and an absence of strategy for resolving this. It is considered challenging to include health in EIA as it connects with a broader set of skills among actors and authorities (Harris and Haigh 2015). A common knowledge base among relevant institutions is also a crucial success factor for integrating HIA in impact

assessment (Carmichael et al. 2012, Morgan 2011). Terminology is used inconsistently in existing literature, where ‘health in EIA’, ‘HIA in IA’ and ‘HIA in EIA’ are often used interchangeably. We regard HIA and EIA as being separate processes, and EHIA to represent a process where the scope of assessment is expanded to include health as well as the environment. The advent of EHIA as a new process implemented as part of decision-making processes thus requires the development of appropriate capacity to implement the statutory obligations. Therefore, in order to shed light on how well and how effectively EHIA has been implemented in the Thai context, this paper examines the procedural, substantive, transactive and normative effectiveness of the first four completed EHIAs of power plant projects developed by the Electricity Generating Authority of Thailand (EGAT).

2. Effectiveness perspectives in impact assessment (IA) practice

Defining the effectiveness of impact assessment practice is problematic given it varies by context (Chanchitpricha 2012). Identifying effectiveness categories is considered a practical means of breaking down our understanding of effectiveness into measurable components (Theophilou et al. 2010). When the effectiveness of environmental assessment was first investigated systematically, Sadler (1996) classified it into three dimensions: procedural; substantive; and transactive effectiveness. Later on, a normative aspect was added by Baker and McClelland (2003); an approach subsequently supported by other scholars in this area (e.g. Cashmore et al. 2004; Bina 2007; Arts et al. 2012; Bond and Morrison-Saunders 2013; Chanchitpricha and Bond 2013) as a result of an understanding that changes in context, i.e. organisations, philosophy, and culture, lead to changes in attitudes / decision making / norms when implementing IA tools.

Chanchitpricha and Bond (2013) synthesised an evaluation framework from the literature encompassing procedural, substantive, transactive and normative aspects with a set of criteria for each category. After initial testing on a single case study (Chanchitpricha 2012), they suggested broader testing of IA practice in different contexts to further refine the framework, a task already started through a minor amendment (Chanchitpricha and Bond, 2015). This paper is a contribution to that broader testing.

The four effectiveness categories are:

Procedural effectiveness of IA is considered based on principles, procedures and robustness of information applied and provided in the IA process (Bina 2007, Sadler 1996, Therivel 2010).

Substantive effectiveness is achieved when the implementation of an IA tool leads to changes or adjustments of the proposed plan or project (Baker and McLelland 2003, Sadler 1996, Theophilou et al. 2010, Christensen 2005, Art et al. 2012, Phylip-Jones and Fischer 2013).

Transactive effectiveness is achieved where resources, e.g., cost, time, human resource skills, are invested efficiently in IA practice (Sadler 1996, Theophilou et al. 2010).

Normative effectiveness is achieved where the outcome meets attitudes / individual expectations through application of IA processes (Stoeglehner et al. 2009, Van Buuren and Nootboom 2009).

The effectiveness framework criteria adapted for this research are presented in section

3. Legal requirements for EHIA of power plants in Thailand

The decision making process involving EHIA in Thailand was promulgated by the Natural Resource and Environment Ministerial Notification (2009) which lead to legislation that approval from the government cabinet will be required for any project development conducted by the government, or government authority cooperating with the private sector. Power plant developments requiring EHIA in Thailand are listed in **Table 1** separated into categories dependent on fuel source.

Table 1 Power plant project development mandatorily requiring EHIA in Thailand

Types of fuels used in thermal power plant projects requiring EHIA	Power generation capacity (MW)	Practice regarding regulatory
1) Coal	≥ 100 MW	EHIA required to submit for
2) Biomass	≥ 150 MW	construction approval/or
3) Natural gas operated by combined cycle or cogeneration system	≥ 3000 MW	project operation permit
4) Nuclear	Any scale	

Source: adapted from Natural Resource and Environment Ministerial Notification Re: Specification of types, scales, and regulations for projects which may cause severe effects on health, environment and natural resources B.E. 2553 (2010)

The Electricity Generating Authority of Thailand (EGAT) is controlled by the Ministry of Energy, and has a power generation capacity of approximately 15,500 MW (as of December 2015) (EGAT 2017). Any power plant project developed by EGAT requiring EHIA would require a final decision to be made by the government cabinet. The involved authorities and parties to the EHIA practice as well as decision making process are: project developer (EGAT), EHIA practitioner (licensed consultant), Office of Natural Resources and Environment (ONEP), expert panel (appointed by ONEP), Independent Commission on Environment and Health (ICEH), regulator authority (Energy Regulatory Commission: ERC), National Environment Board (NEB), other relevant local authorities i.e. health organisations, experts,

the public, and the government cabinet. **Figure 1** demonstrates the connection between EHIA practice, public participation processes and the decision making process of relevant authorities / panels which set the context for this study. Apart from the Natural Resource and Environment Ministerial Notification (2009), the regulation of the Prime Minister’s Office on public consultation B.E. 2548 is also applied as a public participation guideline in the EHIA process (Public Service Centre: Office of the Permanent Secretary 2009, p.17), and ICEH’s role is defined by The Prime Minister’s Office regulation (2010).

