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Full Length Research Paper

Creating of roadmap model for public policy towards national power development plan

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Currently, public policies and plans of work are presented in a descriptive format which makes systematic projections of future scenarios a difficult task. This concern is especially applicable to the National Power Development Plan (PDP), which is expected to be an important factor in the economic development and quality of life of the Thai citizenry. This paper therefore proposes a PDP Roadmap-Model, employing the principle of Technology Road-Mapping (TRM). The TRM has practical applications in forming an effective public policy for the creation of the PDP. In our current case study of the PDP, we will be examining the PDP 2007: Revision 2. A study of the PDP shows that the TRM yields a very clear and comprehensive view of the pattern of change in the project. The TRM is applicable both to the PDP of today, as well as to the PDP of the future. Accordingly, it serves as a very practical approach towards the development of an energy plan over the long term and may even be useful for the formulation of policy and plans of work in other industries as well.

Key words: Technology road-mapping, PDP Roadmap-Model, power development plan, public policy, energy policy.

INTRODUCTION

Technology road-mapping (TRM) constitutes a useful tool for the observation of changes and developments in the technologies of the future. The principle of TRM is realized in its systematic display of directional images that track changes in emerging technologies. TRM also has practical use in the examination and study of existing programs and projects so that they may proceed in a suitable direction with optimal timing.

From the standpoint of public-policy analysis and its various applications, it was found that policy proposals cannot in their own right generate innovative views of future trends and developments. The result was that the policies adopted turned out to be very inefficient when put into practice. Accordingly, this paper adopts the descriptive format of a roadmap for public-policy proposals that are based on the principle of TRM. TRM, in turn, can then be practically applied for policy analysis in a manner most conducive to achieving policy objectives. The sort of public policy that will become the subject of our case study will be in the area of nation-wide power generation, which is the object of the Power Development Plan, or PDP.

Presently, responsibility for the PDP has been undertaken by the Energy Planning and Policy Office (EPPO) of the Ministry of Energy. Working committees in PDP administration and management were formed from various sectors, including the Electricity Generating Authority of Thailand (EGAT), the Metropolitan Electricity Authority (MEA), the Provincial Electricity Authority (PEA) and various technocrats representing independent entities. The PDP is considered to be an energy policy that defines a direction for the Nation's power generation that will prove effective for both the economic well-being and the quality of life of its people.

Execution of the PDP plan begins with compiling the electrical-power generating capacities of various energy

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sources, using data supplied from local and foreign-based plants. The results immediately add up to investment decisions regarding the types of power plants that might be constructed, how these different plant types should be apportioned and their projected completion dates. In this way, we arrive at an optimal combination.

One important question to be considered is: what will be the consequences of the decisions made regarding their impact on energy security, on the environment or on public safety, and to what degree? For the decisions to be truly optimal, those charged with making the decisions must be able to foresee the various change-inducing factors that might arise. For that reason, this paper recommends that the principle embodied within the TRM be applied to the PDP in order to arrive at an optimal response to the question just posed.

The most recent version of the Power Development Plan, namely PDP 2010, was adopted by the Cabinet on 12 March, 2010 (Ministry of Energy, 2010), but it has yet to publish and distribute its official approval. We then instead refer the case study to the Second Revised Edition of the Power Development Plan 2008-2021, or PDP 2007: Revision 2. It is this version which is the latest to be officially published and distributed while writing this paper. PDP 2007 was considered as a fifteen-year plan which subdivided into an electrical-power generation plan and a capital-investment plan. These two lower-level plans, in turn, were aimed at the construction of power generation plants of various types, with construction extending into the year 2021.

THE UNDERLYING PRINCIPLE OF THE TECNOLOGY ROADMAP

Technology Road-Mapping or TRM discreetly selects from available resources to optimize fulfillment of future needs. In this process, we derive an overview of product development as it follows a certain path oriented along the dimensions of marketing and technology. As product development follows this path, both technology and marketing must be coordinated together with respect to future time constraints. Thus, a product technology roadmap constitutes a methodology for compiling together in a single comprehensive view of all stages of production. The technology roadmap thus formed leads directly towards predefined production goals. It does so through careful and judicious timing, so that production can be linked with the directional movements of both technology and marketing.

Currently, technology road-mapping is being widely applied in numerous areas of industry where technology-development planning is seen as important. Emphasis is focused on linking business strategy with technology strategy into a single larger process (Kostoff and Schaller, 2001). The coordination of such activity is that organizational development and technological development become mutually compatible, functioning harmoniously together in a appropriate direction and resulting in significantly greater efficiency (Phaal et al., 2002). To achieve these ends, it becomes essential that there be a tool to assist in the development of technology. Such a tool is TRM, which has gained acceptance as a significant predictor of future developments in technology through the discreet selection of available resources. Its effect on technological administration and management, and on the setting of policy for industry, is much greater clarity. It displays a reliable and credible process image for the technology of the future. Strategies formulated at both the policy and practical levels are coordinated together. The design-analysis and decision making that go into programs and projects will follow an optimal course that minimizes error.

TRM specifies a dimension of time in any of its uses. Otherwise stated, TRM is the attainment of a time-oriented series of technology-development goals at various levels of development. Within each specified time interval, there must be some kind of planning support (Gerdsri et al., 2010). The setting of a TRM timeframe might well result in a period of ten or fifteen years, according to the goal that has been set. An interesting feature of the TRM is the specification of different technologies by the preparer of the roadmap itself - a feature that was recommended and proposed by Kone and Eirma, and shown in Figure 1 (Koen, 1997; Eirma, 1997). Additionally, roadmaps in general will display a chart showing the centerlines of the time intervals blended with the relevant technological features. Mapping of this sort enables production and technology to develop properly and to proceed in a manner consistent with specified objectives and plans of action.

The process of forming a technology road-mapping (TRM)

The process of forming a TRM involves five stages. These are: 1) the assembling together of multiple viewpoints to establish a common vision, 2) setting a direction for the development process, 3) formulation of a production strategy, 4) identifying the principle functions of the working technology, 5) ultimately forming the technology roadmap, as shown in Figure 2 (Khan-Ngern, 2010).

Types and formats of technology road-mapping (TRM)

Kostoff and Schaller (2001) subdivided technology roadmaps into six groups, according to the type of map. These are: 1) science/research roadmaps, 2) cross-industry roadmaps, 3) industry roadmaps, 4) general-technology roadmaps, 5) product-technology roadmaps and 6) technology roadmaps with social/public concern. They also identified eight standard formats of TRM by classifying them in terms of policy objective, as shown in

