HUMAN RESOURCE DEVELOPMENT IN A NEWCOMER COUNTRY: MNPC'S EXPERIENCE AS A DEDICATED NUCLEAR ENERGY PROGRAMME IMPLEMENTING ORGANIZATION (NEPIO)

IAEA International Conference on Human Resource Development (HRD)
for Nuclear Power Programmes at the IAEA
12-16 April 2014; IAEA Vienna

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WAY FORWARD & CONCLUDING REMARKS

ECONOMIC TRANSFORMATION PROGRAMME (ETP) REPORT , 2010

EPP 11: Deploying Nuclear Energy for Power Generation

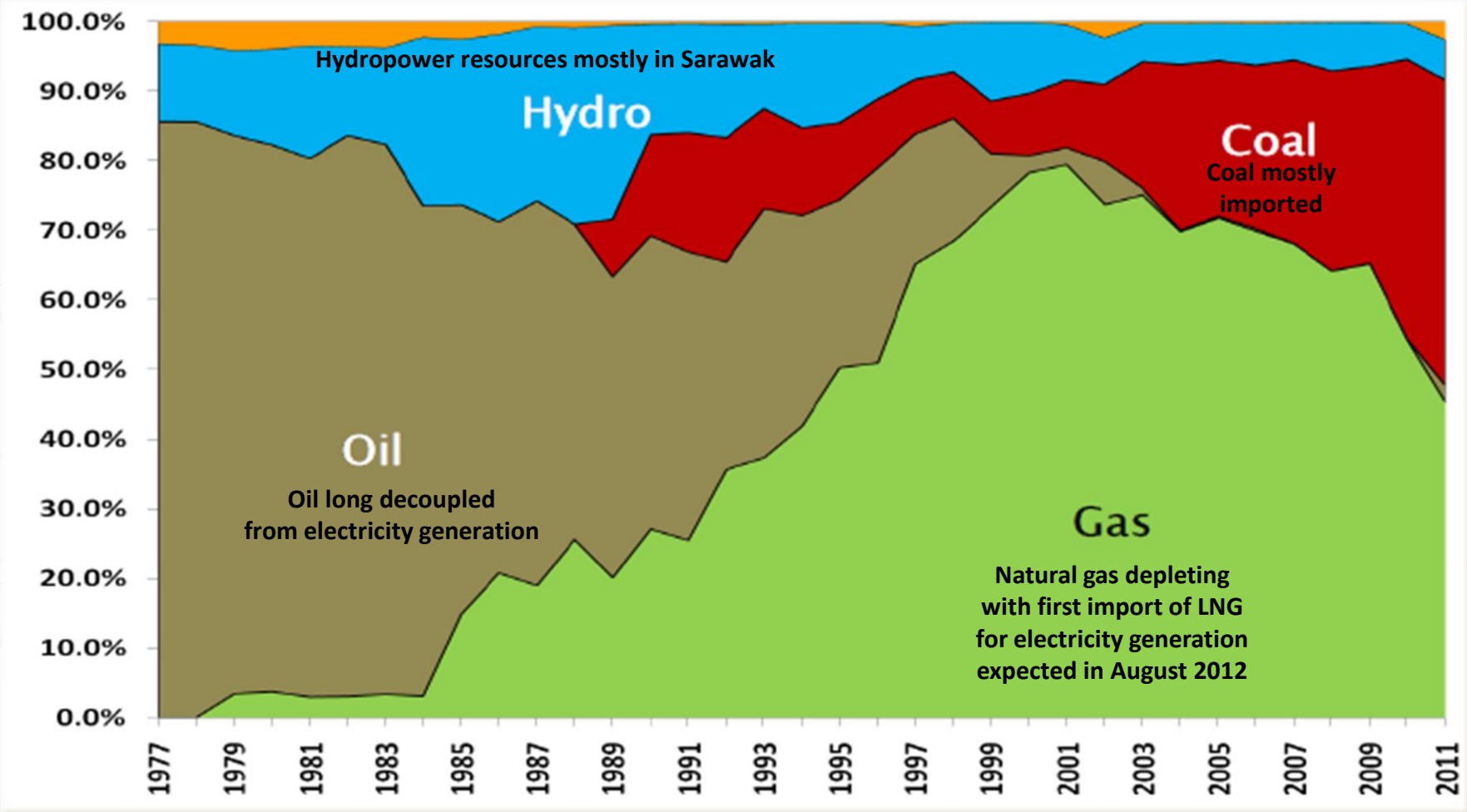
Rationale

Malaysia is exploring the option of deploying nuclear energy in order to meet future demand and diversify the energy mix for Peninsular Malaysia. A Nuclear Power Development Steering Committee, headed by the Ministry of Energy, Green Technology and Water, was set up in June 2009 to plan and coordinate the preparatory efforts towards deploying nuclear energy for electricity generation. The committee has been tasked to conduct various studies towards preparing a Nuclear Power Infrastructure Development Plan (NPIDP), which is targetted to be ready by 2013. Prior to conducting these necessary studies, a nuclear power pre-feasibility study and initial site selection study has already been undertaken.

Actions

The Steering Committee is studying the possibility of delivering a twin-unit nuclear power plant with a total capacity of 2 gigawatts, with the first unit in operation by 2021. The plan under development lays out a development timeline of 11 to 12 years from pre-project to commissioning. The plan presents a positive case for nuclear energy in Malaysia (*Exhibit 6-17*). Firstly, if Malaysia developed nuclear energy, it would be cost-competitive, supplying the cheapest source of energy. Secondly, nuclear power is a cleaner energy than coal and gas (0 grams of carbon dioxide equivalent per kilowatt hour vs approximately 800 and 400 grams respectively).

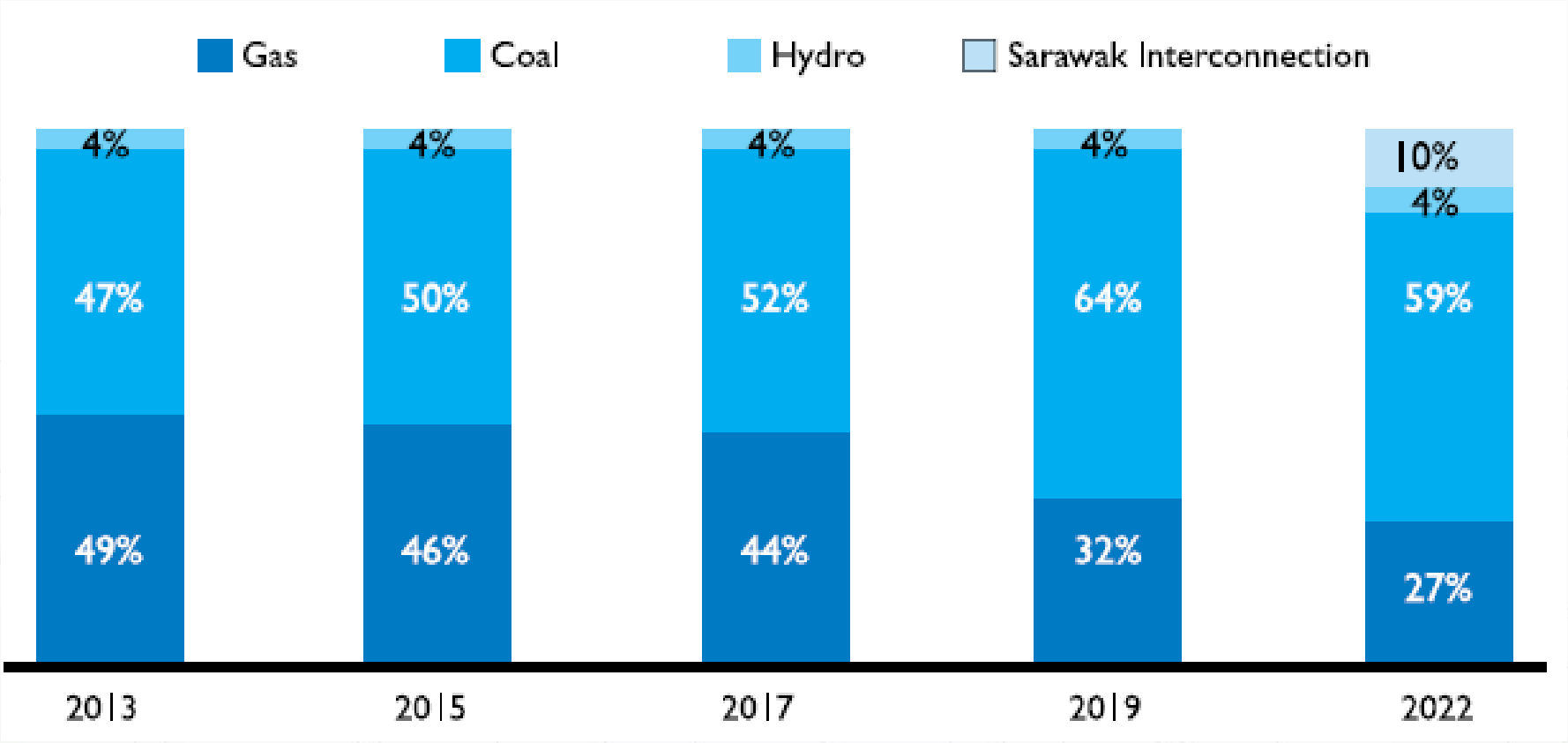
EVOLUTION OF GENERATION MIX BY FUEL TYPE