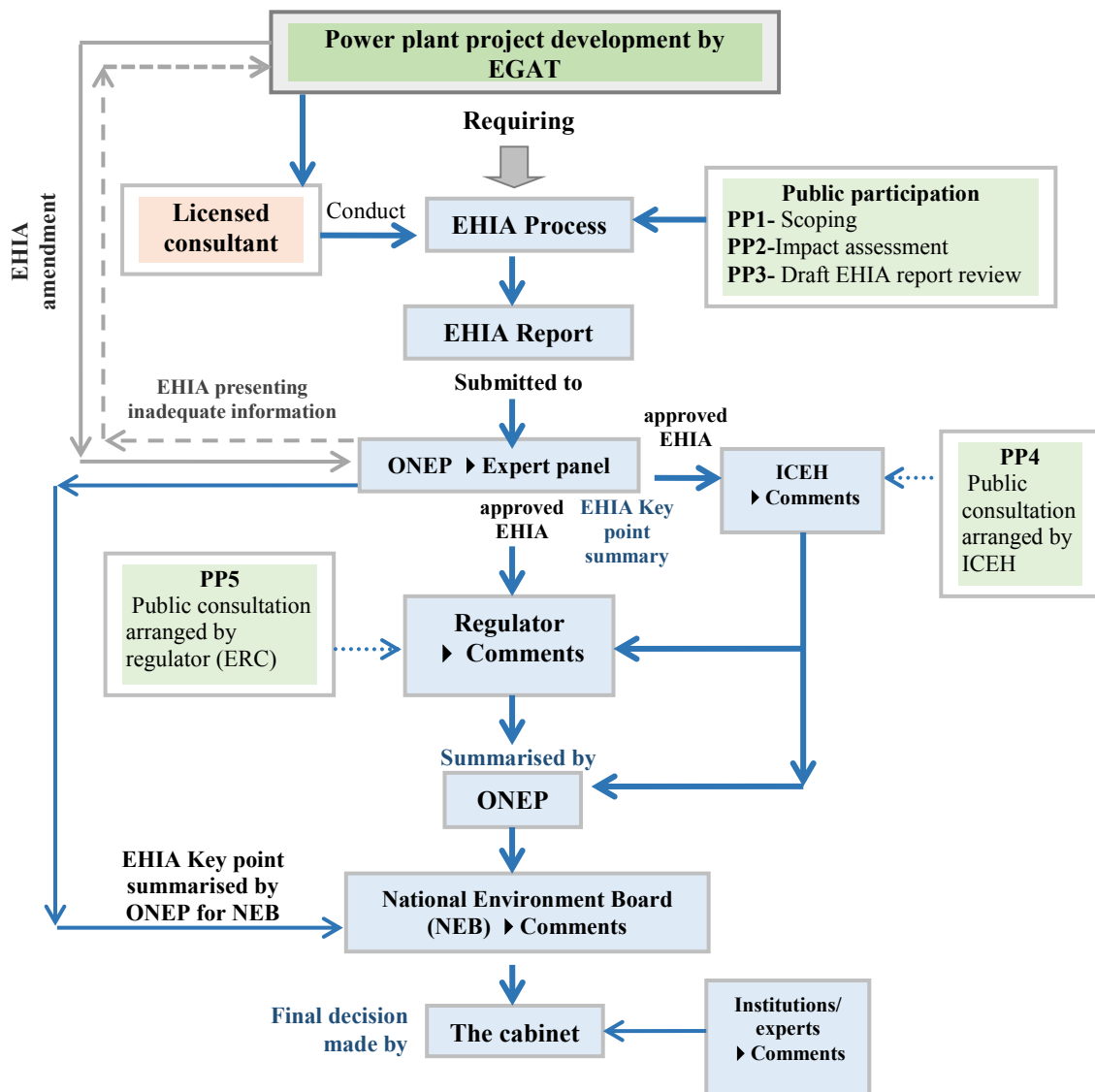


Figure 1 Decision making flows of ERIA approval and project development for power plant projects proposed by Electricity Generation Authority of Thailand (EGAT).

Source: adapted based on Natural Resource and Environment Ministerial Notification (2009), Office of Natural Resources and Environment Policy and Planning (2013, p.45) and The Prime Minister’s Office (2010)

Public participation processes are particularly frequent in EHIA practice. The regulation and guideline (Environmental Impact Evaluation Bureau: Office of Natural Resources and Environment Policy and Planning (ONEP) 2014) requires public participation at the scoping, impact assessment, and at the draft EHIA report review stages. The guideline indicates that a public meeting should be conducted for at least 2 hours during EHIA scoping as PP1; a public opinion survey is required during the impact assessment stage (PP2) via one or more of: interview, focus group, workshop, stakeholder representative meeting, or remote communication i.e. telephone, post, email, internet. Finally, a public meeting is required for the draft EHIA report review as PP3.

Referring to **Figure 1**, after submission to ONEP, if the expert panel approves the EHIA, they summarise the key issues and communicate them to the Independent Commission on Environment and Health (ICEH) (The Prime Minister's Office 2010) and the regulator, the Energy Regulatory Commission (ERC), for power plant projects. At this stage, ICEH publishes the EHIA online via its website informing the general public that are interested in taking part in a public consultation of advisory comments provided by the committee. This is public participation stage PP4. The public comments are subsequently summarised and communicated to ERC and ONEP. This is not directly compulsory as written in The Prime Minister's Office (2010) but ICEH conducts PP4 in line with its own internal procedures.

Additionally, the regulator (ERC) must conduct public consultation (PP5) according to the legal regulation on EHIA practice (Ministry of Natural Resource and Environment 2009) as presented in **Figure 1** prior to providing comments for ONEP. Comments from both ICEH and ERC are collected and summarised by ONEP for the National Environment Board (NEB).

NEB then synthesise the relevant findings from the IA process and provide additional opinion to the government cabinet which makes the final decision where the project developer is state-owned. For power plant projects developed by the private sector, approval and a license permit is granted, if appropriate, by the regulator (ERC). In these cases the PP4 and PP5 summary reports conducted by ICEH and ERC respectively, are posted online via the authority websites.

As of May 2017 four completed EHIA reports submitted by EGAT have been published online (**Table 2**). The first two power plant EHIAs in the table were previously assessed for procedural effectiveness in Chanchitpricha and Bond (2015). Prior to the implementation of EHIA as a legal requirement in 2010, the EIA reports of the two power plants (Nos. 1&2) were already approved by decision makers. However, as the projects spanned the period between changing legal regulations and approval of their EIAs, the project developers were advised to conduct EHIA additionally. This meant that the final decision making process leading to EHIA approval, for case nos. 1&2, was different to that in the subsequent cases developed by EGAT. As such, the reports for case nos. 1&2 were proposed for approval by ERC instead of NEB & the government cabinet (SECOT Co. Ltd. 2013, Team Consulting Engineering and Management Co. Ltd. 2014).

Table 2 Completed EGAT EHIAs approved by ONEP and processed by ICEH and regulator (ERC)

No	Project/ (no. of EHIA practitioners)	Power plant capacity/ location	Fuel	EHIA started date	Project status when EHIA report was submitted	ONEP approval comments	Approval of EHIA and permission of project development	PP1-PP3 by consultant & EGAT	PP4 by ICEH	PP5 by ERC	Remarks
1*	Bang Pakong combined cycle power plant block 5/ (15) ¹⁾ PDP 2004 EHIA published online in February 2014	763.3 MW/ Bang Pakong, Chachoengsao ²⁾	Natural gas & oil ²⁾	16 March 2012	Operation has been conducted (reported on 4 July 2013)	30 April 2013 ²⁾	Approved (Reg#1)	✓	✓	✓	EIA was approved on 16 March 2009 prior to conducted EHIA in 2011 regarding additional changes of project design & enforcement of EHIA legal regulation in 2011 Total power plant generating capacity combined with existing plants = 3720.3 MW *EIA+EHIA = 5 years approximately
2*	Mae Moh power plant unit 4-7 replacement/ (24) ²⁾ EHIA published online in July 2014 PDP 2015	600MW/ Mae Moh, Lampang ³⁾	Lignite coal ⁴⁾	11 July 2011	Construction in progress (as of October 2016 updated by regulator authority)	13 February 2014 ³⁾	Approved (Reg#1)	✓	✓	✓	Total power plant capacity combined with existing plants = 2400 MW
3	South Bangkok (Phra Nakorn Tai) power plant replacement phase 1/(15) ³⁾ PDP2010 EHIA published online in March 2016	1,350 MW/ Samuth Prakarn	Natural gas & oil ⁴⁾	30 May 2014	Construction has not been commenced (reported on 18 March 2016)	26 November 2015 ⁴⁾	Approved by the cabinet with condition of EHIA approval by NEB (11 October 2016)	✓	✓	✓*	Total power plant capacity combined with existing plants = 3070.6 MW * updated with ERC as of February 2017
4	Bang Pakong combined cycle power plant unit 1-2 replacement) / (15) ⁴⁾ PDP2015 EHIA published online in August 2016	1450 MW/ Bang Pakong, Chachoengsao ³⁾	Natural gas & oil ⁵⁾	31 January 2014	Construction has not been commenced (reported on 11 August 2016)	28 July 2016 for updated version of EHIA ⁵⁾	In process of approval by the cabinet (updated with EGAT as of February 2017)	✓	✓	✓	The EHIA was initially approved by ONEP on 29 September 2015, however, due to technology change when choosing technology supplier such that project detail design was partially change, therefore, EHIA study was re-considered & updated focusing on such change./ Total power plant capacity combined with existing plants = 4070.3 MW

Source: 1) SECOT CO.LTD. (2013), 2) TEAM CONSULTING ENGINEERING AND MANAGEMENT CO. LTD. (2014), 3) SECOT CO.LTD. (2016a), 4) SECOT CO.LTD. (2016b)

4. Methodology and effectiveness analytical framework

4.1 Research design and methods

A qualitative research methodology is applied in order to evaluate the effectiveness of this decision-making tool. A qualitative approach can lead to increased understanding based on data collection via analysing words, documents and points of views (Chadwick et al. 1984, Creswell 2007, Denzin and Lincoln 2000).