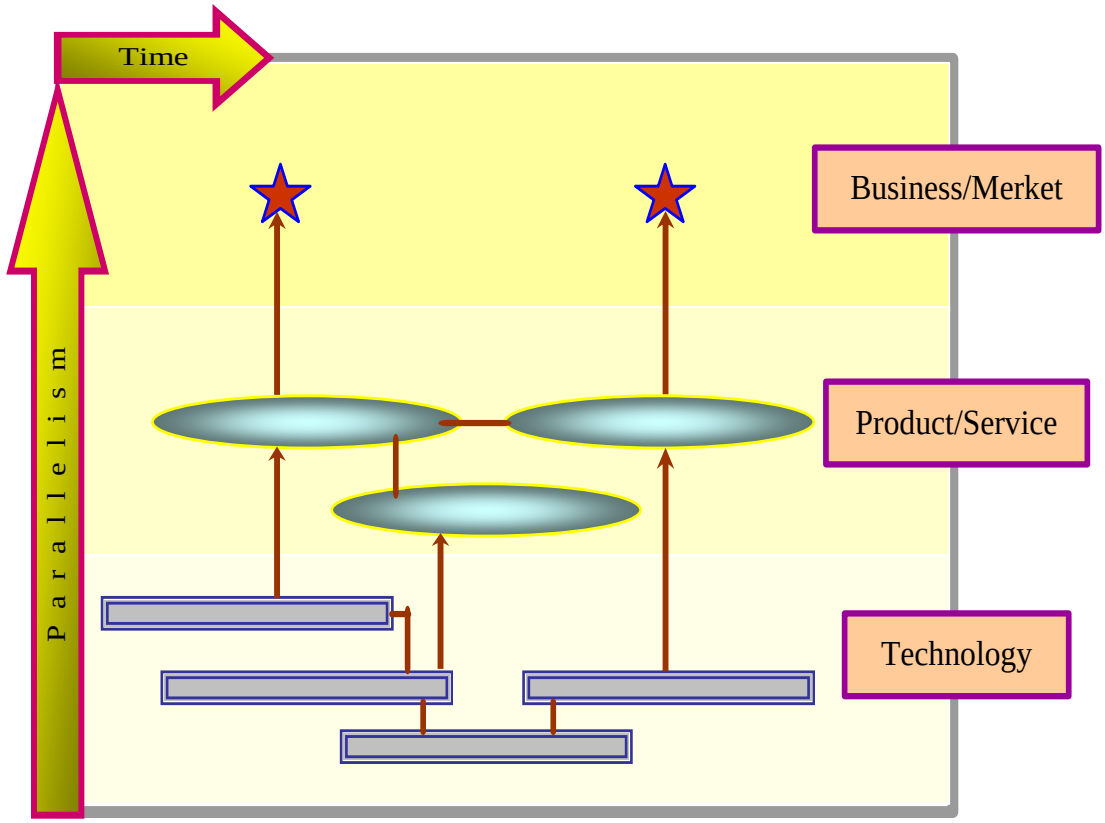

Figure 1. Conceptual technology roadmap.

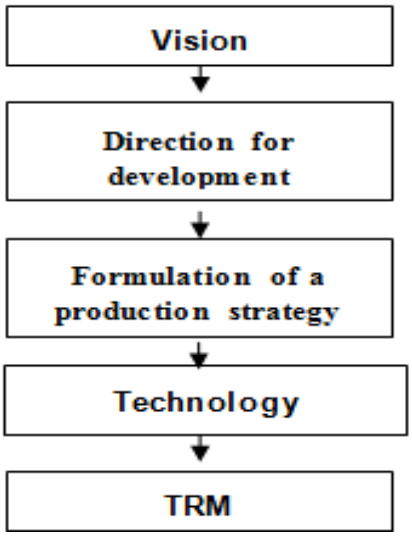

Figure 2. The process of forming a TRM.

Figure 3. These eight objectives are:

Product/merchandise planning: This format is the general standard for TRM and is applicable to the technology planning of new products or merchandise, which their producer expects will go into production in the near future. The production technology for these products could conceivably be multi-dimensional.

Service/capability planning: This format emphasizes the basic service elements. It focuses on various technolo-gies that can be used for the support of organizational capability.

Strategic planning: This format is applicable to general strategy evaluation. It is applied in situations in which estimating the worth or value of an opportunity that involves variety, or is subject to a business threat, needs added support or backing. At the business level, this format will stress the development of a futuristic vision for business that is aimed at products, technology, skills, culture andother concerns. It will juxtapose this vision of the future against present-day scenarios, focusing on alternative strategies previously surveyed. Its purpose will be to bridge the gaps in existing businesses correctly and in a manner best suited to the period of development.

Long-range planning: This format supports planning over the long term. A roadmap of this format is applied to the formulation of a plan at the national level. It is capable of forecasting the direction of a technology that ma-terializes at some future time, or simply indicating what

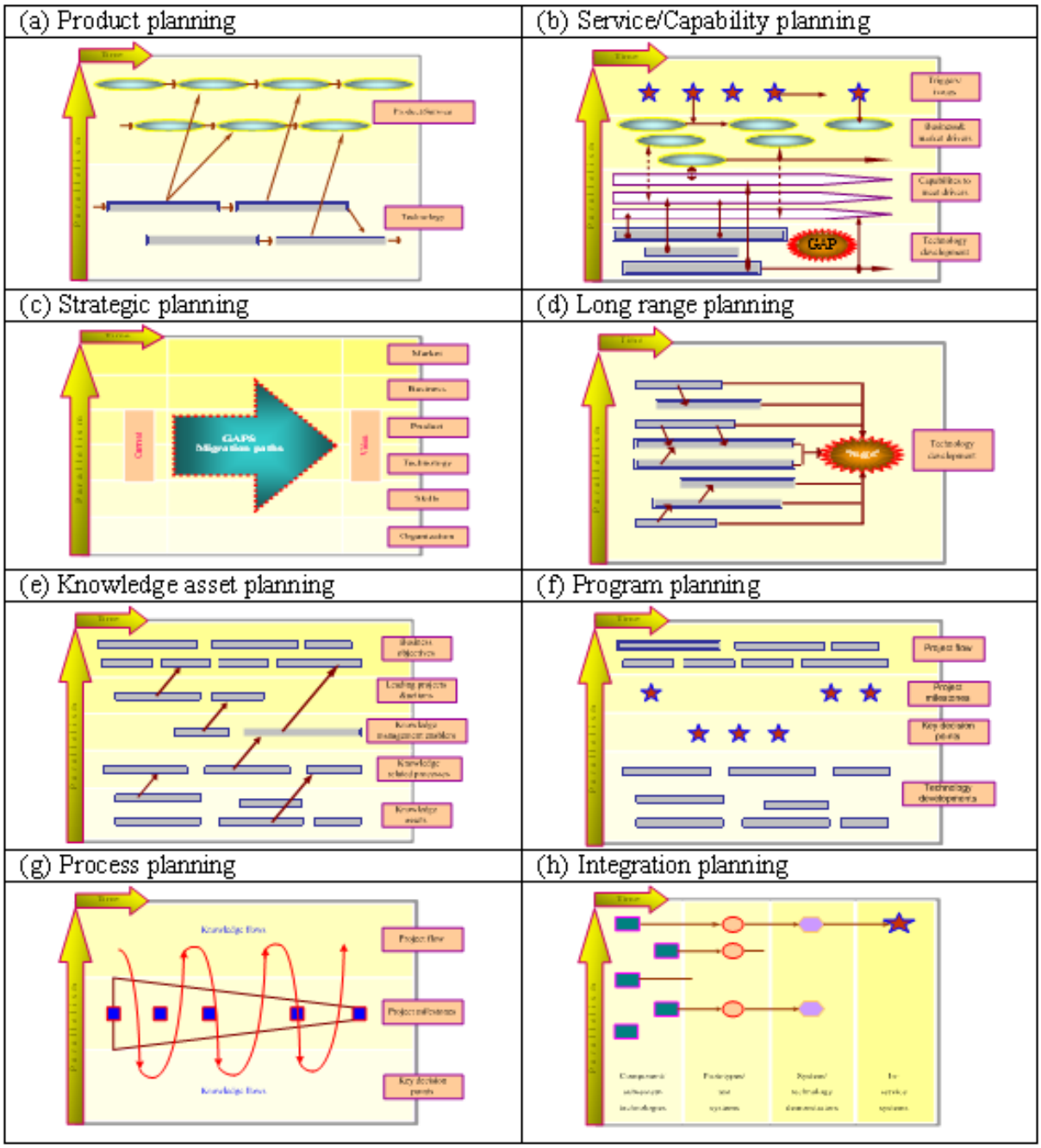

Figure 3. Technology roadmaps: basic types (Kostoff and Schaller, 2001).

that future technology will be.

Knowledge asset planning: This format describes the planning and management of informational modules that contain new knowledge. It functions by linking those in possession of the expertise in their organization together with the needed technologies in order to meet the actual needs and desires of future markets.

Program/project planning: This format places a direct emphasis on the use of strategic tools and project planning such as in the creation of a research-and-development (r and d) program;

Process planning: This format supports the management of informational modules that contain new knowledge by focusing on the basic elements of a specified process in product development. It also focuses on a knowledge process that is truly factual in its output and well-suited to facilitating new-product development. It

proceeds with a view towards achieving results that are truly optimal.

Integration planning: this format consists in the systematic integration of various technologies for the creation of innovative products with forms and features that are new.

Benefits of TRM

Technology roadmaps used by an organization aid in the analysis of existing technologies in terms of their strengths and weaknesses and further supplements the developmental capabilities of these technologies. It concentrates on technology planning and emphasizes priority levels, while maintaining a harmonized interface and continuity at each stage of development. It thus enables managers to optimize their decision-making. It further enables entire organizations to allocate limited available resources and assets with considerably greater efficiency.