Mainly oil (pre-1980) → **Mainly gas (2000s)** → **Mainly coal (post -2015?)**

Source: adapted from Malaysia's Ministry of Energy, Green Technology & Water (KeTTHA) 2012

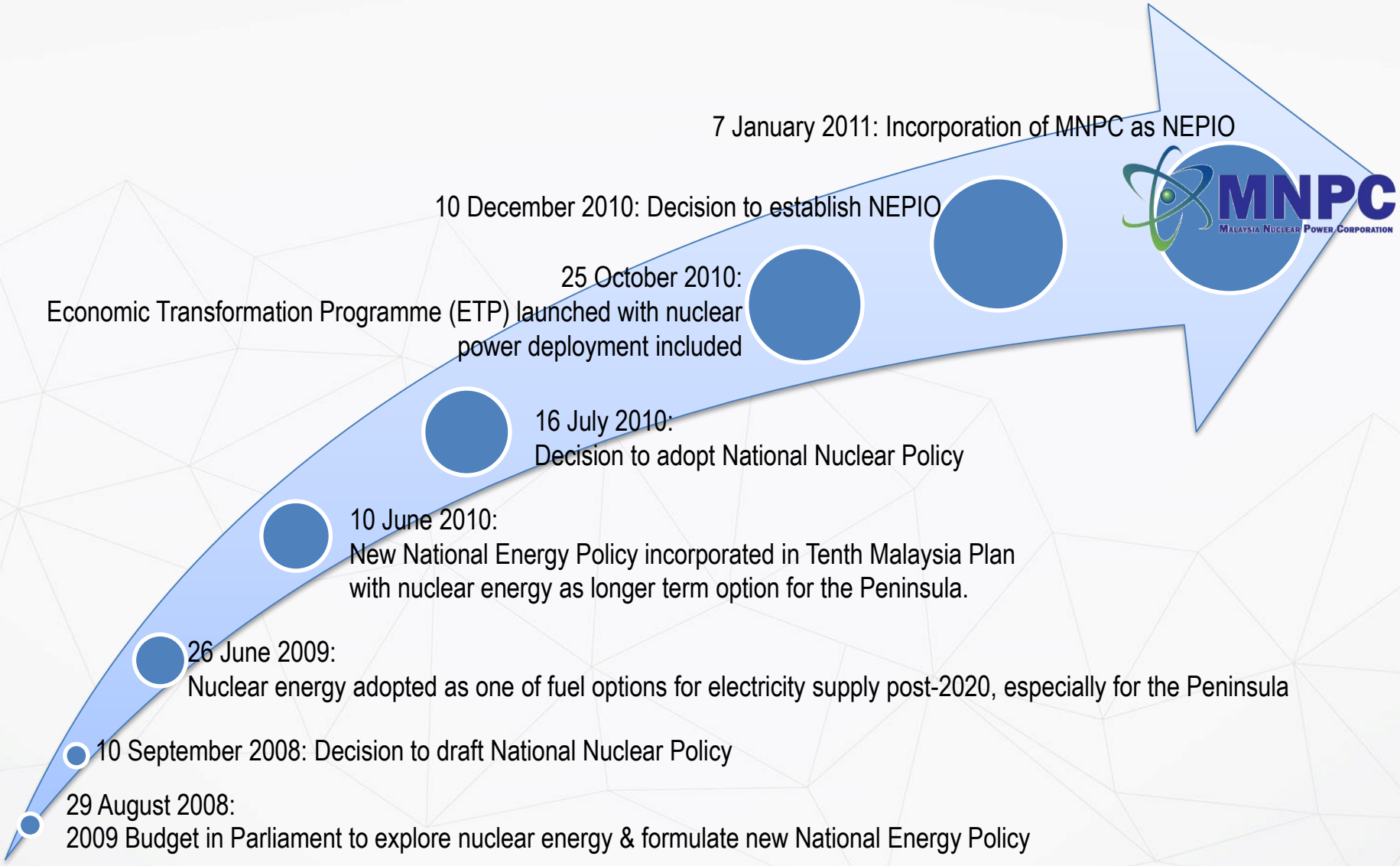
PENINSULAR MALAYSIA POWER GENERATION MIX 2013 - 2022



Peninsular Malaysia continues to be highly dependent on fossil fuels (coal & gas) for electricity generation

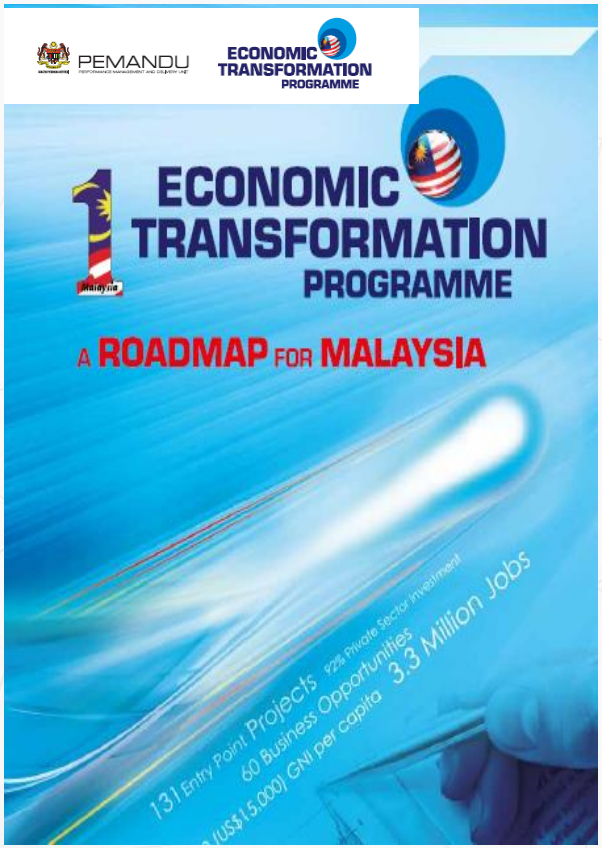
Source: Energy Commission, *Peninsular Malaysia Electricity Supply Industry Outlook 2013*

POLICY DECISIONS TOWARDS NUCLEAR POWER DEVELOPMENT

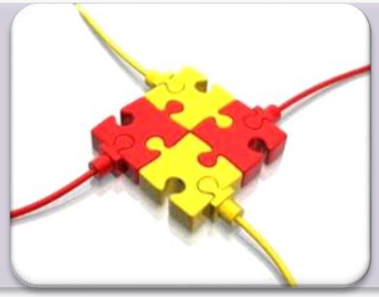


ECONOMIC TRANSFORMATION PROGRAMME (ETP)

A comprehensive effort to transform Malaysia into a high-income nation by 2020



EPP 11: Deploying Nuclear Energy for Power Generation



RATIONALE

Exploring option of deploying nuclear energy to meet future demand and to diversify energy mix for the Peninsular

ACTION

Study possibility of delivering a twin unit nuclear power plant with total capacity of 2000 MW post-2020

ENABLERS

4 critical path items/enablers must be addressed with highest priority to ensure prompt delivery.