The scope of EHIA to be investigated in this paper draws on a sample of four completed EHIAs (see **Table 2**) of power plant projects developed by the Electricity Generating Authority of Thailand (EGAT) out of the total population of six EHIA reports, approved by the statutory consultation authority (Office of Environmental Policy and Planning: ONEP).

Accessibility of EIA & EHIA information in Thailand

In terms of power plant project development, completed EHIA reports, approved by the ONEP expert panel between 2011-2016, are provided for public accessibility on ICEH's website (www.iceh.or.th/v1) and ERC's website (app04.erc.or.th/EHIA/) (as of May 2017). The EHIA project status is updated on ERC's website as well as ONEP's website. The public provision of EIA and EHIA reports online helps meet the rights of public access to information as specified in Thailand's Official Information Act B.E. 2540 (1997). However, it was noted that collaboration between key relevant authorities could have been improved in terms of sharing information as EHIA resources (NGO#1); this is because some stakeholders have limited access to the Internet. Appropriate communication and ways of delivering information should be compatible with the audience (Reg#1, NGO#1).

As presented in **Table 3**, data collection was conducted based on documentary reviews (16 reports) along with purposive sampling of key informants, drawn from the stakeholders of power plant project development, for in-depth interviews, prior to thematic analysis facilitating triangulation of sources (Creswell 2007, Maxwell 2005, Miles and Huberman 1994).

Interviewed key informants

The response for the invitations to be interviewed was generally very positive, albeit there were some inevitable challenges associated with postponements or a lack of response. Letters requesting the interviews were officially delivered to 17 authorities/ key informants using a purposive sampling method based upon their roles in the four cases. Responses were obtained from the project developer (EGAT), EHIA practitioners, environment and health authorities (ONEP and Department of Health), independent organisation (ICEH), Non-governmental organisations (NGO), and the regulator (ERC) as presented in **Table 4**.

Table 3 Relevant documents of the four power plant EHIA cases and key informants as sources of data collected in this study

Sources of data	Power plant projects	No. of reports by title	Source of data	Data collection methods	Remarks
EHIA report approved by ONEP Power plant project EHIA full & summary reports of 4 power plant EHIA cases (main reports + summary reports)	Case 1: Bang Pakong combined cycle power plant block 5	2	ICEH website/ ERC website	Documentary review (DIW & ERC Stakeholder Public Consultation Committee 2014, ERC Stakeholder Public Consultation Committee 2014, ERC Stakeholder Public Consultation Committee 2016a, ERC Stakeholder Public Consultation Committee 2016b, ICEH 2013, ICEH 2014, ICEH 2016a, ICEH 2016b, SECOT Co. 2016, SECOT Co.ltd. 2013, Team Consulting Engineering and Management Co. Ltd. 2014)	* Views from affected community members were investigated based on different sources of public consultation summary reports provided by EHIA consultant(s), ICEH and regulatory authority (5 times of PP in total conducted in each one particular project)
	Case 2: Mae Moh power plant unit 4-7 replacement	2			
	Case 3: South Bangkok (Phra Nakorn Tai) power plant replacement phase 1	2			
	Case 4: Bang Pakong combined cycle power plant unit 1-2 replacement	2			
Support statutory consultation by ICEH ICEH advisory comment reports of 4 power plant EHIA cases	Case 1: Bang Pakong combined cycle power plant block 5	1	DIW website		
	Case 2: Mae Moh power plant unit 4-7 replacement	1			
	Case 3: South Bangkok (Phra Nakorn Tai) power plant replacement phase 1	1			
	Case 4: Bang Pakong combined cycle power plant unit 1-2 replacement	1			
Approval process by ERC Public hearing summary reports of 4 power plant EHIA cases	Case 1: Bang Pakong combined cycle power plant block 5	1	ERC website		
	Case 2: Mae Moh power plant unit 4-7 replacement	1			
	Case 3: South Bangkok (Phra Nakorn Tai) power plant replacement phase 1	1			
	Case 4: Bang Pakong combined cycle power plant unit 1-2 replacement	1			
<p align="center">Key informants:</p> EGAT representative Statutory consultation representatives EIA/EHIA practitioners Health authority representatives ICEH representative Regulator representatives				*Semi-structured & in-depth interviews	Official request letters were sent to relevant organisations & consultants. Organisation representatives were assigned to respond to the interviews later on. However, not all expected participants took part according to their time availability.

Table 4 Key informants having been involved with power plant EHIA cases contacted and interviewed

Group	Key informants	Letters sent	Interviewed	Code
1	Project developer	1	1	EGATrep#1
2	EHIA practitioners/ consultants including those conducting EGAT's EHIA	8	4	Practitioner#1 Practitioner#2 Practitioner#3 Practitioner#4
3	<i>Government organisations</i> Environment authority Health authority	3 1	2 2	GOrg#1, GOrg#2 GOrg#3, GOrg#4
4	Independent organisation	1	1	ICEHrep#1
5	Non-government organisations/	1	1	NGO#1
6	Regulator	1	2	Reg#1, Reg#2
	Total	17	13	

All key informants responded based on their involvement in the 4 case studies, except for the consultants who either continually postponed, did not respond or failed to find time to agree transcripts as required under the ethical procedure. As a result, as a surrogate viewpoint, four practitioners who have been involved in other EHIA cases (Practitioner#1,#2,#3,#4) were interviewed to get their general views on the process. This remains one area of weakness in the approach, but one that could not be avoided. **Table 4** indicates the interview process and lists the successful interview numbers.

4.2 Effectiveness framework

The analytical framework on EHIA effectiveness in this study (see **Table 5**) relies on Chanchitpricha and Bond (2013) as amended by Chanchitpricha and Bond (2015).