Technology roadmaps are capable of providing managers and executives with a much clearer and more comprehensive view of their organization. Further, the maps have proven to be an excellent tool in the decision-making process. Thus they benefit the ongoing work of the company while serving as a directional guide for the company's future. Most importantly, they reduce needless and costly duplication in the company's operational activities. For example, the case of a large company with numerous lower-level business affiliates in which each such affiliate or branch operates independently, these branches may be duplicating the same functions. The result is gross inefficient use of time and miss-allocation of resources that cause the company to fall short of its stipulated objectives.

PDP ROADMAP-MODEL

Construction of the PDP Roadmap-Model: Basic concept

The National Power Development Plan (PDP) is an energy policy designed to govern the direction of electrical-power production for the Nation. However, the format is regarded as awkward which makes systematic projections of future development and modification quite difficult. The result has been that these policies cannot be put into effect without loss of efficiency, because the work proceeds along a path that is not best suited to the task at hand.

A study of the principle of technology road-mapping shows that the TRM can serve as a very useful instrument for the systematic projection of future change and development. It is particularly advantageous to the management of technology and to the setting of policy governing capital investment and industrial development in ways that interrelate. It is especially effective in formulating policy and implementation strategies, resulting in an increase of efficiency. Accordingly, TRM has practical application in the design of roadmap-model, which can then be used to plan the development of electrical-power generation at the national level. The result is the PDP Roadmap-Model, which is used as a tool in constructing the Nation's PDP roadmap both for the present and the future. Some examples of this map have been PDP 2007; PDP 2007: Revision 1; PDP 2007: Revision 2; and PDP 2010. These are arranged in graph format in Figure 4 below, in which one of the graph nodes includes a future PDP. The model formed serves as a useful approach to developing an energy policy over the long term. It may also be applied to formulate policies or plans of work for other industries in the years ahead.

Architectural design principles

The architectural design of the roadmap-model incorporates the principle of technology road-mapping (TRM) by discreetly combining together the basic elements of the TRM as shown in Figure 1 (Koen, 1997; Eirma, 1997), the standard format of the TRM as shown in Figure 3 (f) (Kostoff and Schaller, 2001) and the structural diagram and principal components of the PDP as shown in Figure 5, optimizing the design and modeling of the PDP roadmap. Accordingly, the authors have selected the TRM format as a means of program planning that will lay direct emphasis upon strategic tools and the design of work projects. The design of the roadmap-model for PDP planning specifies a series of one-year time intervals indicated by vertical lines centered within each interval. These, in turn, are related to the PDP as a function of time, so that the movement of the PDP can be traced from one year to the next. Major plans that involve various projects include the phasing out of power plants, power-plant construction projects of the EGAT, construction of power-plant projects by the private sector, purchasing of electricity from abroad and new power-plant projects. The modeling process blends the PDP into a practical application of the TRM and thus creates the PDP Roadmap-Model shown in Figure 5.

Conceptual thinking approach

The creation of a roadmap-model is characterized by a systematic thinking approach based upon the format of the PDP Roadmap-Model. This new model is capable of modification and practical use consistent with the needs and objectives of the PDP in any of its versions. (Its emphasis is directed towards analyzing the process of integrating the various features of the PDP structure

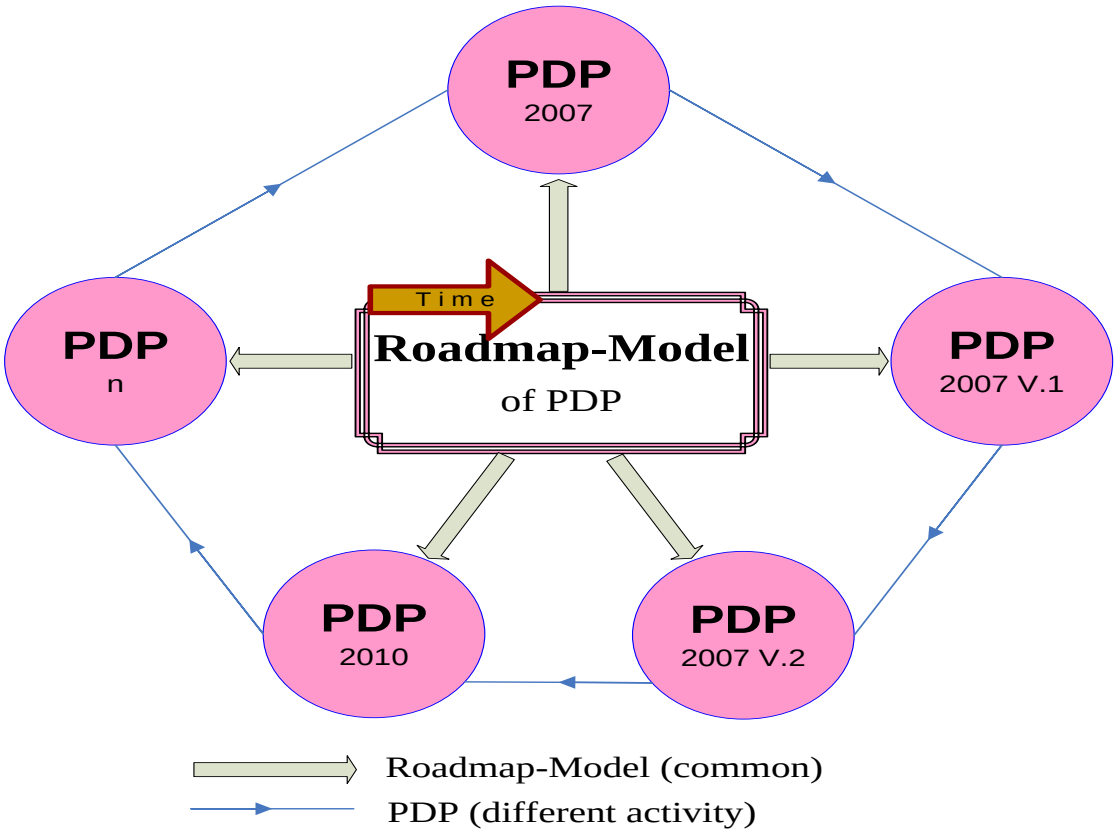

Figure 4. Roadmap-model depicting PDP integration.

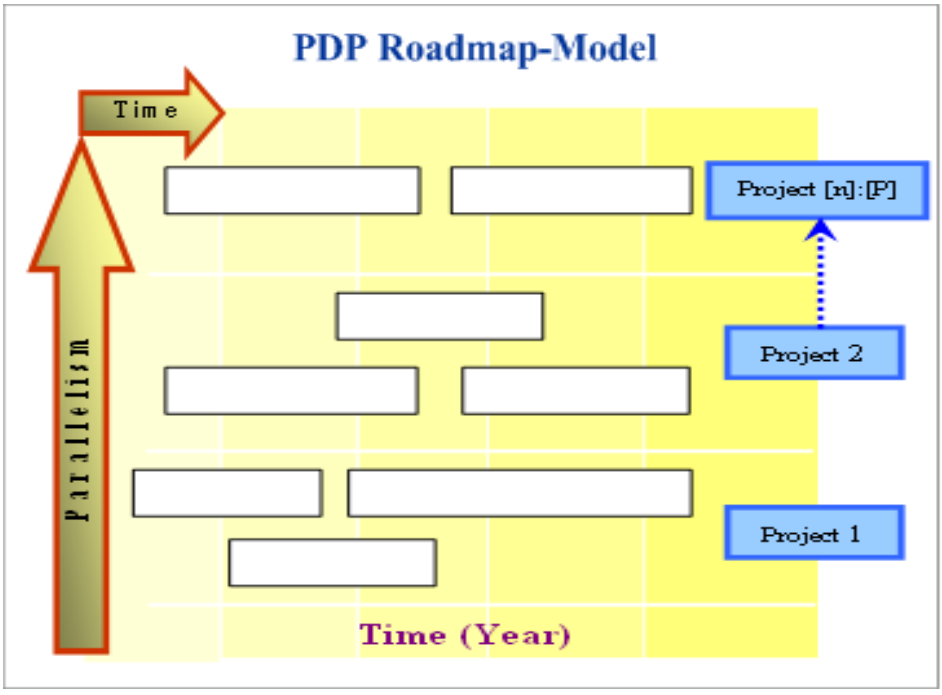

Figure 5. Generalized PDP Roadmap-Model form.