ECONOMIC TRANSFORMATION PROGRAMME (ETP)

A comprehensive effort to transform Malaysia into a high-income nation by 2020

Four critical path items must be addressed with highest priority to ensure prompt delivery, which are:

1 Public Acceptance

Promote public acceptance

→ Relevant Government stakeholders already engaged. Public engagement NOT yet. Appointment of International Consultant in process

2 International Governance (IAEA)

Sign/ratify relevant treaty & conventions

3 Regulatory context

Put in place detailed regulations

→ Legal & regulatory study completed. New nuclear law must be enacted before signing international instruments.
Tabling of new nuclear law expected in 2014

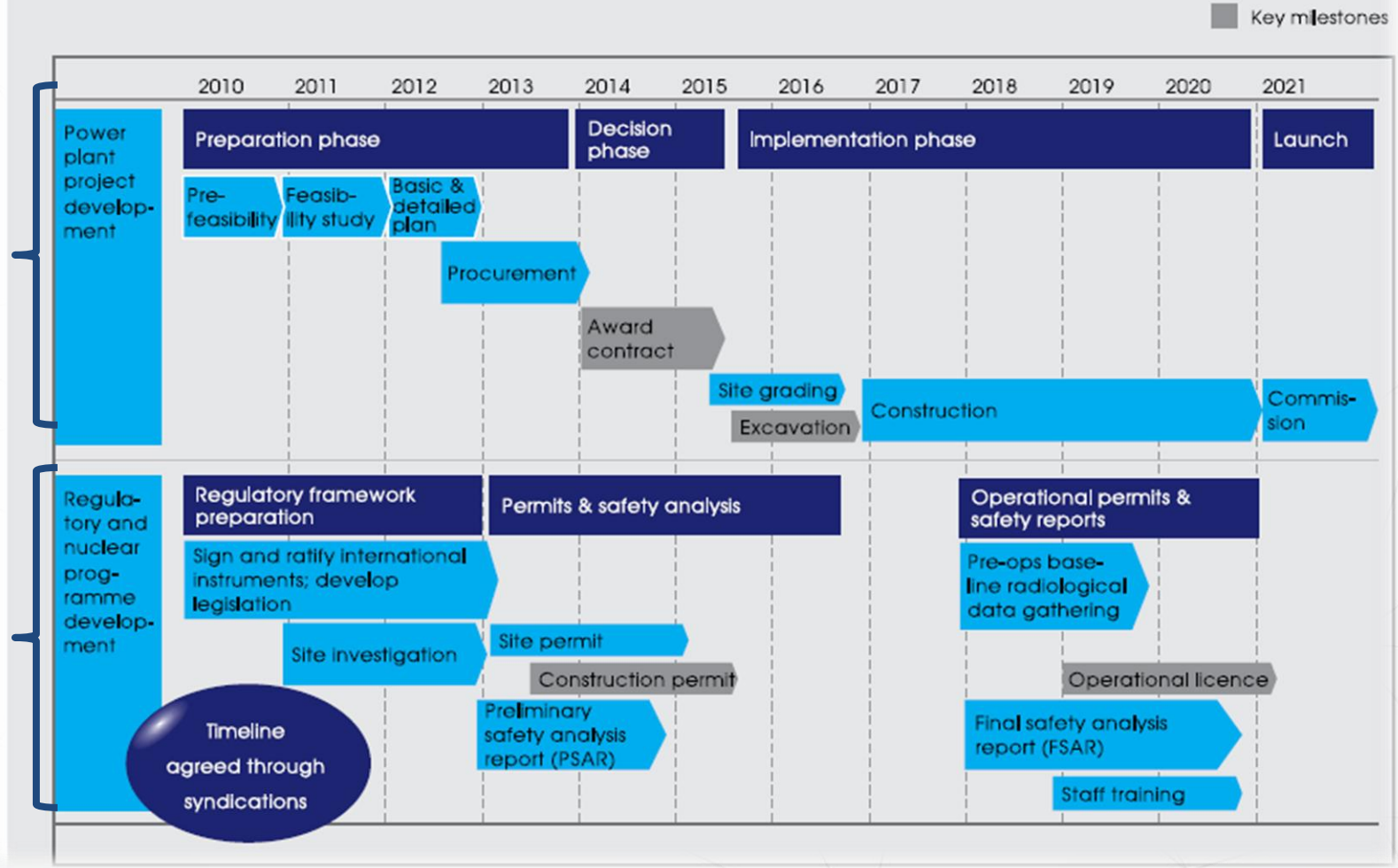
4 Nuclear Plant Site Acquisition

- Acquire approval for plant site
- Obtain community support

→ MNPC appointed international Consultant. Site Evaluation including site license application is deferred but NPIDP, Feasibility Study & Bid Document preparation on-going, and target to be completed by December 2014

NUCLEAR TIMELINE IN ETP REPORT (*no longer valid*)

To generate nuclear power by 2021, Government will provide resources to proceed with planned activities



ECONOMIC TRANSFORMATION PROGRAMME (ETP)

A comprehensive effort to transform Malaysia into a high-income nation by 2020

Launched by Y.A.B. Prime Minister of Malaysia, Datuk Seri Mohd Najib Tun Abdul Razak on 19 March 2013 at Angkasapuri, Kuala Lumpur.

EPP 11 Deploying Nuclear Energy for Power Generation

Malaysia has been exploring the option of deploying nuclear energy to meet future demand and diversifying the energy mix for Peninsular Malaysia. Since 2009, a Nuclear Power Development Steering Committee, driven by KeTTHA, has been conducting various studies towards preparing a Nuclear Power Infrastructure Development Plan (NPIDP). The committee also worked on nuclear pre-feasibility and initial site selection studies.

In 2011, the Government formed the Malaysia Nuclear Power Corporation (MNPC) to lead the feasibility study of this project taking into consideration safety and environment impacts.

When formed in Jan 2011, MNPC set out to follow the approach adopted by UAE/ENEC for nuclear power programme development. This is still the case today despite the G2G approach adopted in some newcomer countries

10

MNPC, A FULLY DEDICATED NEPIO

- A fully Government-owned company limited by guarantee, without share capital, and fully funded by the Government, established on 7 January 2011.
- Registered under Companies Act of Malaysia, and placed under jurisdiction of the Prime Minister's Department, as a new fully dedicated NEPIO
- Supersedes 2009 Nuclear Power Development Steering Committee
- Officially launched by the Prime Minister to spearhead nuclear power deployment under Economic Transformation Programme (ETP) on 11 January 2011

VISION

Nuclear power for a sustainable high-income economy

MISSION

Establishing a comprehensive groundwork for a successful, sustainable, safe, secure and peaceful national nuclear power programme within time, on budget and in a transparent manner

OBJECTIVES OF MALAYSIA NUCLEAR POWER CORPORATION (MNPC)

Based on the Memorandum of Association of MNPC under the Companies Act:

To plan, spearhead & coordinate the implementation of
nuclear energy development programme for Malaysia
and to take the necessary action to realise the development of
the first nuclear power plant in Malaysia;

To ensure the development of nuclear infrastructure for the country
is in line with International Atomic Energy Agency (IAEA) guidelines
covering 19 key areas of national position, nuclear safety, management, funding & financing, legislative framework, safeguards,
regulatory framework, radiation protection, electrical grid,
human resource development, stakeholder involvement,
site & supporting facilities, environmental protection, emergency planning, security & physical protection,
nuclear fuel cycle, radioactive waste,
industrial involvement, and procurement; and,

To identify the company or special purpose vehicle (SPV)
to be the owner and/or operator of nuclear power plant.

THE ROLES OF MNPC AS A NEPIO

1 Phase 1 (Pre-Project)

- NEPIO is responsible for most activities.
- Number of staff is relatively small and drawn from various government agencies.
- Much of the actual specialised work is performed by external experts/expert groups.
- Mixture of high-level policy work and detailed feasibility studies.