Table 5 EHIA effectiveness analytical framework

Procedural effectiveness criteria	Substantive effectiveness criteria
<p>P1. Relevant policy framework and procedures for EHIA process – Existence of national plan on environment and health, regulations or guidelines or standard performance for EHIA, and licensing.</p> <p>P2. Institutional roles, collaborations & infrastructure – Existing environmental monitoring network, disease surveillance network, and allocated roles of relevant authorities in impact assessment process.</p> <p>P3. Integrating EHIA in planning process</p> <p>P4. Identification of financial funds for EHIA practice</p> <p>P5. Involvement of stakeholders in the process.</p> <p>P6. Capacity of EHIA in presenting as a sound and clear, understandable evidence for decision-making process with validity of predictions, argumentation, and understandability</p> <p>P7. Delivering the findings of report to participating stakeholders</p> <p>P8. Time enforcement for EHIA process</p>	<p>S1. Regulatory framework on implementing EHIA in decision-making.</p> <p>S2. Incorporation of proposed changes – most or all proposals for changes or additions to the draft emanating from the EHIA were taken into account in the final version of the project/ or programme related to project development.</p> <p>S3. Informed decision-making – the use of mandatory documents as part of the EHIA process, with continuous dialogue between the parties involved in the process of informed decisions on the final version of project development</p> <p>S4. Close collaboration – there was communication and a high level of collaboration between those producing the EHIA, and project developer.</p> <p>S5. Parallel development – the EHIA and the project/ programme developed alongside one other with considerable cross-cutting between the processes.</p> <p>S6. Early start – the EHIA process was initiated at the very first stages of project development.</p> <p>S7. Institutional and other benefits – there is strong evidence of better department relations, development of otherwise absent expertise, learning, new partnerships and better public-private-voluntary sector communication as a result of EHIA when implementing in decision making.</p> <p>S8. Successful statutory consultation – the statutory consultation bodies had a fair opportunity to contribute their roles, and their views/comments were taken on board.</p> <p>S9. Successful public consultation – the public consultation bodies had a fair opportunity to contribute and their views and comments were taken on board.</p> <p>S10. Satisfactory/ understandability/ Comments in using EHIA in decision-making process</p>
Transactive effectiveness criteria	Normative effectiveness criteria
<p>T1. Time – EHIA was carried out within a reasonable time frame without undue delay or within a very short time period (as compared to old ex-ante mechanism, where applicable).</p> <p>T2. Financial resources – carrying out the EHIA did not entail excessive spending</p> <p>T3. Skills – the acquiring of skills and personnel required for the EHIA did not contribute a big burden and these were easily accessible.</p> <p>T4. Specification of roles – responsibilities were clearly defined and allocated and tasks were undertaken by the most appropriate subjects.</p>	<p>N1. Adjustment of relevant policy framework concerning the normative goal achieved in term of changes of views.</p> <p>N2. Learning process, perception, and lesson learnt from EHIA.</p> <p>N3. Development or changes in relevant institutional policies and policy choices</p> <p>N4. Improvement of health outcomes and quality of life</p>

Sources: adapted for this paper based on framework developed by Chanchitpricha and Bond (2013) and Chanchitpricha and Bond (2015)

5. Effectiveness of power plant EHIA

5.1 Procedural effectiveness

Although the four EGAT EHIAs have been approved by the statutory authorities and considered to have achieved procedural effectiveness based on documentary analysis; it was found that not all the EHIA cases of power plant projects fully meet the procedural criteria when interview findings are taken into account. Overall, the four EHIAs meet five procedural effectiveness criteria (*P1*, *P3*, *P4*, *P5*, and *P7*) whereas cases 2 & 3 partially meet *P2* and *P6*, case 1 partially meets *P6* and does not achieve *P8* while case 4 partially meets *P6* (**Table 6**).

The findings suggest that the relevant *policy framework and procedures (P1)* are in place from the top to bottom level (EGATrep#1, GOrg#1,#2,#3,#4, Reg#1,#2, ICEHrep#1). However, EHIA practitioners argued that existing EHIA guidelines need to be clearer on how to conduct the EHIA process (Practitioner#1,#2,#3,#4). Research scholars also recommend that clear guidance and adequate guidelines are essential factors influencing effective inclusion of health in impact assessment (Fischer et al. 2010, Harris et al. 2009, Tamburrini et al. 2011).

As the legislation is enforced, it allows *institutional roles, collaborations & infrastructure (P2)* to be clearer for all relevant stakeholders and authorities (EGATrep#1, GOrg#1,#2, Reg#1,#2, ICEHrep#1). However, it was found that area context is influential in creating networks to work together i.e. establishing monitoring network systems on environment quality and health (Reg#1,#2). According to documentary analysis and interviews, EHIA cases 1&4 meet the *P2* criterion fully whereas cases 2&3 meet it partially. Basically, EGAT provides a Continuous Emission Monitoring System (CEMS) onsite as well as maintaining an environmental monitoring network with relevant organisations i.e. Pollution Control Department (PCD) and the Department of Fisheries (if the project is located near a river/ watercourse) for all of its power plants (EGATrep#1) (SECOT Co. 2016a, SECOT Co. 2016b, SECOT Co. Ltd. 2013). The local authorities in Chachoengsao province, where case 1

and case 4 are to be located, used the Chachoengsao Provincial Decree No.2391/2554 and No.16671/2557 to establish the local committee and subcommittee. This suggests that the local governance context could shape the line of collaboration between project developers and community differently, and is related to the key point that the political/ administrative system is a contextual factor in relation to the effectiveness of impact assessment (Kolhoff et al. 2009).

Six-month monitoring reports of operating power plants are routinely submitted to ONEP (EGATrep#1) and it was agreed that the majority of power plant project developers are likely to follow monitoring measures (GOrg#2). It was argued that the project developer should share environmental monitoring information with the health authority so that it can be combined with the health impact investigation (GOrg#4) while it was suggested that data sharing between organisations requires improvement (NGO#1) which aligns with Jha-Thakur and Fischer (2016) who noted that monitoring is a challenging element to achieve.

It is considered crucial that planning at national level can lead to influential changes on health determinants (Bond et al. 2013), a point covered by criterion **P3** concerning the extent to which the *EHIA is integrated in the planning process*, EGAT has integrated the concept of environmental and social responsibility in the planning process of the national energy development policy framework as well as the organisation policy (EGATrep#1, (EGAT 2010)). As EGAT is state owned, it is required that issues on environmental, health and social impact are taken into account (EGATrep#1, GOrg#2), however, concerns about the gap between government policy and impacts affecting stakeholders have been raised (ICEHrep#1). This could reflect the lack of EHIA of national development policy, an area where assessment is becoming more prevalent (Adelle and Weiland 2012).

For *Identification of financial funds (P4)* supporting the EHIA process, the project developer is mainly responsible for providing a budget for the EHIA process (as implicitly suggested in Ministry of Natural Resource and Environment (2009)). It was noted by

Practitioner#3 and NGO#1 that the financial fund for public consultation should be co-supported by the government. Although PP5 is already arranged by the regulator which is responsible for the cost at that stage, more financial support from government authorities was felt to be warranted (Practitioner#3). It was also pointed out that the EHIA process includes environmental and health impact monitoring and that financial resources for this practice should be provided explicitly in the long term (GOrg#4). In addition, the changing of national legislation and political context i.e. the termination of the Thai Constitution B.E. 2550, which enforced EHIA, has caused uncertainty for the future of relevant organisations involved in the EHIA process, i.e. for ICEH, the Thai Constitution B.E. 2550 stated in clause no. 12 of section 1 that the Department of Environmental Quality Promotion (DEQP) has to financially support practice conducted by the ICEH committee (The Prime Minister's Office 2010). As the constitution was cancelled, it is unclear what the future financial source of public consultation conducted by ICEH might be (GOrg#1, ICEHrep#1). However, regarding the 4 cases, financial sources for EHIA still met the *P4* criterion at the time the EHIAs were undertaken, as the results demonstrate in **Table 6**.