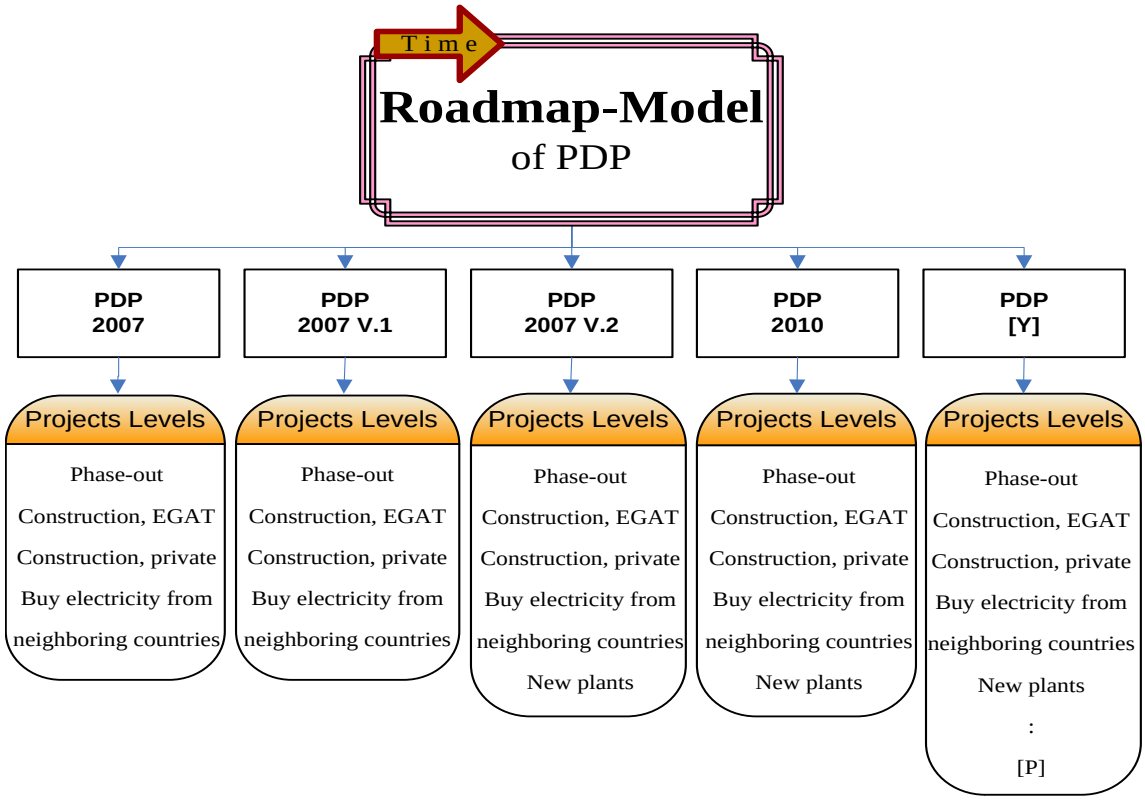

Figure 6. Diagram of structure and major components of the PDP.

together into the PDP Roadmap-Model.) It is usable with the PDP in all of its versions, including PDP 2007; PDP 2007: Revision 1; PDP 2007: Revision 2; and PDP 2010. Figure 5 illustrates the conceptual thinking approach in the design of the basic roadmap-model. It subdivides into two parts, as follows:

A series of one-year time intervals (Time: [Y]) are each specified by a vertical line centered within each interval. These describe the plan as a function of time based on the initial formulation of the plan. Total timeframes include periods of 10, 15 and 20 years. On that basis:

PDP 2007; PDP 2007: Revision 1; PDP 2007: Revision 2: and PDP 2010 will yield to PDP [Y].
PDP [Y] will then be defined as the working model of the PDP.

The project definition (Projects: [P]) of the PDP as based on the roadmap-model makes possible the expansion or reduction of the PDP by following the structure of the previous plan. Currently, there are five projects:

[Project 1] Phasing out of current power plants.
[Project 2] Power-plant construction by the EGAT.
[Project 3] Power-plant construction by the private sector.
[Project 4] Purchase of electricity from abroad.
[Project 5] New power-plant construction.

Ultimately: [Project [n]]: [P].

When: [P] has been defined as the working model of the PDP. [n] The number of PDP projects.

The PDP-based analysis for Thailand from past to present went through four versions, beginning with PDP 2007. It was followed by PDP 2007: Revision 1; PDP 2007: Revision 2; and PDP 2010. Major components of the PDP can be sub-grouped together according to the basic differences in each of the plans, as shown in Figure 6.

The PDP Roadmap-Model that conforms to the PDP structure shows that, there are major components that make up each plan, there are projects that are similar to each other and there are increases in new projects. It can be concluded that, among the different versions of PDP, there are often similarities in structure, while for a given plan there may be an increase in project construction.

Thus, whatever version of the PDP may be in effect for Thailand, it may possibly involve either expansion or reduction in projects that are underway. In either case,

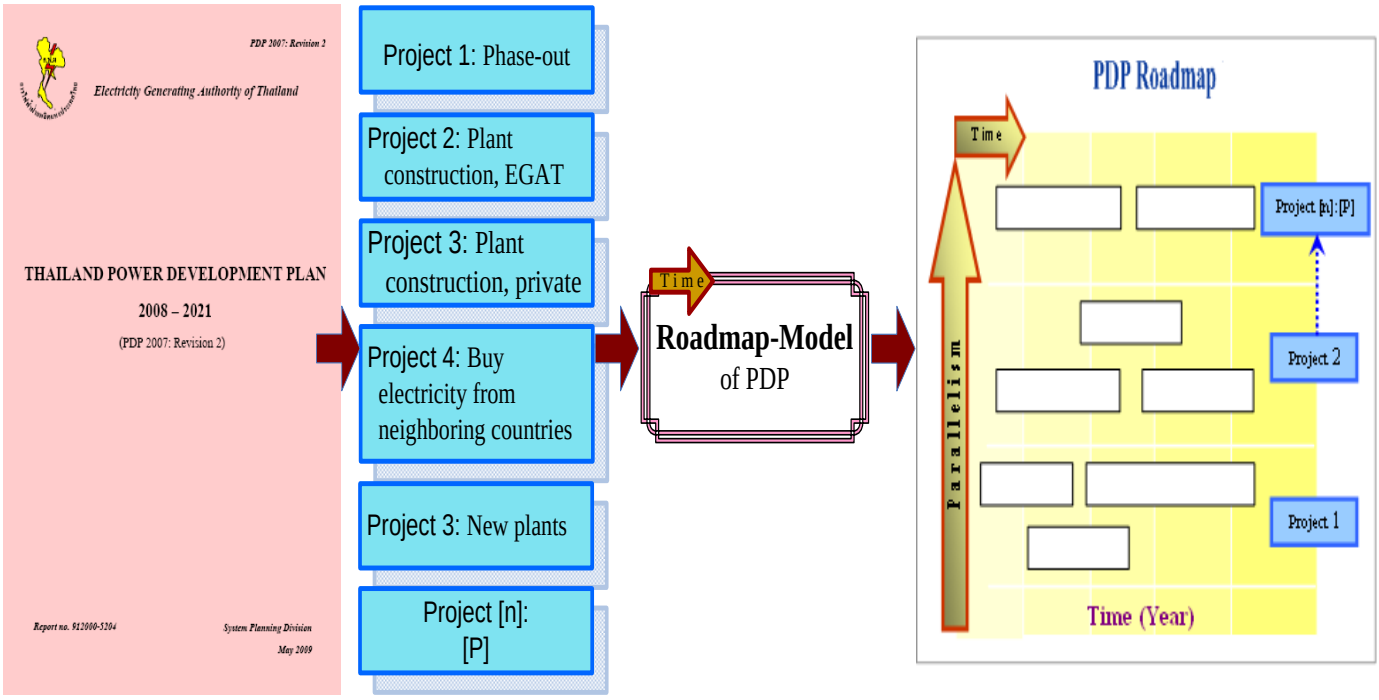

Figure 7. Relationship between PDP Roadmap-Model and strategic planning.

the roadmap-model can be applied to the National PDP for Project [P], whether [P] belongs to the present time or to the future. This relationship is illustrated in Figure 7.

