NUCLEAR INFRASTRUCTURE AND INSTITUTIONAL ARRANGEMENTS FOR THE DEVELOPMENT AND DEPLOYMENT OF SUSTAINABLE NUCLEAR ENERGY SYSTEMS – EXPERIENCE OF MNPC, AS A DEDICATED NEPIO
IAEA MILESTONE, MNPC as NEPIO and EPP 11 IN ECONOMIC TRANSFORMATION PROGRAM (ETP) REPORT

STATUS & PROGRESS
OF NUCLEAR POWER PRE-PROJECT ACTIVITIES

WAY FORWARD & CONCLUDING REMARKS
NUCLEAR INFRASTRUCTURE DEVELOPMENT PROGRAM

10 – 15 year timeframe for Nuclear Infrastructure development program, Phase 1 – 3

Source: IAEA NG-G-3.1, 2007
REVISED TARGET MILESTONES FOR NUCLEAR POWER DEVELOPMENT IN MALAYSIA

**MILESTONE 1: JUNE 2009**

Ready to make a knowledgeable commitment to a nuclear power programme
Cabinet decision for nuclear energy to be a fuel option post-2020.

**MILESTONE 2: 2017**

(Rescheduled from 2013)

Ready to invite bids for the first nuclear power plant based on the timeline for EPP11 under OGE sector in the ETP.

**MILESTONE 3: 2025 or 2026**

(Rescheduled from 2021)

Ready to commission and operate the first nuclear power plant based on the timeline for EPP11 under OGE sector in the ETP.
When established in January 2011, MNPC set out to emulate the UAE experience and targeted the shorter (10-year) timeframe for phase 1 – 3 nuclear infrastructure development program, as per IAEA Milestone approach.

UAE worked with Consultants and experts and gathered information on vendors. In 2008 or 09, ENEC decided to shortlist and invited three (3) vendors to submit formal bids and in Dec 2009 ENEC signed a contract with KEPCO Consortium to build the 1st NPP project in UAE - 4 x 1400 MWe and 1st Unit to be commissioned in May 2017 - 7.5 years after contract signing.

Mindful of the Fukushima accident in March 2011, MNPC targets a longer timeframe (~ 15 years) as we need to be convinced of nuclear electricity COMPETITIVENESS, nuclear SAFETY, legacy issues and PUBLIC SUPPORT.

Unlike some newcomer countries which adopted the Government to Government (G2G) approach for their 1st NPP project, Malaysia is still pursuing the traditional EPC bidding approach. MNPC has signed 3-party non-disclosure agreements (NDA) with several vendors and this enabled MNPC-appointed Consultant to gather and assess relevant information. The intention is to shortlist a few vendors to be invited for the bidding process, if a national decision is taken to proceed with the 1st NPP project in Peninsular Malaysia.
**MNPC, A FULLY DEDICATED NEPIO**

- Established on 7 January 2011 (*just over 2 months before Fukushima*)
- Registered under Companies Act of Malaysia, and placed under jurisdiction of the Prime Minister’s Department, as a 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
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.

Developing nuclear infrastructure for 1st NPP project regardless of the plant capacity is very challenging and requires the same amount of national efforts.
THE ROLES OF MNPC AS A NEPIO

**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.

**Phase 2 (Project Definition)**
- Start of Phase 2 - NEPIO still drives the programme.
- Other key organisations, including the Regulatory Body and the 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.

**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.
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.
ECONOMIC TRANSFORMATION PROGRAMME

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

To ensure Malaysia keeps its options open in the event that nuclear power becomes essential to support the country’s economic growth, the Government is putting in place a framework to ensure it is done safely and efficiently. Malaysia is following the roadmap as established by the International Atomic Energy Agency (IAEA) to ensure that the regulatory, technical, safety and environmental foundation is available should any future decision on nuclear power be made.