In terms of *Involvement of stakeholders (P5)*, the EHIA regulation weighs public consultation as a priority in the EHIA process as indicated in section 2 (**Figure 1**). As it is mandatory, public participation processes were conducted in the four EHIA cases. Thus all the cases meet the *P5* criterion. However, it was noted that the public consultation methods suggested in the guideline (Ministry of Natural Resource and Environment, 2010), are sometimes too fixed e.g. the minimum time required and public meeting patterns as specified for PP1 (Practitioner#1,#2,#4). It was argued, for example, that stakeholder analysis should be conducted based on social context (NGO#1). This may suggest that the roles of public participation should be investigated (Glucker et al. 2013) in the Thai context as should the stakeholder roles (McCallum et al. 2015) in the EHIA process.

Capacity of EHIA in presenting as a sound and clear, understandable evidence for decision-making process (P6): the reports satisfy the *P6* criterion based on approval awarded by the ONEP expert panel. However, referring to documentary analysis of the EHIA reports in terms of content coherence, as well as ICEH comment reports (ICEH 2014), coupled with interviews (ICEHrep#1, Practitioner#1); it can be argued that *P6* is partially met by the four EHIA cases. The documentary reviews in this study suggested that the project developer and EHIA practitioners have tried hard to prepare EHIA documents leading to plenty of technical information required for project operation; however, considering the size of the EHIA main reports, varying between 970 and 2121 pages excluding the summary report and appendices, minor inconsistencies are common e.g. incorrect lists of contents and variable format of page numbers. EHIA summary reports, were also large in size i.e. case nos. 2, 3, and 4 were 370, 411 and 531 pages long respectively, such that there is a second summary version of EHIAs provided by ICEH, to reduce the volume sizes to 35, 38, and 34 pages, respectively. Nor were the non-technical summaries presented along with the main reports as this is not demanded explicitly in the ONEP guideline associated with the legislation.

In terms of alternative analysis presented in the EHIA reports, Case 1 does not present this section whereas Case 2 identified project development options and the preferred option; Case 3 does not present alternatives but explains the proposed project option and Case 4 also summarised the proposed project option. This suggests that different consultants vary in their interpretation of this part of the regulations. The main reports were provided in line with the legislative guideline but it has been found that environmental and health impact assessments are reported separately in different chapters as an EIA chapter and a HIA chapter, suggesting that they were conducted in isolation from each other within the EHIA process, rather than as an integrated whole as inferred in **Figure 1**. This means connections between impact assessment processes i.e. scoping and impact assessment are not clearly demonstrated

according to the chapters in the reports. Additional supervisory comments from the ICEH committee also raised this point (Independent Commission on Environment and Health (ICEH) 2014). Bond et al. (2013) suggested that practitioners and professionals in both fields should learn to collaborate, as well as facilitate knowledge training in order to ensure sufficient capacity in areas outside their immediate areas of expertise. Interviewees also noted that integration between the environment and health fields is challenging (Practitioner#1, GOrg#1) as *'expectation and target set from different perspectives are unlikely to present the same picture'* (Practitioner#1). Connections between chapters are not sufficiently clear; whereas the power plant expert panel had tried to point out that the connections between environment and health aspects are essential (GOrg#2).

Whilst it is compulsory that an EHIA scoping report is submitted to ONEP (Ministry of Natural Resources and Environment 2009), the findings from EHIA scoping are required to be more integrated in the main reports, and to include cumulative impacts arising from existing and planned developments. In addition, based on a site visit by the ICEH team, it was suggested that information provided by the project developer and the EHIA consultant should be linked better to reduce the time taken in rechecking for correctness of information (ICEHrep#1).

While the non-mandatory power plant EHIA guideline (Health Impact Assessment Division, 2012) has been additionally established and applied in the EHIA process by consultants; in-depth understanding of the guideline has not been achieved when practitioners conduct EHIAs (GOrg#3). This suggests that further capacity building and institutional support is needed as recommended by Fischer et al. (2010) and Morgan (2011).

Concerning *delivering the findings of report to participating stakeholders (P7)*, the findings of the EHIAs and the reports are delivered to participating stakeholders via local organisations, for example, district/ sub district offices (Reg#2) and via the public review stage (EGATrep#1, Practitioner#3) alongside disclosing the reports online (Reg#1,#2, ICEHrep#1)

such that the four EHIA cases achieved the **P7** criterion. Nevertheless, it was suggested that risk communication should be promoted and the government should disclose impact monitoring information to the public (NGO#1); communication language delivered should be simplified and stakeholders should be informed using suitable techniques/ patterns (GOrg#4).

Finally, **Time enforcement for EHIA process (P8)** was not achieved given that, because of the EIA legislation changing in 2009-2010, Case 1, which was previously granted EIA approval, was required to produce an EHIA after construction had already begun. This suggests that the consequences of regulation changes could affect the procedural effectiveness of impact assessment in terms of practice conducted by relevant stakeholders/ actors. Hence, guidelines on how to deal with such changes would need to be published by the relevant authorities in advance.

Table 6 Effectiveness overview of power plant EHIAs based on documentary analysis and interviews

	Effectiveness criteria	Case 1	Case 2	Case 3	Case 4	Remark/ References	
	Year EHIAs conducted	2011	2011	2014	2014		
Procedural	P1	Relevant policy framework and procedures for EHIA process					
		Existence of governmental policy framework and national plan concerning environmental and health impact	Yes	Yes	Yes	Yes	National economic and social development plan and policy statement no. 10&11; Government policy statement (The Prime Minister's Office 2011, The Prime Minister's Office 2014)
		Existence of regulations in relation to guidelines or standard performance for EHIA process, and licensing	Yes	Yes	Yes	Yes	* EHIA rules & guideline (Ministry of Natural Resource and Environment 2009, Ministry of Natural Resources and Environment 2010b)
	P2	Institutional Characteristics					
		2.1 Existing environmental monitoring network	Yes	Yes	Yes	Yes	EGAT
		2.2 Disease surveillance network	Yes*	Partially	Partially	Yes*	*Chachoengsao Provincial Decree No.2391/2554 *Chachoengsao Provincial Decree No.16671/2557
		2.3 Collaborations between relevant sectors	Yes*	Partially	Partially	Yes*	*Chachoengsao Provincial Decree No.2391/2554
	P3	Integrating EHIA in planning process of national energy development policy framework	Yes	Yes	Yes	Yes	National energy regulatory strategic plan no.1 B.E. 2551-2555, p.8 & Strategy 1 of National energy regulatory strategic plan no.2 B.E. 2556-2560, p.21 Electric Generating Authority of Thailand Notification no. 15/2553 Re: EGAT Environmental Policy (Draft) Thailand Energy master plan B.E.2558-2578
	P4	Identification of financial funds for EHIA practice					Since Thai constitution B.E. 2557 was terminated in 2014 affecting ICEH supporting fund in future
		4.1 Funding for conducting EHIA	Yes	Yes	Yes	Yes	EGAT & DEPQ, ERC (for PP5)
		4.2 Funding for conducting relevant research to improve EHIA practice & guideline in Thailand	Yes	Yes	Yes	Yes	EGAT supports research grants
	P5	Involvement of stakeholders in the EHIA process	Yes	Yes	Yes	Yes	PP1-PP5; * EHIA rules & guideline (Ministry of Natural Resource and Environment 2009, Ministry of Natural Resources and Environment 2010b)
	P6	Capacity of HIA to present a sound and clear understandable evidence for the decision-making process with valid prediction and argumentation	Yes	Yes	Yes	Yes	As a result that all EHIA reports of the 4 cases received ONEP approval
			Partially	Partially	Partially	Partially	Documentary review + Interviews
P7	Delivering the findings of report to participating stakeholders	Yes	Yes	Yes	Yes	Published online via ICEH & ERC websites	
P8	Time enforcement for EHIA process	No*	Yes	Yes	Yes	*Affected by the change of new EHAI legislation	