CASE STUDY

To illustrate the practical application of the TRM, the Thailand Power Development Plan (PDP 2007: Revision 2) issued by the Ministry of Energy is used as a case study. Recommendations are subdivided into three categories:

Origin of the PDP 2007: Revision 2.
Highlights of the PDP, extending to detailed PDP specification of electrical-power construction projects for the future.
PDP Roadmap-Model design and modeling for PDP 2007: Revision 2.

Origin of the national power development plan for the years 2008 – 2021 (PDP 2007: Revision 2)

Creation of the National Power Development Plan (PDP) results from a long-term investment in Thailand's electrical-power system. It defines a form of technology, investment structure, industrial structure and business for electrical power. It also foresees the social impact that is expected to follow - both economically and socially, as well as environmentally - within a fifteen-year planning period. The Electricity Generating Authority of Thailand (EGAT) has formulated the Thailand Power Development Plan for the years 2007-2010 (PDP 2007) under the policy framework of the Ministry of Energy. Important concerns of interest included reliability of power supply, fuel diversification, power purchases from neighboring countries and power demand forecast. The PDP 2007 was approved by the National Energy Policy Council (NEPC) and endorsed by the Cabinet in June 2007 (EGAT, 2009).

Subsequently, the EGAT, under the guidance of the Ministry of Energy, reviewed the PDP 2007 in order to cope with the situation of the time, and created the so-called "Thailand Power Development Plan 2007-2021; PDP 2007: Revision 1". The PDP 2007: Revision 1 was approved by NEPC and endorsed by the Cabinet in December 2007. However, after ten months of applying the PDP 2007: Revision 1, the situation and condition affecting the plan had changed significantly. In particular, the demand for power was lower than previously forecasted because of the global economic recession. If the plan remained unchanged, the power system would be left with a large surplus. Furthermore, the power-development projects in the Lao People's Democratic Republic (PDR) led to the signing of The Memorandum of Understanding on Tariff (Tariff MOU), affecting many of its projects and their developers. For that reason, the EGAT, together with the Ministry of Energy, once again reviewed the PDP 2007: Revision 1, adapting it to the

present situation. In its revised form, it was called the "Thailand Power Development Plan 2007-2021; PDP 2007: Revision 2" (EGAT, 2009). It was endorsed by NEPC on January 16th, 2009 and proposed before the Cabinet on January 28th, 2009. The Cabinet directed NEPC to consider the need for a public hearing process on the PDP 2007: Revision 2. During the meeting of the PDP Review Committee on February 2nd, 2009, EPPO and EGAT were assigned the task of preparing information for the PDP workshop. The workshop was arranged to allow any issues they have concerning the PDP to be discussed. Subsequently, the Ministry of Energy again made its proposal to the NEPC. The proposed PDP 2007: Revision 2 was endorsed by NEPC on March 9th, 2009 and finally endorsed by the Cabinet on March 24th, 2009. From the formulation of the PDP 2007: Revision 2, the following benefits was derived:

1. Thailand electricity reserve margin can be maintained at an appropriate level with respect to the decline in demand for electricity. Consequently, a majority of power plants that had been previously planned, as stated in the PDP, were postponed.
2. The investment in power generation and transmission projects can be reduced because of the postponement of the power projects of IPP and EGAT. Also, new unidentified capacities as well as power purchases from neighboring countries have been affected by the decline in demand for electricity. The result has been a decrease in the generation capacity stated in the investment plan.
3. Power purchases from SPP are being accelerated to support the Government policy on economic enhancement and reduction of public debt.

The intention of these measures is that the PDP 2007: Revision 2 will go forward with maximal efficiency and in complete harmony with the National Energy Policy. Accordingly, the Committee for the Appraisal and Update of the Thailand Power Development Plan has now been appointed to realize this intention. Its role will be to formulate a PDP for the purpose of procuring electricity in an efficient manner over the long term, and with attention to the security of the Nation's power grid. It will also include investment in the expansion of power generation and power transmission at appropriate levels, and at a rate consistent with the Nation's economy. Further, it will assist in reviewing guidelines for the propositions stated above in the course of updating the National Power Development Plan for maximal efficiency. Provisions of this Committee for the Appraisal and Update of the PDP (EGAT, 2009) include the followings:

1. The Permanent Secretary of the Ministry of Energy shall serve as the committee chairman.
2. The Deputy Permanent Secretary of the Ministry of Energy shall serve on the committee.
3. The Energy Regulatory Committee shall serve on the committee.
4. The Secretary of National Economic and Social Development Board or designated representative shall serve on the committee.
5. The governor of the electricity generating authority of Thailand (EGAT) or designated representative shall serve on the committee.
6. The managing director of the PTT Public Company Limited shall serve on the committee.
7. The director of the energy planning and policy office (EPPO) shall serve on the committee and function as secretary.

The necessary information in formulating the PDP comprises four of the following aspects: policy, power grid, forecasting the electricity demand of Thailand and fuel. A state of optimization for the Plan can be generated by inputting these four factors into a computer program. The Plan was reviewed by EGAT, the Ministry of Energy and the EPPO. The Plan then is presented for public hearing and evaluated by those with the relevant technical expertise from the public sector. The thoughtful input from these quarters can then be incorporated into the Plan for its further enhancement, prior to its presentation before the Ministry of Energy and the Energy Regulatory. The Plan will then be brought to the NEPC for approval, and then pass to the Cabinet for their appraisal (EGAT, 2009). These various phases in formulating the PDP are shown in Figure 8, while Figure 9 shows the steps involved in gaining approval for the PDP.

Essential elements of the Thailand Power-Development plan (PDP 2007: Revision 2)

The Thailand Power-Development Plan (PDP 2007: Revision 2) covers the planning horizon for the period 2007 to 2021 (EGAT, 2009). Details of the plan can be described as follows:

New power plant projects for the period 2009 to 2015: The total installed power-generating capacity of the new projects during this period is projected to be 12,604.8 MW.

New power plant projects for the period 2016 to 2021: All new projects presented in the Plan for this period shall have a total capacity of 17,550 MW.

Renewable energy: The renewable-energy projects of the EGAT, which will have a total capacity of 81.7 MW, were deemed acceptable by the committee on energy policy administration (CEPA) and were approved by the national energy policy council (NEPC). Coal supply plan for the four coal-fired power plants of EGAT.