2 Phase 2 (Project Definition)

- Start of Phase 2 - NEPIO still drives the programme.
- Other key organisations, including Regulatory Body and Owner/ Operator should be fully established and taking an increasingly active role.
- The core project management team for the plant construction should be in place.
- Recruitment of those Operations staff with long training lead-times should begin.
- End of Phase 2 - NEPIO hands over many of its tasks to the relevant organisations.

3 Phase 3 (Construction)

- Start of Phase 3 - NEPIO will still have an oversight role.
- Owner/Operator will be responsible for management of plant construction and commissioning.
- Regulatory Body will be actively engaged in the plant licensing and overseeing construction, as appropriate.
- Owner/Operator will be actively recruiting and training permanent staff.

KEY CHALLENGES IN NUCLEAR POWER DELOYMENT

	Challenge	Potential resolution
Public Acceptance 	▪ Promote public acceptance	▪ Public opinion survey to identify priority segments & concerns ▪ Awareness projects ▪ Transparency in project implementation
International Governance	▪ Sign/ratify relevant treaties & conventions	▪ Fast-track process & make government priority
Regulatory context 	▪ Put in place detailed regulations	▪ Align on international best practices ▪ Top-down mandate to accelerate process ▪ Engage foreign experts to assess site & construction permit applications
Nuclear Plant Site Acquisition 	▪ Acquire approval for plant sites ▪ Obtain public support in locality	▪ Public information programme ▪ Option for localities to bid to host nuclear plants as in Japan & Republic of Korea
Construction Timeline 	▪ Require best-in-class timeline from vendors	▪ Negotiate with vendors based on timeline
Project Financing 	▪ Obtain low-cost financing	▪ Combine low-cost & market financing e.g. sovereign-guaranteed foreign export credits, foreign equity, commercial loans, including Islamic financing options.

NUCLEAR LEGAL & REGULATORY STUDY

NEW NUCLEAR LAW	• Drafted new comprehensive nuclear law on safety, security & safeguards including nuclear liability • Formation of a new effectively independent nuclear regulatory body proposed to be Malaysia Atomic Energy Regulatory Commission (MAERC); • Proposed repeal of the Atomic Energy Licensing Act (Act 304) of 1984.
NUCLEAR POWER REGULATORY INFRASTRUCTURE DEVELOPMENT PLAN (NPRIDP)	• Formulation of a Nuclear Power Regulatory Infrastructure Development Plan (NPRIDP) with a comprehensive, clear short and medium term actions, benchmarked against IAEAs 19 Infrastructure Issues, for comprehensive nuclear regulatory development.
LEGISLATION GAP ANALYSIS	• Assessment of laws & subsidiary laws in Malaysia that may be impacted by the proposed new comprehensive nuclear law.
INTERNATIONAL LEGAL INSTRUMENTS	• Identification of international instruments for Malaysia to be a party to. for international confidence-building in nuclear power development.
SUBSIDIARY REGULATIONS & GUIDELINES	• Drafted subsidiary regulations & subsidiary guidelines for the new law.

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT PLAN (NPIDP), FEASIBILITY STUDY (FS), SITE EVALUATION (SE) & BID DOCUMENTS (BD)

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT PLAN (NPIDP)	• Formulation of a Nuclear Power Infrastructure Development Plan (NPIDP) based on a comprehensive assessment of national state-of-preparedness on IAEA 19 Infrastructure Issues; • Formulation of Public Communications Kick-Start Strategy & 10-Year Road-Map on Nuclear Energy.
FEASIBILITY STUDY	• Detailed technical, financial & economic analysis of the viability of nuclear power as part of national energy mix vis-à-vis other sources; • Identification and/or establishment of a Special Purpose Vehicle (SPV) nuclear power plant owner/operator & its manpower requirements; • Assessment of sources & methods of nuclear power project financing; • Recommendations on possible nuclear reactor technologies, plant size, manpower requirements & other main technical features.
SITE EVALUATION	• Shortlisting & detailed evaluation of nuclear power plant candidate sites in accordance with regulatory requirements & guidelines under new law, with Detailed Environmental, Radiological & Social Impact Assessments (DEIA, RIA & SIA).
BID DOCUMENTS	• Recommendations for bidding & contractual approach to nuclear power project implementation; • Preparation of bid documents & bid evaluation methodologies to invite potential vendors for nuclear power project implementation.

OTHER AREAS OF WORK

STAKEHOLDER ENGAGEMENT & PUBLIC COMMUNICATIONS	• Formulation and implementation of a communications strategy and action plan for nuclear power, incorporating a comprehensive public opinion survey. • Continuous engagement with national and international stakeholders at all levels.
OWNER/OPERATOR SPECIAL PURPOSE VEHICLE STUDY	• Facilitating identification and/or establishment of a Special Purpose Vehicle (SPV) that will own and/or operate the possible nuclear power plant, including manpower requirements . • Assessing sources and methods of financing for a possible nuclear power plant project.
NUCLEAR POWER HUMAN RESOURCE CAPACITY DEVELOPMENT	• Supporting competency development of domestic human resources required for a successful and sustainable nuclear power industry, both at a company level and also at a national scale in collaboration with academic institutions and other relevant agencies.

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT PLAN (NPIDP)

MNPC
Malaysia Nuclear Power Corporation

To objectively determine and assess the current level of national capabilities and state-of-preparedness which are pertinent to the development of a national nuclear power programme.

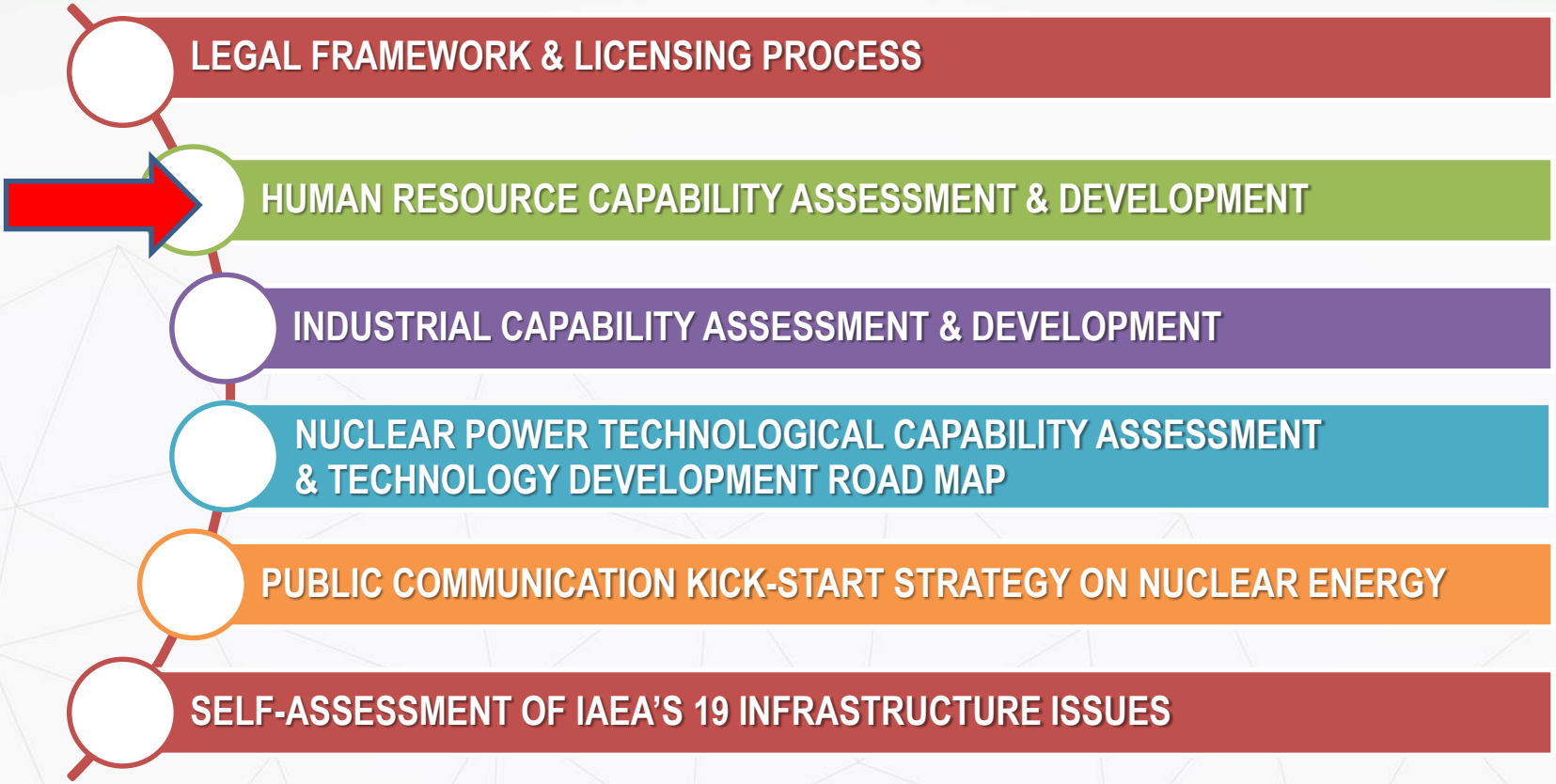
To compare and benchmark the current level of national capabilities and state-of preparedness, as determined and assessed above, with the level that should be attained for an effective development of such a nuclear power programme, based on best international practices.