The Malaysia Nuclear Power Corporation (MNPC) was established in 2011 as the Nuclear Energy Programme Implementation Organisation (NEPIO) based on the IAEA guidelines. The MNPC will focus on critical enablers as identified in the ETP, including public acceptance of the project and the readiness of the correct regulatory framework in Malaysia.
STATUS & PROGRESS
OF NUCLEAR PRE-PROJECT ACTIVITIES
ECONOMIC TRANSFORMATION PROGRAMME
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 will begin in 2015 after appointment of International Consultant in June 2014

2. International Governance
   - Legal & regulatory study completed in December 2013.
   - Tabling of new nuclear Bill is now expected in 2015
   - New nuclear law must be enacted before signing International instruments.

3. Regulatory context
   - Put in place detailed regulations
   - MNPC appointed international Consultant to prepare Nuclear Power Infrastructure Development Plan (NPIDP), Feasibility Study and Bid Document reports - expected completion in 2015. However, Site Evaluation work package including site license application is deferred.

4. Nuclear Plant Site Acquisition
   - • Acquire approval for plant site
     • Obtain community support
     - Today, the above 4 critical enablers are NOT yet resolved
OVERALL PRE-PROJECT ACTIVITIES BY MNPC, 2011 - 2014

• **Legal & Regulatory Study**
  – Started mid-2011, Completed in Dec 2013
  – New Atomic Energy Bill, Guidelines & Regulations, some already reviewed by IAEA
  – Nuclear Power Regulatory Infrastructure Development Plan (NPRIDP)
  – Legislation Gap Analysis
  – International Legal Instruments

• **Project Development Study**
  – Started Jan 2012, expected completion early 2015 (extended from 31 Oct 2013)
  – Nuclear Power Infrastructure Development Plan (NPIDP)
  – Feasibility Study
  – Bid Documents
  – Site Evaluation (deferred)

• **Public Communications on Nuclear Energy**
  – Started in June 2014
  – International Consultant Appointed

• **Human Capacity Development**
  – Close collaboration with IAEA & Local Universities
  – Continuous process for all stakeholders

**Underlying Challenges**
• Key project activities started around the same time as the Fukushima accident
• Compounded 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
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);

NPRIDP
- Formulation of 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.
<table>
<thead>
<tr>
<th><strong>NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT PLAN (NPIDP), FEASIBILITY STUDY (FS), SITE EVALUATION (SE) &amp; BID DOCUMENTS (BD)</strong></th>
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<tr>
<td><strong>NPIDP</strong></td>
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| **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) - **DEFERRED** |
| **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. |
COMPREHENSIVE COMMUNICATIONS PLAN & STRATEGIES ON NUCLEAR ENERGY

- New Comprehensive Nuclear Law to be tabled in Parliament
  - New law & regulations to comply
  - Will lead to intense public debate

- In Situ Detailed Site Investigations & Evaluation
  - Detailed site parameters pending
  - Pending prior approval of local authorities & communities

- Completion of Feasibility Studies
  - Pending completion of Feasibility Studies
  - Approval of Site by Local Stakeholders

- Policy Decision to proceed with Nuclear Power Plant Project
  - Needs national public support

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**NEED**

- Public Opinion Research Results by Q1 2015
- Social Media Platform for public feedback on concerns
- Stakeholder Mapping with Segmental Concerns
- Communications Plan & Strategies to address public concerns by stakeholder segment

**WHY NOT DONE EARLIER?**

- Fukushima accident
# Other Areas of Work

## Stakeholder Engagement & Public Communications
- Implementation of a communications strategy and action plan for nuclear power
- 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 nuclear power plant, including manpower requirements.
- Assessing sources and methods of financing for a nuclear power plant project.

## Nuclear Power Human Resource Capacity Development
- Supporting skills and competency development of domestic human resources required for a successful and sustainable nuclear power industry, both at company level and also at national scale in collaboration with education, training & research institutions and other relevant agencies.
One component of Feasibility Study is Technology Assessment which necessitates the involvement of technology OWNERS i.e. known reactor vendors
NON-DISCLOSURE AGREEMENTS (NDA) WITH VENDORS FOR TECHNOLOGY ASSESSMENT IN THE FEASIBILITY STUDY

Tripartite NDAs concluded between MNPC, the consultant to MNPC and each of the following nine (9) nuclear power plant vendors:

- AREVA
- ATMEA
- CANDU Energy
- Hitachi GE Nuclear Energy (HGNE)
- Korea Electric Power Corporation (KEPCO)
- ROSATOM
- Toshiba
- Westinghouse
- China National Nuclear Corporation (CNNC)

REQUEST FOR INFORMATION (RFI) SENT TO VENDORS and all vendors gave required cooperation
**REACTOR TECHNOLOGY ASSESSMENT**

- **Nuclear Technologies** – All candidate reactor technologies are deemed suitable for Malaysia’s goals in terms of Nuclear Safety, Security & Safeguards.