Remark: ? = not clear; Case 1= Bang Pakong combined cycle power plant block 5; Case2= Mae Moh power plant unit 4-7 replacement; Case3= South Bangkok (Phra Nakorn Tai) power plant replacement phase 1; Case4= Bang Pakong combined cycle power plant unit 1-2 replacement)

Table 6 Effectiveness overview of power plant EHIAs based on documentary analysis and interviews (continued)

	Effectiveness criteria		Case 1	Case 2	Case 3	Case 4	Remark/ References
	Year EHIAs conducted		2011	2011	2014	2014	
Substantive	S1	Regulatory framework on implementing EHIA in decision-making	Yes	Yes	Yes	Yes	* EHIA rules & guideline (Ministry of Natural Resource and Environment 2009, Ministry of Natural Resources and Environment 2010b)
	S2	Incorporation of proposed changes - EHIA was taken into account in the final version of the project	Partially	Partially	Partially	Partially	As presented in final EHIA main and summary reports
	S3	Informed decision-making	Yes	Yes	Yes	Yes	Evidence presented in the initial parts of EHIA main report, and progress of EHIA proposed to decision-making process are updated on ONEP website as well as ERC website, however, regular updating required.
	S4	Close collaboration	Yes	Yes	Yes	Yes	Project developer and EHIA practitioner have worked together, EGATrep#1, Practitioner#3,
	S5	Parallel development	Yes	Yes	Yes	Yes	EHIA process are aware as part of parallel development
	S6	Early start	No	Partially	Yes	Partially	Mismatch timing of EHIA final approval and technology availability(findings from EHIA is not updated when performing procurement process for power plant technology which has been changed & developed overtime)
	S7	Institutional and other benefits	Partially	Partially	Partially	Partially	Establishment of local power fund regarding ERC power fund regulations Re: Establishment of power fund for local development and restoration in affected area resulting from power plant operation B.E. 2553
	S8	Successful statutory consultation	Partially	Partially	Partially	Partially	Legally opened to all relevant authorities taking part in EHIA process
	S9	Successful public consultation	Partially	?	Partially	Partially	Legally opened to all stakeholders taking part in EHIA process but the outcomes of public consultation are unclear/ questionable (Reg#1,#2, Practitioner#4, NGO#1, GOrg#4, ICEHrep#1)
	S10	Satisfactory/ understandability/ comments in using EHIA in decision-making process	Partially	Partially	Partially	Partially	There are comments provided by ONEP and ICEH for regulator in taking on board
Transactive	T1	Time	No*	?	Partially	?	Approx. 2-2.5 years for each project EHIA to obtain ONEP approval *EIA+EHIA = 5 years approximately ; EGATrep#1, Practitioner#1,GOrg#4
	T2	Financial resources	Unlikely	Unlikely	Partially	Partially	By Project developer, DEQP, ERC; NGO#1, Reg#2, Practitioner#3,EGATrep#1, ICEHrep#1
	T3	Skills & personnel	Partially	Partially	Partially	Partially	EHIA Practitioners, GOr#2, ERC#1,#2, NGO#1
	T4	Specification of roles	Partially	Partially	Partially	Partially	Practitioner#3, GOrg#2, Reg#2
Normative	N1	Adjustment of relevant policy framework concerning the normative goal achieved in term of changes of views	Yes	Yes	Yes	Yes	EGATrep#1, Reg#1,#2,NGO#1,Practitioner#3, GOrg#1,#4,
	N2	Learning process, perception, lesson learnt from HIA	Yes	Partially	Yes	Yes	GOrg#4,NGO#1, Practitioner#3,EGATrep#1
	N3	Development or changes in relevant institutions	Partially	Partially	Partially	Partially	NGO#1, Reg#2, GOrg#2,#4, Practitioner#3, EGATrep#1
	N4	Health /Quality of life improvement	?/ Partially	?/Partially	?/Partially	/ Partially	Establishment of power fund for quality of life is ruled by ERC authority

Remark: ? = not clear; Case 1= Bang Pakong combined cycle power plant block 5; Case2= Mae Moh power plant unit 4-7 replacement; Case3= South Bangkok (Phra Nakorn Tai) power plant replacement phase 1; Case4= Bang Pakong combined cycle power plant unit 1-2 replacement)

5.2 Substantive effectiveness

As the results presented in **Table 6** suggest, the four EGAT's EHIAs meet four substantive effectiveness criteria (*S1, S3-S5*) while *S2* and *S6-S10* are unlikely to be achieved fully.

As *the regulatory framework for implementing EHIA in decision-making (S1)* came into force in Thailand in 2009, statutory consultation authorities, regulators and relevant decision-makers are required to take EHIA findings into account as stated in a Ministry of Natural Resource and Environment (2010a) notification. It was emphasised that the EHIA process is applied as part of decision making to support national power development policy to ensure that appropriate measures are provided once power plant projects are developed (GOrg#4, EGATrep#1, Reg#1,#2). The availability of regulatory requirements for EHIA could be a sign that practice is progressing (Tamburrini et al. 2011) while '*formal application*' of legislation is argued to influence decision making by resulting in project modifications (Christensen et al. 2005, p.393).

In terms of *incorporation of proposed changes (S2)*, findings from the EHIAs were taken into account in the project development by the relevant authorities as presented in final EHIA reports and it suggests that the four cases are likely to meet this criterion. However, it is noted that the proposed changes are prioritised based on legislative requirements in favour of issues raised by the public (Practitioner#3). In general, although the EHIA findings are considered as part of decision making, it was felt by some that the anxieties of those people against the project development had not been sufficiently investigated (GOrg#4).

Informed decision-making (S3) of the four cases are presented via relevant evidence, for example, in the initial parts of EHIA main reports, authorities' websites i.e. ONEP, ICEH and ERC; however, updating relevant information regularly is required. The decisions are also

informed to the community located within 5 km of the project site at the local administration office (Reg#2).

For *close collaboration (S4)*, EGAT and EHIA practitioners work together during EHIA processes (Reg#2, EGATrep#1, Practitioner#3) such that this criterion is achieved in all four cases. Good communication is essential between project developers and EHIA practitioners (Reg#2) while they work as a team in conducting EHIA (Practitioner#3). GOrg#4 commented that the project developer could approve and/or influence how the EHIA practitioner delivers findings in the EHIA report, however, it was argued that the expert panel appointed by ONEP is a balance which can ensure EHIA correctness and reliability (GOrg#2). As it is state owned, EGATRep#1 emphasises that there are authority procurement regulations on how to select qualified EHIA practitioners.

In terms of *parallel development (S5)*, the EHIA processes of the four cases were developed in parallel with power plant project development (EGATrep#1, GOrg#4).

While the *early start (S6)* criterion seems easy to achieve if EHIA is implemented early before the construction phase assuming it has been well planned at the feasibility and detailed design stages, three EHIAs do not meet this criterion fully. Case 1 fails to satisfy this criterion as it was affected by the timing of changes in EIA legislation such that EHIA was required and commenced after the construction phase started. The 2nd version of Case 4 EHIA was submitted for the approval process after the first version was approved by the ONEP expert panel; this second version was necessary because of technology changes leading to a higher power generating capacity than that identified in the first-version of the EHIA when procurement was performed (SECOT Co. 2016b). Case 2 EHIA has encountered the same problem as case 4 (EGATrep#1). Thus only case 3 meets the *S6* criterion.