To identify the gaps that may exist between the current and expected levels of national capabilities and state-of-preparedness as identified above and to recommend appropriate strategies and plans of action required to close the gaps, based on best practices, including recommending appropriate timelines for such plans of actions.

To recommend Malaysia's industrial infrastructure requirements, and to survey as well as analyze national participation possibilities for localization during construction and operation of the nuclear power plants.

To coordinate and perform national self assessment of the conditions to achieve the milestones of 19 Key Nuclear Infrastructure areas as recommended by IAEA (Nuclear Energy Series No. NG-G-3.1 Milestones in the Development of a National Infrastructure for Nuclear Power).

NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT PLAN (NPIDP)



- A nuclear power human capital development plan is integrated in NPIDP being formulated by MNPC.
- This human capital development plan will provide a basis and strategy for building the national education and training capability, designed to produce sufficient nuclear power engineers, technicians and allied personnel for the development and management of the nuclear power programme and, ultimately, for the operation of the nuclear power plants and other related R&D activities.
- The current status for the nuclear HRD planning for the NPIDP is the distribution of questionnaires for information gathering on nuclear-related education in local institutions of higher learning, as well as of individual Malaysians pursing nuclear-related education in foreign institutions.

NUCLEAR SCIENCE & TECHNOLOGY EDUCATION

- Almost all public universities and some private universities offer science, technology & engineering programmes
- Universiti Kebangsaan Malaysia (UKM) set up Nuclear Science Department in 1978, where specific nuclear science degrees at both undergraduate & graduate levels are offered
- Universiti Teknologi Malaysia (UTM) started offering its Bachelor in Nuclear Engineering in 2012 and is scheduled to have its first batch of graduates in 2016. From 2016 onwards, UTM is expected to produce on average 32 graduates a year.
- Universiti Tenaga Nasional (UNITEN) currently offers nuclear engineering elective courses to all engineering students in 2009 and planning to offer nuclear engineering minor in 2014.
- International Islamic University of Malaysia (UIAM) also plans to offer a Bachelor in Nuclear Engineering and Radiation, expected to start in late 2014.
- Universiti Tun Hussein Onn (UTHM) plans to offer Master of Nuclear Engineering in collaboration with Malaysian Nuclear Agency (Nuclear Malaysia) as sister campus where the 1 MWt TRIGA research reactor is located.
- HELP University College will only provide American Degree Transfer Program, where the basic program for Year 1 & Year 2 will be provided in Malaysia, before students pursuing their studies in nuclear engineering and other areas in the United States.

MAIN CHALLENGES THAT NEED TO BE ADDRESSED

i. Develop and implement a comprehensive education programme in all nuclear specialised areas to ensure continuous availability of adequate competent human capital to sustain all aspects of the national capability and competency, including scientific, technical and non-technical competency for the implementation of nuclear safety, security and safeguards;

ii. Develop and implement a continuous education programme in nuclear fields to promote life-long learning amongst all levels of human capital involved in all aspects and regulatory supervision of nuclear energy, including professional training and exchange programmes at national and international institutions, towards sustaining a high level of proper attitude, skills and knowledge;

iii. Develop and implement a comprehensive national scheme to verify and sustain high level of competence and certification of personnel;

iv. Develop and implement appropriate schemes to attract and retain an adequate complement of competent human capital, with clear career prospects and succession plans;

v. Integrate R&D at universities, national laboratories and industry to revitalise nuclear education;

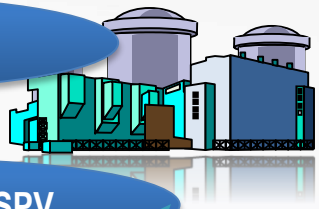
vi. Facilitate transfer of knowledge from aging nuclear workforce to the next generation of workers; and,

vii. Promote R&D to capitalise on transfer of know-how.

RECOMMENDED NUCLEAR ENGINEERING HIGHER EDUCATION ROAD-MAP

	MILESTONE 1: June 2009 Ready to make a knowledgeable commitment to a nuclear power programme.	MILESTONE 2: 2015 Ready to invite bids for the first nuclear power plant	MILESTONE 3: 2021 Ready to commission and operate the first nuclear power plant	
PHASE 1: **2008 to June 2009** **Considerations before a decision to launch a nuclear power programme is taken**	**PHASE 2:** **June 2009 to 2015** **Preparatory work for construction of a nuclear power plant after a policy decision has been taken**	**PHASE 3:** **2015 to 2021** **Activities to implement a first nuclear power plant**	**POST-2021:** **Maintenance and continuous infrastructure improvement**	
NUCLEAR ENGINEERING HIGHER EDUCATION DEVELOPMENT ROAD-MAP				
Commencement of nuclear energy-related subjects under other engineering courses at local universities.	**Commencement of nuclear engineering first degree courses in local universities.**	**Local graduates in nuclear engineering enter the job market during implementation of first nuclear power project.**	**Sustained output of local nuclear engineering graduates commensurate with demand.**	
	Conduct of short-term courses on nuclear engineering for engineering professionals from other engineering disciplines in preparation for nuclear power project management & implementation.	**Commencement of nuclear engineering post-graduate courses in local universities for sustainable long-term nuclear power-related research & development.**	**Sustained nuclear power-related local research & development for long-term requirements.**	
	Development of teaching staff in nuclear engineering through international cooperation.	**Development of teaching staff in nuclear engineering from among local graduates.**	**Sustained output of teaching staff in nuclear engineering from among local graduates.**	

CAPACITY-BUILDING & SUPPORTING NETWORK



NEPIO (MNPC)

NPP Owner SPV

NPP Operator SPV

planning & implementation coordination

technical support

supply

NPP Vendor Turnkey Contractor

TSO's (NM & others)

Vendor Country Nuclear Utility

regulate

National Regulators (AELB, ST, DOSH, DOE, MHLG)

Vendor Country TSO

technology transfer & technical assistance

Vendor Country Regulators

Malaysian Industries

Vendor Country Industries

Malaysian Educational & Training Institutions

Vendor Country Educational &Training Institutions

SHORT-TERM TRAINING AND LONG-TERM POST-GRADUATE ACADEMIC DEGREE PROGRAMMES IN THE NUCLEAR POWER-RELATED FIELDS

1. IAEA inter-regional, regional & national training courses under the framework of IAEA or managed by AEA, viz, IAEA Technical Assistance and Cooperation Programme (TACP), Regional Cooperative Agreement for Research, Development & Training relating to Nuclear Science & Technology in Asia and the Pacific (RCA), Asian Nuclear Safety Network (ANSN), Asian Network for Nuclear Education and Training (ANENT), and, IAEA Extra-budgetary Programmes (EBP);
2. Training programmes under the framework of Association of South-East Asian Nations (ASEAN), including ASEAN Committee on Science and Technology (ASEAN-COST) Technical Working Group on Nuclear Power Plants (TWG-NPP) & ASEAN Ministers of Energy Meeting (AMEM) KEPCO ASEAN+3 Civilian Nuclear Energy Senior Policy-Maker Course;
3. Training programmes under the Forum on Nuclear Cooperation in Asia (FNCA);
4. Training programmes under existing Memoranda of Understanding in the nuclear power-related fields between KeTTHA with its counterpart Ministries in Japan & Republic of Korea;
5. Training and knowledge sharing programmes in nuclear power-related fields under existing Memoranda of Understanding between TNB & EdF, KEPCO & TEPCO;