- **Technical Assessment** - A framework and methodology was developed taking into account IAEA guidelines, to assess reactor technologies. PWR, BWR & PHWR reactor types considered and altogether eight (8) designs were reviewed to suit Malaysia’s target deployment schedule

*(Assessment excludes advanced Generation IV or SMR technologies)*
Assessment takes into account the following elements:

1) Economics and Financing
2) Infrastructure and Implementation
3) Nuclear Safety
4) Proliferation Resistance and Physical Protection
5) Environment, Resources, Spent Fuel and Waste Management
6) Technical Considerations

(Preliminary results will be reviewed and subject to further scrutiny)
SOME POINTS TO PONDER

- The vendor selected has a lasting influence on the success of the project
  - From planning through decommissioning (approximately 80 - 100 years)

- All candidate technologies are acceptable with regards to nuclear safety
  - Can be deployed within Malaysia’s proposed schedule

- Some aspects of candidate technology are not known
  - Too soon in the project development timeline
  - Re-evaluation may be necessary as project matures

MNPC has established contacts with most technology OWNERS-cum-reactor vendors, if future re-evaluation is needed,
3.

WAY FORWARD
& CONCLUDING REMARKS
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<td><strong>NEW NUCLEAR LAW</strong></td>
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<tr>
<td>• Obtaining Government approval for enactment of the new nuclear law in 2015 and subsequent establishment of the proposed Nuclear Regulatory Authority in the Prime Minister’s Department</td>
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<td><strong>NPRIDP</strong></td>
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<td>• Obtaining Government approval of the NPRIDP &amp; adequate budgetary allocation for its implementation in 2015.</td>
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<td><strong>INTERNATIONAL INSTRUMENTS</strong></td>
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<td>• Ratification or accession to relevant nuclear-related international instruments in 2015 &amp; 2016 after new law is enacted.</td>
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<td><strong>NPIDP</strong></td>
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<tr>
<td>• Obtaining Government approval of the NPIDP &amp; budgetary allocation for its implementation in 2015 or later.</td>
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<td><strong>STAKEHOLDER ENGAGEMENT</strong></td>
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<tr>
<td>• Formulation &amp; implementation of comprehensive communications plan for nuclear energy in 2015</td>
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<td><strong>OWNER-OPERATOR SPV</strong></td>
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<td>• Identification or establishment of the nuclear power plant owner/operator SPV in 2015</td>
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<td><strong>SITE APPROVAL</strong></td>
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<tr>
<td>• Obtaining approval to acquire or gazette sites for nuclear power plant project in 2015 or later</td>
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<td><strong>BID INVITATION</strong></td>
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<td>• Obtaining Government decision for bid invitation in 2016.</td>
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<td><strong>SELF-ASSESSMENT OF IAEA 19 INFRASTRUCTURE ISSUES</strong></td>
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<tr>
<td>• Preparation of reports on national self-assessment of the conditions to achieve milestones of the 19 Key Infrastructure Issues, as recommended by the IAEA. Self Assessment Form submission to IAEA targeted in 2015 or later</td>
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CONCLUDING REMARKS

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

Now, almost 4 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.

Developing nuclear infrastructure for 1st NPP project, regardless of plant capacity is very challenging and requires the same amount of national efforts.

Nuclear Power Infrastructure Development Plan (NPIPD) is being prepared by the Consultant engaged by MNPC and expected to be completed end-Dec 2014.

Based on NDAs, MNPC has established contacts with most technology OWNERS.
Thank You

Mohd Zamzam Jaafar
Malaysia Nuclear Power Corporation
zamzamj@mnpc.org.my