In terms of *institutional and other benefits (S7)* that EHIA outcomes bring about; local power funds have been established under ERC power fund regulations no. 18 Re:

Establishment of power fund for local development and restoration in affected area resulting from power plant operation B.E. 2553. The power funds are run by an appointed committee in each particular area. It was suggested that financial support from the power plant fund should be granted for health impact monitoring (GOr#4) as well as research related to local/community health impact and health follow up (ICEH#1). In Bang Pakong, the power plant authority has granted research funds for community health impact assessment to promote health and environment over a 0-2 km radius from the power plant location (EGAT#1). However, the support is varied regarding location and community context as well as local power fund management (Reg#1, Reg#2, EGAT#1). Overall, the EHIAs meet this **S7** criterion partially.

Referring to **successful statutory consultation (S8)** considered along with **satisfactory / understanding / comments in using EHIA in the decision making process (S10)**; the findings suggest that the statutory consultation authorities (ONEP, the expert panel appointed by ONEP, ICEH and ERC) have conducted their roles diligently. In the EHIA review process, it was questioned if the panel actually conducted the site inspections or not (NGO#1), with the response by GOr#2 that the panel would do so at least one time for each particular project. The comments given by the expert panel are considered useful for the regulator in proceeding in making a decision or providing comments for ONEP and NEB whereas it was noted that ICEH committee's comments (ICEH 2014) tend to be unhelpful in allowing the regulator to reach a decision regarding the project proposal, particularly when promoted by private enterprise (Reg#1,#2). Meanwhile, it was argued that ICEH comments are provided additionally for the regulator to consider, and are not an official obligation (ICEHrep#1). However, the observation made by the regulator could relate to the pattern and structure of the ICEH supervisory comment reports which present the individual committee's comments

without critically concluding all ideas in one place. Therefore, the four EHIA cases could partially achieve the *S8* and *S10* criteria.

Successful public consultation (S9) remains unclear for EHIA case 2, Mae moh power plant unit 4-7 replacement, as the documentary reviews and interviews suggested different viewpoints from different groups of stakeholders participating in public consultation conducted at different times by the project developer (PP1-3), ICEH (PP4) and ERC (PP5) (ERC Stakeholder Public Consultation Committee 2014, Independent Commission on Environment and Health (ICEH) 2014, Team Consulting Engineering and Management Co. Ltd. 2014).

It was emphasised that area contexts could determine how the community and project developer build their relationships (EGATrep#1). This is linked with arguments raised by Schaeffer and Smits (2015) that ‘places’ and people in such places are key factors influencing environmental movements. Nevertheless, other factors could influence the level of success in building good relationships between people to achieve successful public consultation according to the project development consequences experienced among stakeholders. For example, coal power plant operation may cause more public anxiety leading them to take action differently according to where they live i.e. whether in a sensitive area or remote zone. In terms of the EHIA reports for cases 1, 3 and 4; they have achieved the *S9* criterion partially.

Investigating the pros and cons of public consultation in the EHIA process, it was found that additional public consultation (i.e. PP4 and PP5) in the EHIA process could lead to added value where new useful information was obtained in addition to the findings already learned from PP1-PP3 (Reg#1, Reg#2). The EHIA legislation also provides an opportunity for the public to take part in this process (GOrg#4, Practitioner#3, NGO#1) as well as the regulator and decision makers taking this into account in connection with their roles (Practitioner#3, Reg#1,#2). The findings gained from the process could help relevant authorities solve problems regarding project operation as well as providing evidence for the decision making process

(GOrg#4). Nevertheless, it is recognised as a challenge to ensure that all stakeholders recognise the need for, and value of, public consultation (Reg#2).

In terms of barriers to frequent public consultation processes conducted by different organisations, concerns have been raised that the strict time frame and fixed methods mean that practice is not cost effective (Reg#2, Practitioner#2, GOrg#4) and sometimes, stakeholders are paid to take part in the process and present a particular view (Practitioner#2,#3). It was noticed that public consultation time is expected to be used to negotiate for benefits from the established power fund in some areas, however, ONEP is in the process of developing a public consultation guideline (Reg#2). It was also added that, participants taking part in public consultation share their views based on their attitudes towards the project rather than scientific information (Practitioner#3, NGO#1) which could lead to controversy. It was pointed out that too much of the contents of EHIAs are uninteresting for some groups of stakeholders to read (Practitioner#2). It is recognised that different expectations of various groups of stakeholders are challenging to achieve when more of them take part, in line with the findings of Glucker *et al.* (2013).

5.3 Transactive effectiveness

It was found that the transactive effectiveness could not be achieved fully according to resources invested and allocated in any of the four EHIA cases.

Regarding the first criterion of *time invested in the EHIA process*, the results showed that case 1 performed poorly in relation to this criterion as it took 5 years to complete the process of EIA and EHIA (EGATrep#1). As presented in **Table 2**, the EIA was approved by NEB leading to the commencement of project construction prior to the change in legislative requirements. This forced the project developer to start the EHIA process to ensure that the project operation complies with the legislation. Cases 2 and 4 are questioned in terms of time effectiveness because additional assessments were conducted as a result of a technology change

due to procurement choices subsequent to EHIA approval. As the time frame of EHIA decision making is not set in fixed terms for the whole process (GOrg#4, EGATrep#1), it is unlikely to match with the power plant facility procurement process effectively (EGATrep#1). This leads to inefficiencies in terms of time for the EHIA process according to Chanchitpricha and Bond (2013) and Theophilou et al. (2010). Therefore, it is likely only that Case 3 met the **T1** criterion partially for transactive effectiveness of EHIA (**Table 6**).

Concerning **financial resources (T2)** operated in the EHIA process, sources of the funds are mainly from the project developer. DEQP supports public consultation conducted by ICEH (for PP4). ERC covers cost for public consultation (for PP5) prior to re-charging the project developer at the permission approval stage (Reg #1, 2). The amount of budget invested in the EHIA process depends on the area context and public consultation frequency/requirement (EGATrep#1, ICEHrep#1), for example, in Mae Moh, Lampang for Case 2 it was approximately 1.5 million Thai Baht (\$40,200) whereas in Bang Pakong for case 4 it was approximately 500,000-600,000 Thai Baht (ICEHrep#1)(\$14,300-\$17,100). Similarly, the public consultation cost invested is estimated to be 1.5-2 million Thai Baht (\$40,200-\$57,000) in each public meeting for PP5 (Reg#2). Thus it can be calculated approximately that in a project EHIA process, the total cost invested in public consultation varies between 2.5-8.75 million Thai Baht (~\$71,000-\$250,000) depending on project location/ description and number of stakeholders. However, these data are not officially disclosed to the public and it could not be tracked into each individual project.

In summary, the project developer sees this as a worthwhile investment in order to communicate with the stakeholders '*I see this is the way that we can communicate with stakeholders, assuming that 400 people living surrounding project location, they gather in one time to take part in public meeting, this is worthwhile as they can be informed about the project development*' (EGATrep#1). Nevertheless, the point of view was also shared that the budget is

invested inefficiently in public consultation when compared with the outcomes gained (Practitioner#3). Therefore, EHIA cases 3 and 4 meet this criterion partially; whereas case 1 conducted impact assessment twice and fails to meet the criterion. Case 2 is conducting an additional EHIA for project capacity expansion due to technology change and is also unlikely to meet this criterion.