SHORT-TERM TRAINING AND LONG-TERM POST-GRADUATE ACADEMIC DEGREE PROGRAMMES IN THE NUCLEAR POWER-RELATED FIELDS (*Cont'd*)

6. Post-graduate academic programmes in nuclear power-related fields at universities abroad e.g. Texas A&M University and University of Michigan in USA, Cambridge University and Imperial College of Science & Technology in UK, sponsored by various agencies of Government of Malaysia;
7. Post-graduate academic programmes in nuclear power-related fields at selected universities in Japan under Hitachi Scholarship;
8. Post-graduate academic programmes in nuclear power-related fields under KEPCO sponsorship at KEPCO International Nuclear Graduate School (K-INGS) and under RCA sponsorship at Korea Advanced Institute of Science & Technology (KAIST); and,
9. Courses organised by foreign organisations at selected universities in Malaysia, include:
   i. Annual International Summer School on Nuclear Power Science & Engineering organised by KAIST at UKM;
   ii. Winter School on Nuclear Science & Technology organised by Universite Bordeaux 1 of France at UKM; and,
   iii. A series of nuclear power-related & nuclear engineering related short courses organised by Tokyo Institute of Technology (Tokyo-Tech) & Hitachi at UKM & UNITEN.

OVERALL PRE-PROJECT ACTIVITIES BY MNPC, 2011 - 2014

- Legal & Regulatory Study
  - Started mid-2011, Completed in Dec 2013
  - New Atomic Energy Bill, Guidelines & Regulations
  - Nuclear Power Regulatory Infrastructure Development Plan (NPRIDP)
  - Legislation Gap Analysis
  - International Legal Instruments
- Project Development Study
  - Started Jan 2012, expected completion Dec 2014 (extended from 31 Oct 2013)
  - Nuclear Power Infrastructure Development Plan (NPIDP)
  - Feasibility Study
  - Bid Documents
  - Site Evaluation (deferred)
- Public Communications on Nuclear Energy
  - Starting in 2014
  - Engagement of consultant in progress
- Human Capacity Development
  - Close collaboration with IAEA & Local Universities
  - Continuous process for all stakeholders

Underlying Challenges

- Key project activites started around the same time as the Fukushima accident
- Compunded by issues resulting from Lynas rare-earth plant
- Caused downturn in public sentiment for nuclear-related matters, and therefore NOT conducive for public engagement activities which could inhibit policy decision making
- Caused delays to MNPC's approved activity timelines, including major delay for site evaluation work scope

Firm government decision on nuclear power will only be made AFTER completion of studies and comprehensive public opinion survey

WAY FORWARD

NEW NUCLEAR LAW	• Obtaining Government approval for enactment of the new nuclear law in 2014 and subsequent establishment of the proposed Nuclear Regulatory Authority in the Prime Minister's Department
NPRIDP	• Obtaining Government approval of the NPRIDP & adequate budgetary allocation for its implementation from 2015. • Recommendation for additional new 85 job positions to be created to support the development of a competent multi-disciplinary team to regulate nuclear power programme
INTERNATIONAL INSTRUMENTS	• Ratification or accession to relevant nuclear-related international instruments in 2015 & 2016 after new law is enacted.
NPIDP	• Obtaining Government approval for the NPIDP & budget allocation for its implementation from 2015 or later.
STAKEHOLDER ENGAGEMENT	• Engagement of international nuclear communications consultants with local partners for the formulation & implementation of comprehensive communications plan for nuclear energy in 2014.
OWNER-OPERATOR SPV	• Identification or establishment of the nuclear power plant owner/operator SPV in 2015 or later
SITE APPROVAL	• Obtaining regulatory & other stakeholder approval of preferred nuclear power plant site.
BID INVITATION	• Obtaining Government decision for bid invitation.
SELF-ASSESSMENT OF IAEA 19 INFRASTRUCTURE ISSUES	• Preparation of reports on national self-assessment of the conditions to achieve the milestones of 19 Key Infrastructure Issues, as recommended by the IAEA. Self Assessment Form submission to IAEA targeted in early 2015

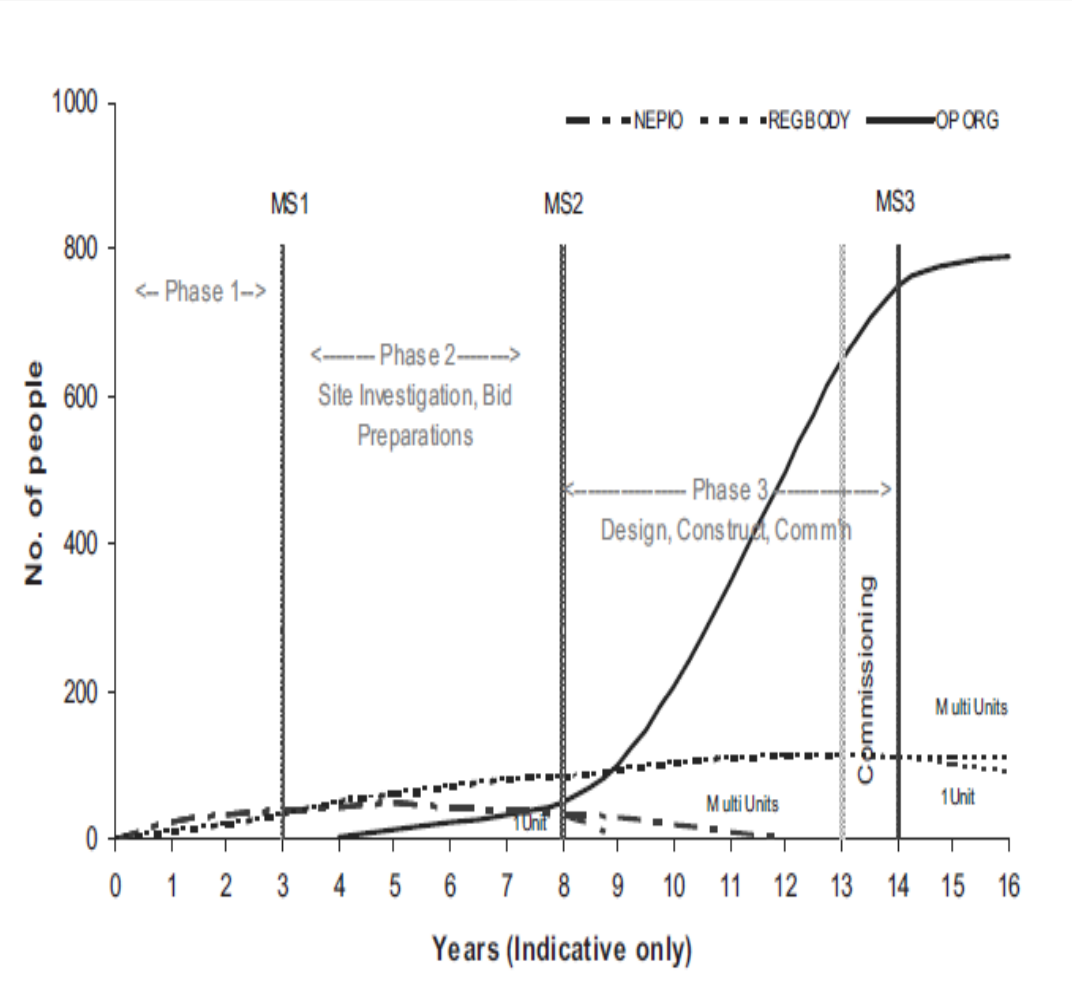


Figure 1: Typical phasing of resource requirements

Today, MNPC has a total strength of 20 staff, some of whom are drawn from nuclear related government agencies but much of the actual specialist work are being performed by international consultants in partnership with local experts. Based on IAEA recommendations for a NEPIO, MNPC is expected to cease to exist just before first plant commence operation. The officials and staff including stakeholders involved with nuclear power planning and programme implementation, could also serve as a local pool of experts and personnel to staff relevant future organisations needed for nuclear power programme development, e.g. proposed new nuclear regulatory commission, NPP owner/operator SPV & TSO.