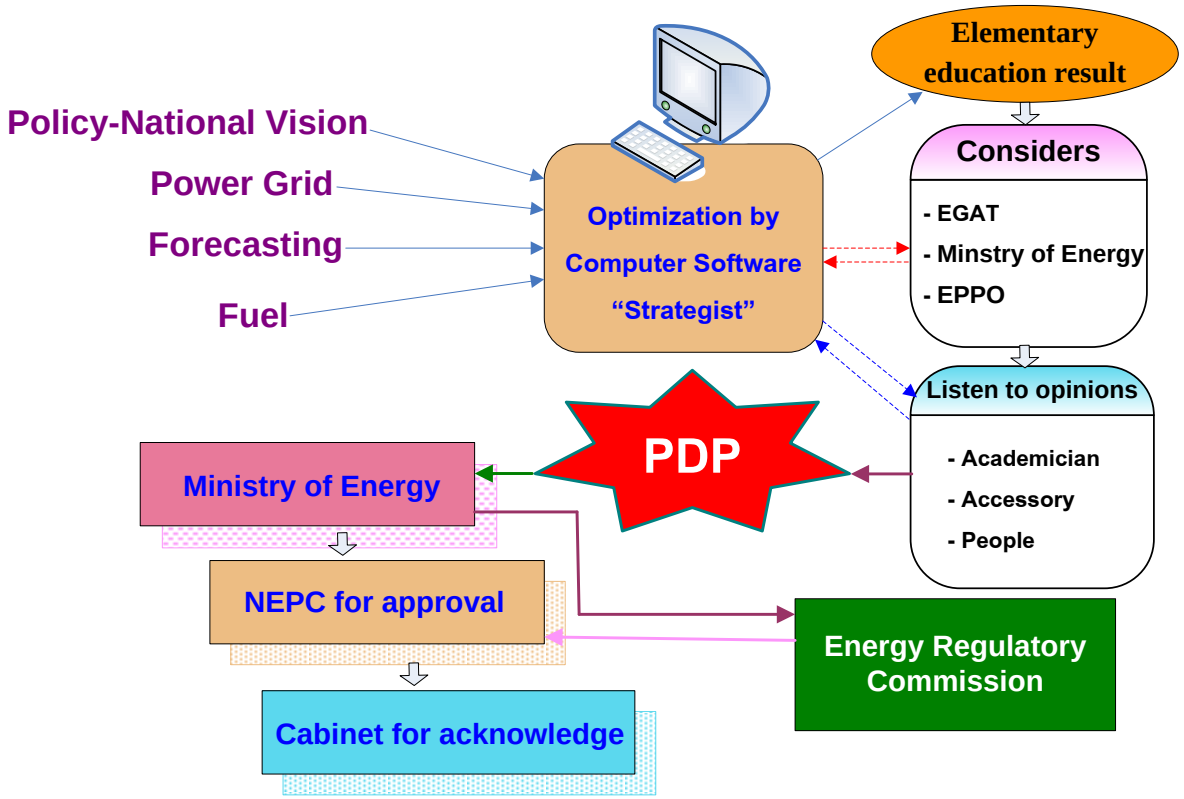

Figure 8. Procedure for formulating the PDP.

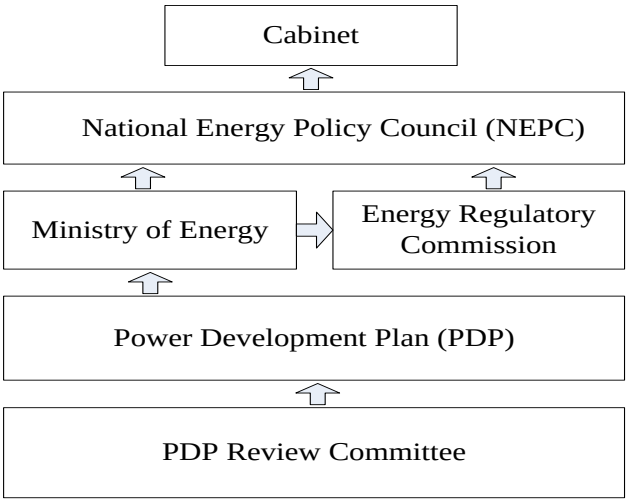

Figure 9. Procedure for seeking approval for the PDP.

The nuclear power plant program: The cooperative committee for nuclear-power infrastructure establishment reported that the nuclear power project can proceed as planned. Capacity has since been reduced to 1,000 MW. Thus, 1,000 MW have been allotted to 2020 and another 1,000 MW as base load plant in the system following 2020.

The net incremental generation capacity is projected to be 22,652.5 MW during the period of 2009 to 2021 resulted from power purchases from SPP and VSPP, and from the retirement of aging power plants. Taking into account the contacted or committed capacity of 29,139.5 MW, the total installed power-generation capacity by the end of plan in 2021 will be 51,792.0 M W (PDP 2007:

Revision 2). The details of plants, power purchases from IPP, SPP, VSPP and neighboring countries are shown in Table 1, while detailed capacity by power plant type is shown in Figure 10.

MODELING THE TRM FOR THE PDP 2007 REVISION 2

Based on the principle of the technology roadmap, a detailed examination of the PDP reveals that the installation of power-generation facilities is subject to the following five programs:

1. Retirement of old power plants.
2. New power plants projects.
3. Construction of new power plants by EGAT.
4. Construction of new power plants by private firms (IPPs).
5. Power purchased from neighboring countries.

Accordingly, the authors have selected the "Program Planning" format as a key pattern for modeling the TRM. This format places direct emphasis on the use of strategic tools intertwined with project planning. It begins with a program of research and development, which is further developed into the PDP of interest. The modeling of the TRM for PDP 2007: Revision 2 is shown in Figure 11. The detailed itemizations are described as follows:

Year 2009: Retirement of old power plants, namely South Bangkok TH #4-5, Lankrabue GT #1-11, Nong Chok GT #1-3 and Suratthani GT #1-2; New plant construction by the EGAT, namely South Bangkok CC #3, Bang Pakong plants CC #5, Small Hydro Power Plants and Wind and Solar energy; New plant construction by private firms, namely VSPP and SPP (Renew); and purchasing power from neighboring countries, namely Nam Theun 2.

Year 2010: New plant construction by the EGAT, namely North Bangkok CC #1 and Small Hydro Power Plants; and New plant construction by private firms, namely VSPP; and SPP (Co-Gen).

Year 2011: Retirement of old power plants, namely Khanom TH #1; New plant construction by the EGAT, namely Small Hydro Power Plants; New plant construction by private firms, namely VSPP, SPP (Renew) and Gheco-one Co., Ltd.; and purchasing power from neighboring countries, namely Nam Ngum 2.

Year 2012: New plant construction by private firms, namely VSPP, SPP (Renew) and SPP (Co-Gen); and purchasing power from neighboring countries, namely Theun Hinbun-expanded.

Year 2013: New plant construction by private firms, namely VSPP, SPP (Co-Gen), the Siam Energy Co., Ltd #1-2, and the National Power Supply Co., Ltd #1–2.

Year 2014: Retirement of old power plants, namely Bang Pakong TH #1-2; New plant construction by the EGAT, namely Wang Noi CC #4 and Chana CC #2; and New plant construction by private firms, namely VSPP, SPP (Co-Gen), the National Power Supply Co., Ltd #1-2, and the National Power Supply Co., Ltd. #1-2.

Year 2015: Retirement of old power plants, namely Rayong CC #1-4; New plant construction by private firms, namely VSPP; and purchasing electricity from neighboring countries.

Year 2016: Retirement of old power plants, namely Khanom TH #2; and Khanom CC #1; New plant construction by the EGAT, namely the Thermal coal-fired power plant of the EGAT #1-2; New plant construction by private firms, namely VSPP; purchasing power from neighboring countries; and program for the new south-side power plant.

Year 2017: Retirement of old power plants, namely Bang Pakong CC #3 and SPP; New plant construction by the EGAT, namely the Thermal coal-fired power plant of the EGAT #3-4; New plant construction by private firms, namely VSPP; purchasing power from neighboring countries; and program for new power plants.

Year 2018: Retirement of old power plants, namely Bang Pakong CC #4, Nam Pong CC #1 and SPP; New plant construction by the EGAT, namely South Bangkok CC #4-5 and Bang Pakong CC #6; and New plant construction by private firms, namely VSPP.

Year 2019: Retirement of old power plants, namely SPP; New plant construction by the EGAT, namely North Bangkok CC #2; New plant construction by private firms, namely VSPP; purchasing power from neighboring countries; and program for new power plants.

Year 2020: Retirement of old power plants, namely South Bangkok CC #2, Nam Pong CC #22, the Tri-Energy Company and SPP; New plant construction by the EGAT, namely the Thermal power plant (Nuclear)_EGAT #1; New plant construction by private firms, namely VSPP and the new IPP power plant; and purchasing power from neighboring countries.

Year 2021: Retirement of old power plants, namely SPP; New plant construction by the EGAT, namely the Thermal nuclear power plant of the EGAT #2; New plant construction by private firms, namely VSPP; purchasing power from neighboring countries; and program for new power plants.

DISCUSSION

The overview of creating on Roadmap Model for Public

Table 1. Detailed layout of the PDP 2007: Revision 2 (EGAT, 2009).