In terms of *skills and personnel (T3)* required in EHIA practice as well as *specification of roles of people involved in the EHIA process (T4)*, EHIA practitioners conducting power plant projects are considered as professional firms with staff who can do the job (GOrg#2), while assigned staff conducting public consultation for PP5 are considered to be operating at a ‘good’ to ‘very good’ level (Reg#2). EHIA practitioners as consultants are able to approach the community better than in the past in the public consultation process, however, local authorities may face limitations in terms of financial support for staff capacity building to strengthen their roles relevant to the EHIA process (NGO#1). It is noted that the EHIA consultants are, in general, recognised to have variable levels of skills, experience and expertise (Practitioner#3). Nevertheless, it has been cautioned by respondent ICEH#1 that the knowledge and skills required in conducting EHIA are high due to the combination of ‘environment’ and ‘health’ aspects from both professions; as a result ‘knowledge controversy’ has sometimes been experienced among the committee when reviewing EHIA reports. It has been noted as an individual point of view that ‘environment’ and ‘health’ aspects in EHIA should be approved separately by two sets of committees from the Ministry of Natural Resource and the Ministry of Public Health (ICEHrep#1, GOrg#1). This reflects that working outside your field of expertise is considered to be a barrier between practitioners (Bond et al. 2013 Carmichael et al. 2012 Harris and Haigh 2015). Regarding perspectives on the skills of people involved in the EHIA process, it can be summarised that the four cases of EHIAs have achieved the *T3* and *T4* criteria partially (**Table 6**).

According to the interviews, a key issue with the lack of *availability of human resources* was raised based on limited expertise in this field. This ties in with Glucker et al.'s (2013) claim that IA human resources are not sufficient in developing countries. The findings suggested that all people involved in the EHIA process work hard in reviewing documents (EGATrep#1, ICEHrep#1, GOrg#2, NGO#1) in addition to those who conduct scientific and field work in technical assessment/ monitoring and non-technical tasks i.e. data collection and public consultation (Practitioner#1,#4). Knowledge shared among disciplines is essential in this field such that *availability of human resources* are necessary and should be added as an additional *T5 criterion* in measuring the effectiveness of EHIA or other relevant impact assessment.

5.4 Normative effectiveness

With regards to *adjustment of relevant policy framework concerning the normative goal achieved in terms of changes of views (N1)*, the four EHIAs achieve this criterion as, later on, EGAT-prioritises the significance of sustainable development in its policy (EGAT 2010). It was suggested that legislation is a key instrument for shifting norms in authorities involved in the EHIA process, particularly state-owned enterprises (EGATrep#1), and it allows stakeholders to access information and take part in the EHIA process (NGO#1). As a result of policy adjustment, environmentally friendly power plant technologies are taken into account more when designing power plant project development (EGATrep#1, GOrg#1). This reflects incremental changes experienced within the authority where EHIA legislation is a key influence on decision making (Chanchitpricha and Bond 2013).

Learning process, perception, and lessons learnt (N2) from the EHIA process suggested that all relevant authorities can learn to adjust themselves and their working styles through their roles in this process where communication skills are essential (GOrg#4). It is

noted that people complain without providing good evidence, and also that people discuss issues based on a different set of evidence to that presented in the EHIA, and this is considered a problem in the EHIA process (NGO#1). This suggests that barriers to learning exist (Fischer et al. 2009) as well as suggesting knowledge management issues (Bond et al. 2010). EHIA cases 1, 3, & 4 achieve this criterion fully while case 2 partially achieves it.

In terms of *development or changes in relevant institutional policies and policy choices (N3)*, it is agreed that findings from the EHIA process can support decision-making in approving licenses as well as providing conditions that the project developer should apply in project operation (Reg#2). It is demonstrated that EGAT power plant projects have been improved in terms of applying mitigation measures, and also that community members help by informing the monitoring authority when environmental quality is not monitored (GOrg#2). This suggests that EHIA cases conducted by EGAT could achieve the *N3* criterion partially.

Concerning *improvement of health outcomes and quality of life (N4)*, it is noted that it is hard to indicate whether this criterion has been achieved among the four cases as factors influencing health impact could vary (Reg#2, Practitioner#3, GOrg#2). However, it was suggested that community mental health should be in a better state as people have been informed of what is happening in their community (GOrg #1, Practitioner#3) and it is evident that mitigation measures are implemented and fewer complaints raised after project operation commenced compared with complaints received at the earlier phase. Therefore, it could be argued that the EHIAs might achieve this criterion partially and observation on this normative change in the longer term is required.

6. Conclusion

Based on the findings in this research, focussed on four power plant EHIA cases established by EGAT between 2011-2016, it can be concluded that procedural effectiveness and area context together control the levels of achievement in substantive, transactive and normative effectiveness. This is consistent with observations made by other authors in relation to consideration of the effectiveness of environmental assessment (i.e. SEA, EIA) in the past. Statistical analysis previously conducted by Fischer (2002, p. 225) proved that the level of success in applying SEA and EIA is correlated with how procedural elements (i.e. legislation, methods and public involvement) were applied and conducted. Better impact assessment practices are likely to lead to better understanding as well as better decisions (Åkerskog 2006, Christensen, Kørnøv and Nielsen 2005, Phylip-Jones and Fischer 2013, Wende 2002). Thus, mandatory impact assessment can shape the extent to which effectiveness is achieved provided that the practice is performed based on *'transparency and positive attitudes'* (Arts et al. 2012). Concerning the Thai context in this study, as EHIA is obligatory, project developers and decision makers implement EHIA as part of their practice. This legislation opens doors to all relevant stakeholders to take part in the EHIA process in five stages, however, this could be considered as either a strength or a weakness of the Thailand EHIA system. Although public involvement is applied in the EHIA process, the level of successful public consultation is questionable in terms of how fruitful the outcomes are. Trust issues between stakeholders/authorities is one concern that has been highlighted. We suggest that the purposes and roles of public participation in the Thai context should be clarified so that it can be applied in the EHIA process meaningfully and efficiently.

Although it was demonstrated that the cases have not achieved all four categories of effectiveness, the findings suggest good progress in EHIA practice in Thailand based on the analytical framework used. In addition, the application of this framework highlighted the need

for a new criterion; *T5: availability of human resources*, to better reflect the full suite of elements underpinning effective practice.

To raise the level of effectiveness, EHIA guideline revision to strengthen procedural effectiveness based on integration of lessons learned, professional experience sharing, and documentary analysis would be a good starting point and is recommended. This should be a collaboration among academics, ONEP, and EHIA practitioners. In addition, institutional capacity building needs for EHIA/ EIA authorities is recommended, to identify how human resources/ institutional roles can be strengthened and contribute to enhanced effectiveness. Last but not least, national policy impact assessment should be considered so that public policy, which links with national environmental and health outcomes, can be developed more sustainably.

Acknowledgement

This research is funded under ‘A New Researcher Scholarship of CSTS, MOST’ by Coordinating Centre for Thai Government Science and Technology Scholarship Students (CSTS), National Science and Technology Development Agency. We would like to thank all key informants in this research and anonymous reviewers for their contributions in this paper.

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