Source: IAEA Nuclear Energy Series No. NG-T-3.10 on Workforce Planning for New Nuclear Power Programmes (2011).

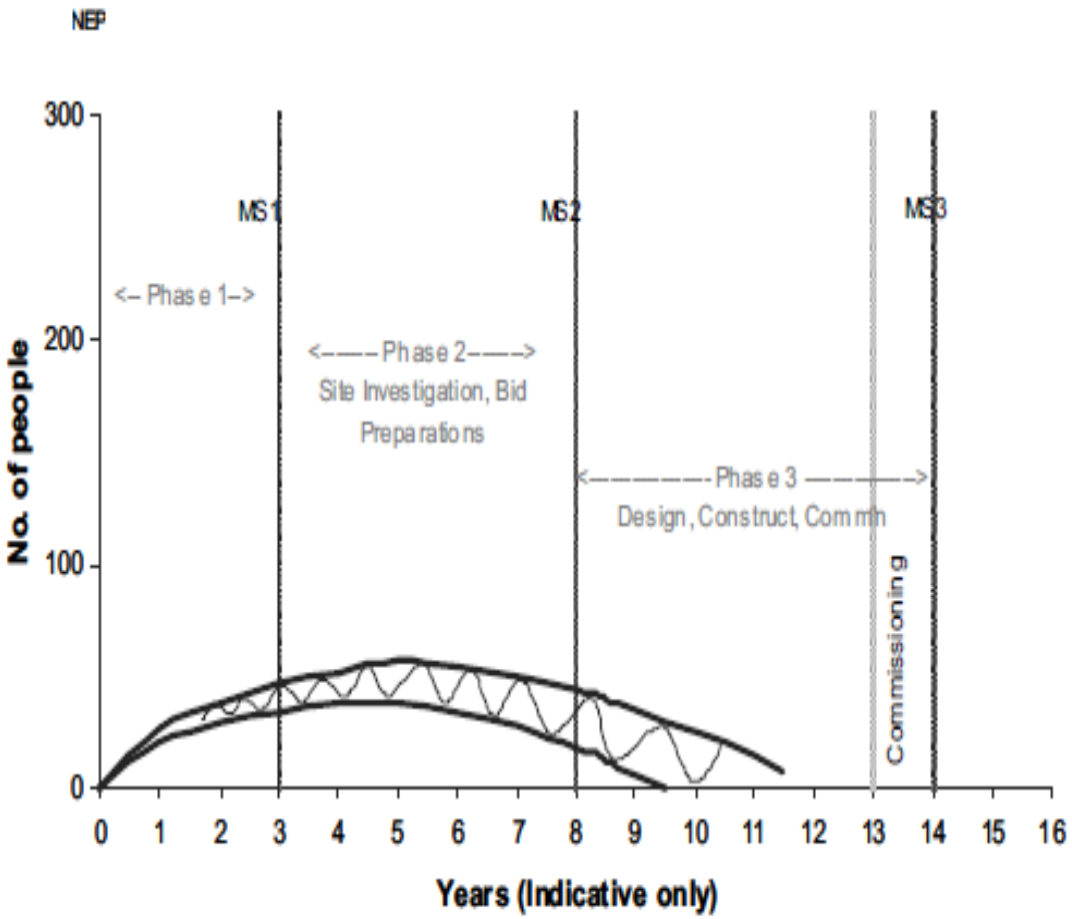


Figure 2: Example of phasing of manpower requirements for a NEPIO

Number of staff directly involved in Phase 1 is relatively small, maybe around 20–30 people, and may require the additional support of expert groups, either nationally or internationally.

The staffing of NEPIO will peak during Phase 2, typically in range **20–50 staff members**, depending of the level of specialist support available. By end of Phase 2, many of their responsibilities should have been transferred to the other responsible organizations, especially RB & OO. Depending on size of nuclear energy programme, NEPIO may cease to exist as such (or its role may shift to one of purely coordination), with some of its **oversight responsibilities (and resources) being transferred to the appropriate regulatory agencies and others being placed within those government departments** which would normally be responsible for such activities.

By the beginning of Phase 3, majority of NEPIO staff is likely to have either transferred to one of the other responsible organizations or returned to one of the government departments with ongoing responsibility for nuclear energy programme.

Source: IAEA Nuclear Energy Series No. NG-T-3.10 on Workforce Planning for New Nuclear Power Programmes (2011).

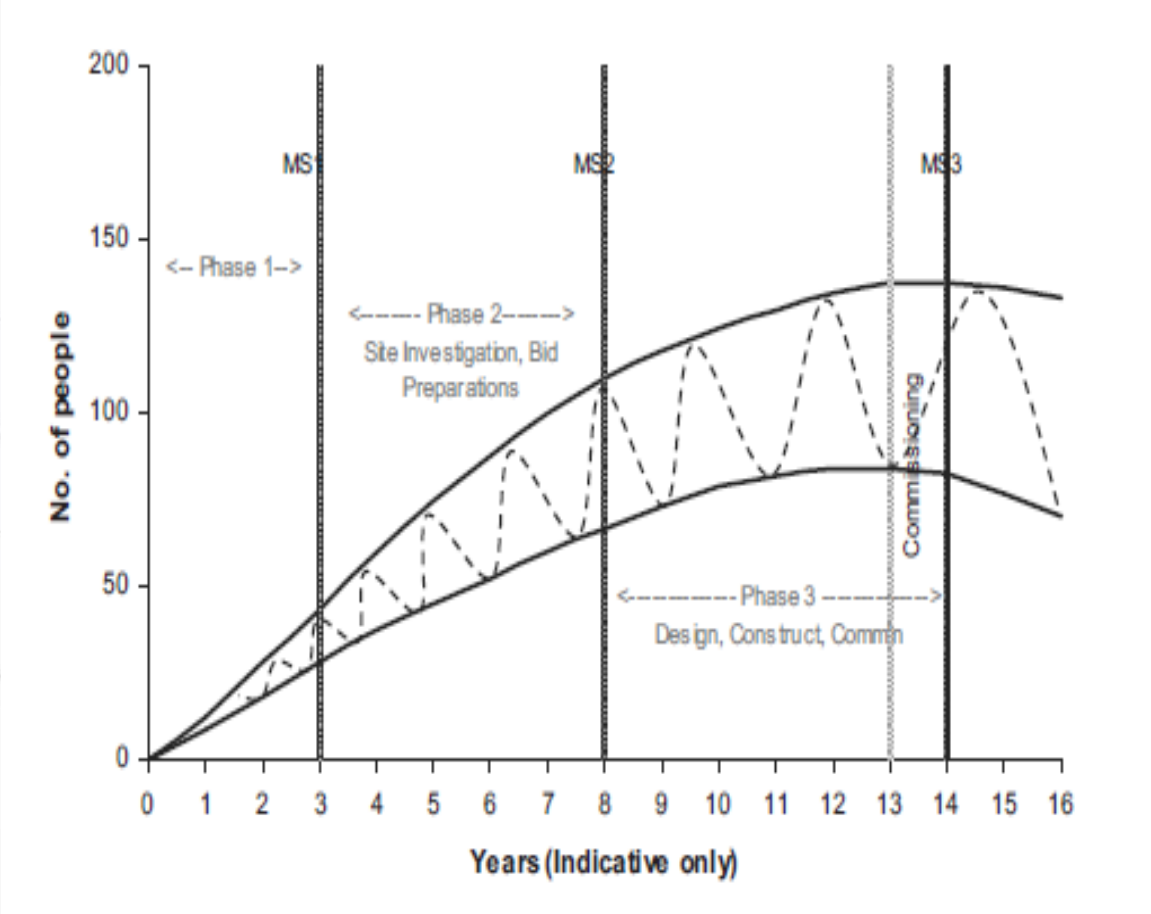


Figure 3: Phasing of manpower requirements for a regulatory body

A regulatory body may have a core staff of about 40–60 people with competencies to develop or adopt safety regulations, develop & implement an authorization process, review & assess the safety and design documentation provided by the operating organization against the adopted regulations, and inspect the facility, the vendor and manufacturers of safety related components.