Thailand Power Development Plan (PDP 2007: Revision 2)					
Year	**Peak demand (MW)**	**Power Plant**		**Capacity (MW)**	**Reserve Margin (%)**
2009	22,886	Retirement of South Bangkok TH # 4-5 (Jan.)	-559	30,153.9	22.4
		Retirement of Lankrabue GT # 1-11 (Jan.)	-220.1		
		Retirement of Nong Chok GT # 1-3 (Jan.)	-351		
		Retirement of Suratthani GT # 1-2 (Jan.)	-234		
		VSPP (Jan.)	6		
		SPP (Renew) (Jan.)	16.5		
		SPP (Renew) (Mar.)	10		
		South Bangkok CC # 3 (Mar.)	710		
		Bang Pakong CC # 5 (Jul.)	710		
		Power purchased from Loa PDR (Nam Theun 2) (Nov.)	920		
		Chao Phraya Dam #1 (Dec.)	6		
		Wind energy and Solar energy (Dec.)	(3)		
2010	23,936	VSPP (Jan.)	10	30,958.6	24.0
		Chao Phraya Dam #2 (Mar.)	6		
		North Bangkok CC # 1 (May.)	670		
		Mae Klong Dam #1-2 (Aug., Dec.)	2x6		
		Pasak Jolasid Dam (Oct.)	6.7		
		Khun Dan Prakarnchon Dam (Nov.)	10		
		SPP (Co-Gen) (Nov.)	90		
2011	25,085	Power purchased from Lao PDR (Nam Ngum 2) (Jan.)	596.6	32,481.3	23.7
		VSPP (Jan.)	48		
		Kwae Noi Dam # 1-2 (Jan., Apr.)	2x158		
		Naresuan Dam (Feb.)	-69.9		
		Retirement of Khanom TH # 1 (Jul.)	250		
		SPP (Renew) (Aug.)	660		
		Gheco-one Co., Ltd (Nov.)			
2012	26,572	VSPP (Jan.)	50	33,740.3	20.3
		SPP (Renew) (Jan.)	65		
		SPP (Co-Gen) (Jun.)	924		
		Power purchased from Lao PDR (Theun Himbun-expanded) (Jan.)	220		
2013	28,188	VSPP (Jan.)	50	36,200.3	20.4
		Siam Energy Co., Ltd # 1-2 (Mar., Sep.)	2x800		
		SPP (Co-Gen) (Jun.)	540		
		National Power Supply Co., Ltd # 1-2 (Nov.)	2x135		
2014	29,871	Retirement of Bank Pakong TH # 1-2 (Jan.)	-1052	38,758.3	16.6
		VSPP (Jan.)	50		
		National Power Supply Co., Ltd # 3-4 (Mar.)	2x135		
		Wang Noi CC # 4 (Jun.)	800		
		SPP (Co-Gen) (Jun.)	90		
		Power Generation Supply Co., Ltd # 1-2 (Jun., Dec.)	2x800		
		Chana CC # 2 (Jul.)	800		

Table 1. Contd.

2015	31,734	Retirement of Rayong CC # 1-4 (Jan.)	-1175.1	38,083.2	16.6
		VSPP (Jan.)	50		
		Power Purchased from neighboring countries (Jun.)	450		
		Retirement of Khanom TH # 2 (Jun.)	-70.2		
		Retirement of Khanom CC # 1 (Jul.)	-678		
2016	33,673	VSPP (Jan.)	50	40,035.0	16.6
		Thermal power plant (Coal)_EGAT # 1-2 (Jan.)	2x700		
		Power purchased from neighboring countries (Mar.)	450		
		New power plant South (Jul.)	800		
		Retirement of Bank Pakong CC # 3 (Jan.)	-314		
		Retirement of SPP (Apr., Oct.)	-180		
2017	35,668	VSPP (Jan.)	50	42,241.0	16.6
		Thermal power plant (Coal)_EGAT # 3-4 (Jan.)	2x700		
		New power plant (Jan.)	800		
		Power purchased from neighboring countries (Jan.)	450		
		Retirement of Bank Pakong CC # 4 (Jan.)	-314		
		Retirement of Nam Pong CC # 1 (Jan.)	-325		
		Retirement of SPP (Feb., Apr.)	-42		
2018	37,725	VSPP (Jan.)	50	44,460.0	15.8
		South Bangkok CC # 4-5 (Jan.)	2x800		
		Bank Pakong CC # 6 (Jan.)	800		
		Power purchased from neighboring countries (Jan.)	450		
		Retirement of SPP (Jun., Sep.)	-189		
2019	39,828	VSPP (Jan.)	50		
		North Bangkok CC # 2 (Jan.)	800	47,221.0	17.0
		New power plant (Jan.)	2x800		
		Power purchased from neighboring countries (Jan.)	500		
		Retirement of South Bangkok CC # 1 (Jan.)	-316		
		Retirement of Nam Pong CC # 2 (Jan.)	-325		
		Retirement of power plant of Tri Energy Co.	-700		
2020	42,024	Retirement of SPP (Feb., May., Aug.)	-188	48,842.0	16.1
		VSPP (Jan.)	50		
		Thermal power plant (Nuclear)_EGAT # 1 (Jan.)	1000		
		New power plant_IPP (Jan.)	2x800		
		Power purchased from neighboring countries (Jan.)	500		
		Retirement of SPP (Feb., Sep., Oct.)	-200		
	44,281	VSPP (Jan.)	50		
2021		Thermal power plant (Nuclear)_EGAT # 2 (Jan.)	1000	51,792.0	15.3
		New power plant (Jan.)	2x800		
		Power purchased from neighboring countries (Jan.)	500		
		Total capacity (as of December 2008)		29,139 MW	
		Total added capacity		30,154.8 MW	
		Total retired capacity		-7,502.3 MW	
	Grand total capacity (at the end of 2010)			51,792.0 MW	