Peak numbers within the regulatory body may be higher, **up to 100–150 personnel**, and will be depending on the level of specialist independent support available & on number of NPPs planned.

Source: IAEA Nuclear Energy Series No. NG-T-3.10 on Workforce Planning for New Nuclear Power Programmes (2011).

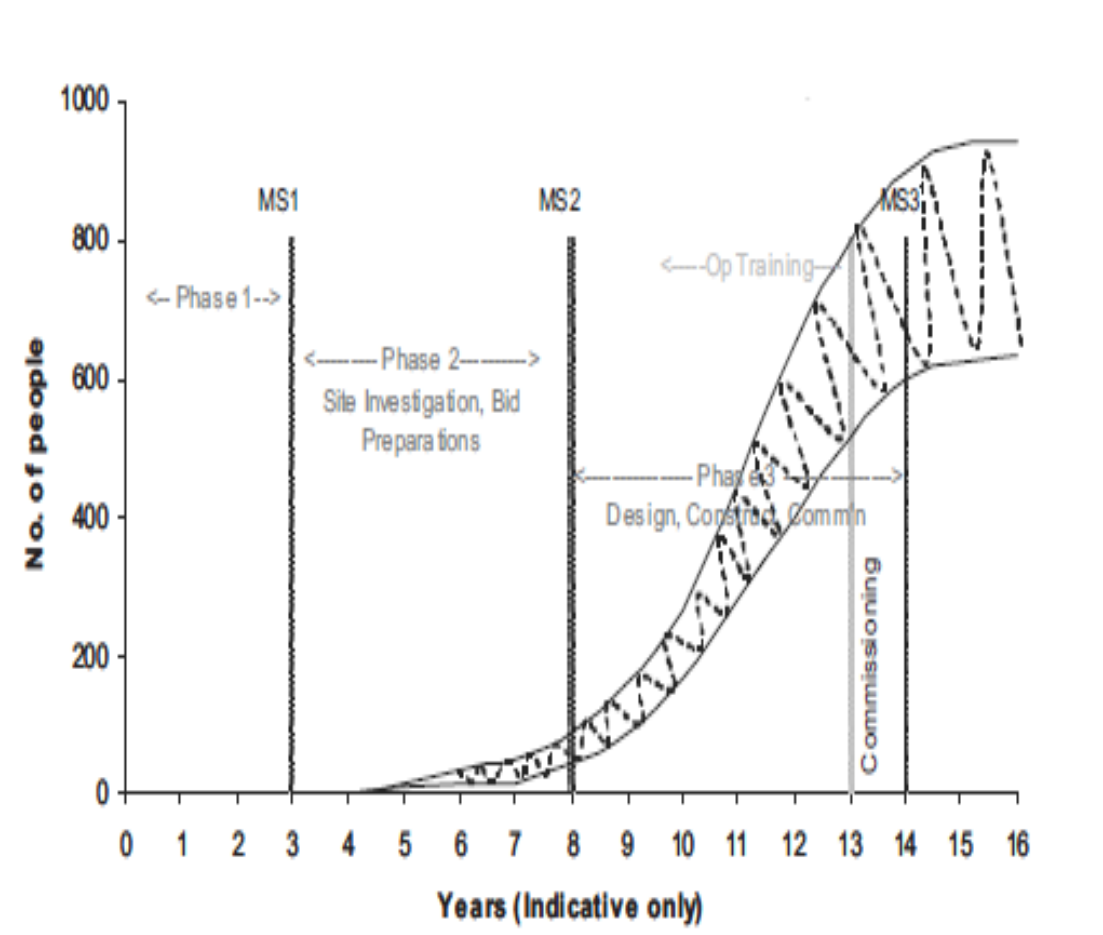


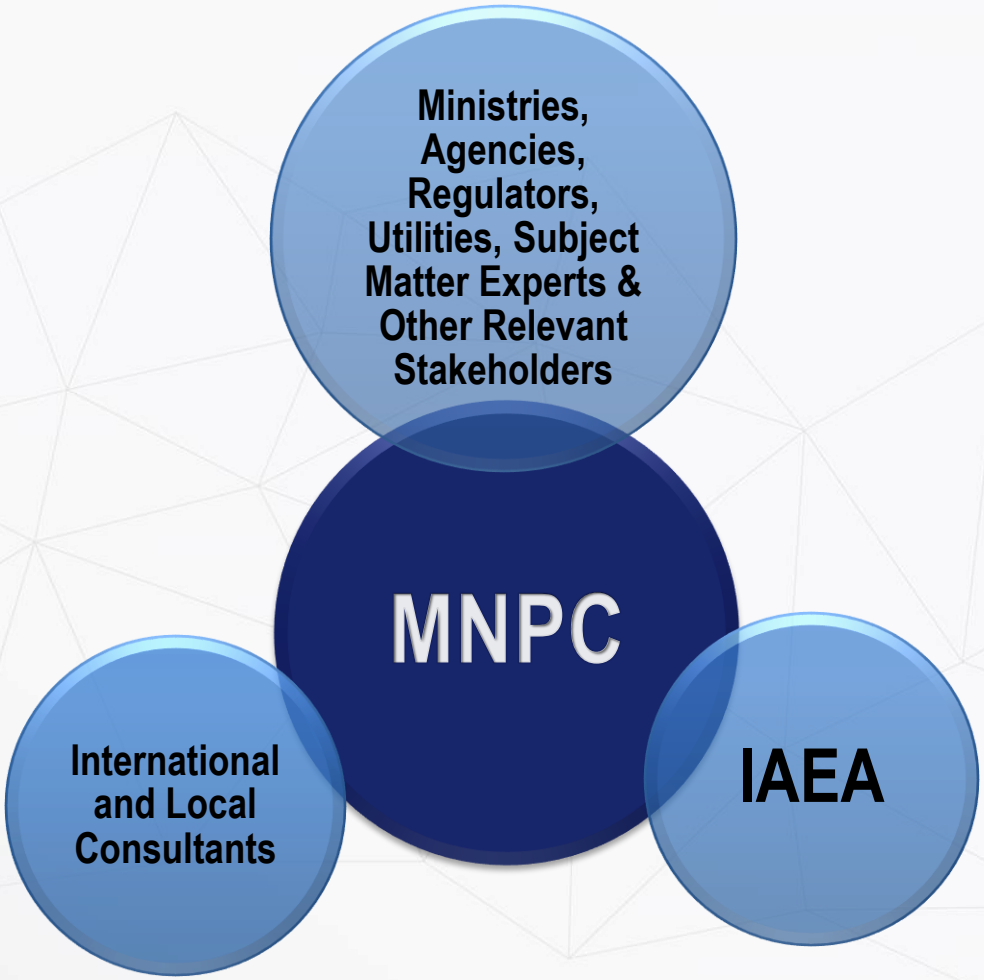
Figure 4: Build-up of plant staff prior to commissioning

The number of staff required is much larger than for the other organizations, typically in the range of 500–1000 for a single or twin unit plant, up to several thousand for a multiple unit plant.

Based on North America and western Europe, giving totals of approximately 700 for a single unit plant and **1000 for a twin unit**.

Source: IAEA Nuclear Energy Series No. NG-T-3.10 on Workforce Planning for New Nuclear Power Programmes (2011).

CONCLUDING REMARKS



The establishment of MNPC as a fully dedicated NEPIO facilitates a focused drive towards implementation of a nuclear energy development program for Malaysia.

Now, 3 years after its establishment, MNPC will continue to spearhead and coordinate collaborative national efforts towards enabling a well-informed Government decision on the option of using nuclear power post-2020.

Nuclear Power Infrastructure Development Plan (NPIDP) is being prepared by Consultant engaged by MNPC and expected to be completed in Dec 2014

Professionals including stakeholders involved with nuclear power planning and programme implementation, could also serve as a pool of experts & personnel to staff relevant future organisations needed for NPP development

Thank You

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