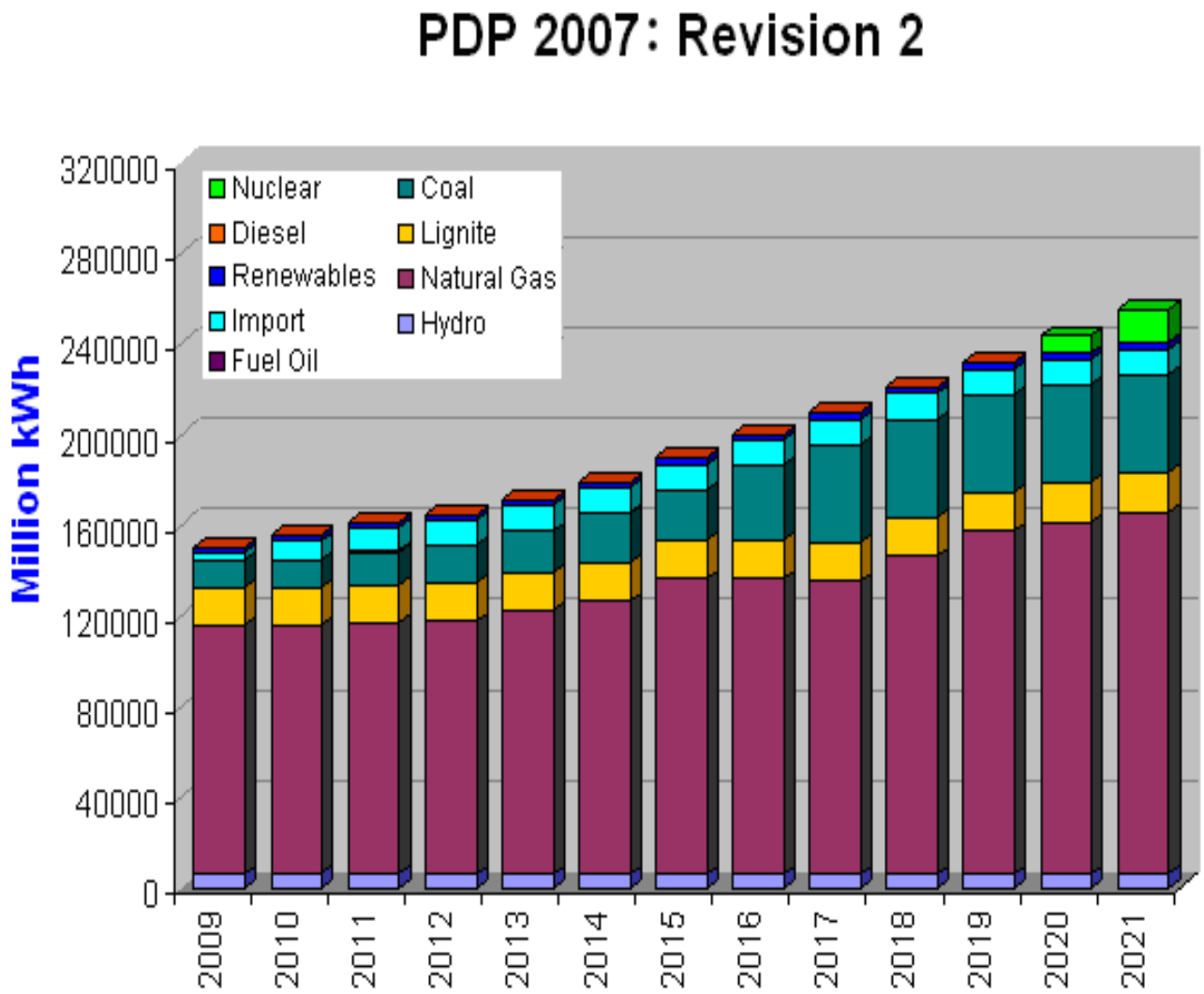

Figure 10. Projection of energy-generating capacity as classified by power plant types.

Policy towards National Power Development Plan is implemented by integrating the TRM concepts and principles in the steps of modeling. Figure 11 shows clearly the trend of future change in the project and overall plan.

From the Roadmap Model for 2007 PDP: Revision 2 to the System Planning Division's Generation System Development Planning Department which directly involves with development of the Nation Power Development Plan, the image reveals that the model is presented in a clear and comprehensible way.

Moreover, it shows trajectory of future technological reforms in systematic way. This, however, will contribute more to the works of the Generation System Development Planning Department, in case there are more and specific information on, such as, peak demand, capacity, and reserve margin, etc.

Hence, an important part of the future work is to add the additional information in the process of modeling the Roadmap for Nation Power Development Plan.

CONCLUSION AND RECOMMENDATIONS

This paper offers guidance on the preparation of a public policy roadmap with the application, concept and principle of the technology road-mapping, or TRM. Further, it makes use of the Thailand Power Development Plan (PDP 2007: Revision 2) as a case study of a PDP Roadmap-Model for the PDP. The models, the directional

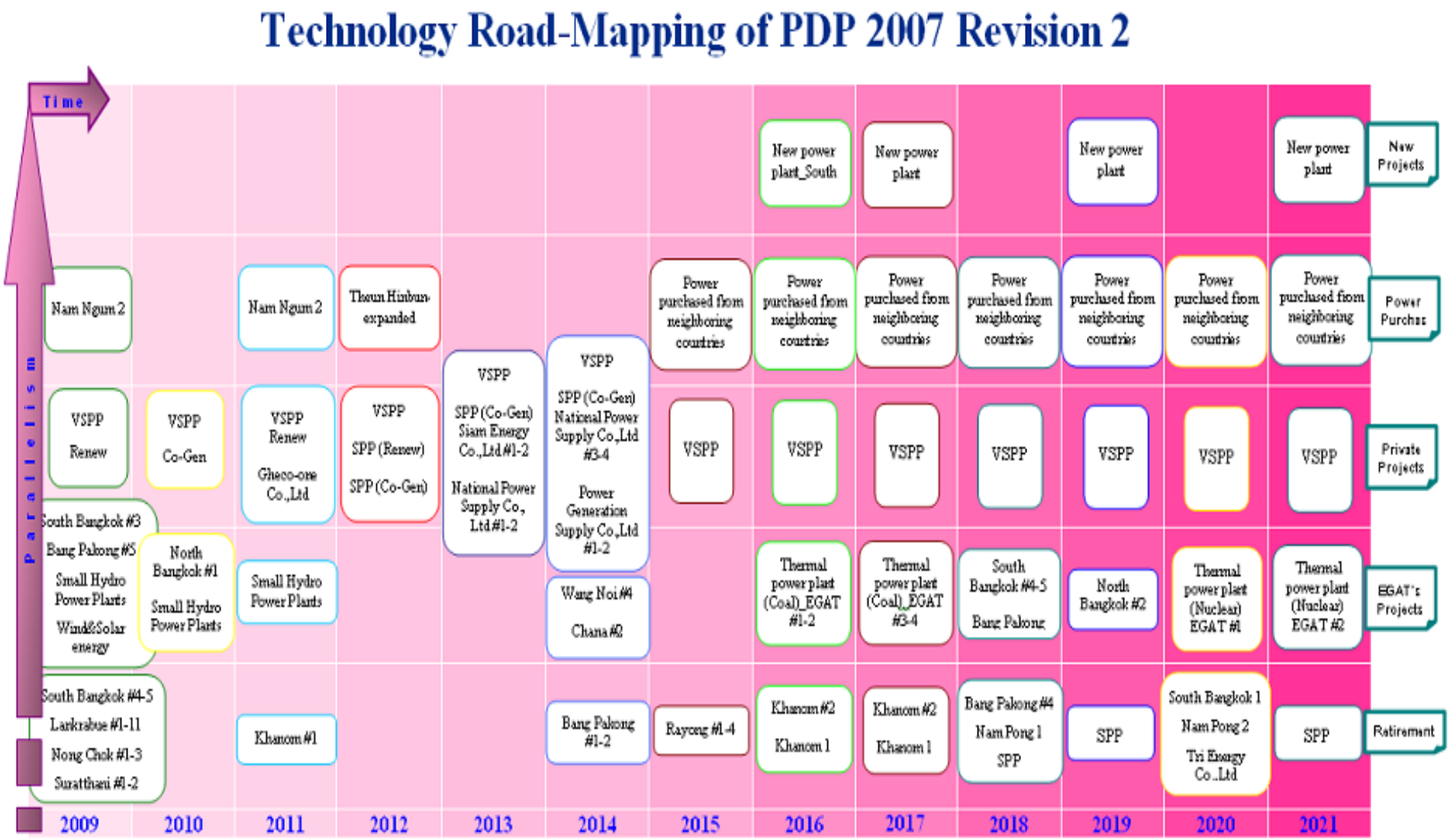

Figure 11. PDP Road-Mapping towards the PDP 2007: Revision 2.

change of a project or program and its plan of work for the future in a comprehensive direction. It thus enables and enhances the decision-making process for managers and directors.

The PDP Roadmap-Model principle has practical application for the PDP in its future editions

as well.

These will include the public policies of various nations pertaining to their allocation of national resources and use of assets in an appropriate direction with maximal efficiency. The result will be continuity and coordination of activity over the very long term.

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REFERENCES

EIRMA (1997). Technology Roadmapping-delivering business vision. Working group report, European Industrial Research Management Association, Paris, p. 52.

Electricity Generating Authority of Thailand (2009). Thailand power development plan for 2008-2021 (PDP 2007: Revision 2).

Gerdsri N, Vatananan R, Dansamasatid S (2009). Dealing with the Dynamics of Technology Roadmapping Implementation: A Case Example. Technol. Forecast. Soc. Chang., 76(1): 50-60.

Khan-Ngen W (2010). TRM - Conceptual Thinking Approach Section 1. Available, Website: http://www.kmitl.ac.th/emc/web%20trm/free%20doc/Road%20map%20pape r1.pdf. Retrieved.

Koen PA (1997). Technology maps: choosing the right path. Eng. Manage. J., 9: 7-11.

Kostoff, R.N., and Schaller, R.R. (2001). Science and technology roadmaps. IEEE Transactions on Engineering Management, 48(2), 132-143.

Ministry of Energy (2010). Thailand power development plan for 2010-2030 (PDP 2010).Website:http://www.eppo.go.th/power/pdp/pdp2010/pdp2010summary.pdf. Retrieved June 30, 2010.

Phaal R, Shehabuddeen NTMH, Assakul P (2002). Technology roadmapping: charting the route ahead for UK road transport. Proceedings of the IEEE International Engineering Management Conference, Cambridge, 18-20 August.