

Webinar #1

Developing a Roadmap for New Nuclear Power Programmes

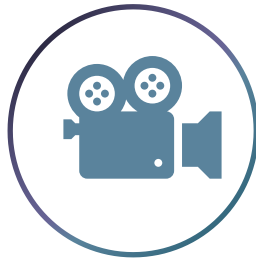
Webinar Series on IAEA Services to Support Infrastructure Development for a New Nuclear Power Programme



MAY 2023

Developing a Roadmap for New Nuclear Power Programmes

Housekeeping



The webinar is recorded



Materials and recording will be posted on the webinar web-page



Q&A button for all questions



MAY 2023

Developing a Roadmap for New Nuclear Power Programmes

Objectives

- ✓ to present to Member States a structured approach to develop a roadmap for new nuclear power programmes
- ✓ to provide practical experiences and recent lessons learned from Member States



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Developing a Roadmap for New Nuclear Power Programmes

Our speakers today



Liliya Dulinets
SH-NIDS, IAEA



Mehmet Ceyhan
NIDS, IAEA



Boldsaikhan Purevsuren
Mongolia, NEC



Erick Ohaga
Kenya, NuPEA



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Developing a Roadmap for New Nuclear Power Programmes

Opening by Liliya Dulinets

- Section Head, Nuclear Infrastructure Development Section, Division of Nuclear Energy, Department of Nuclear Energy, IAEA
- Former Deputy Director, Nuclear Energy Department, Ministry of Energy of the Republic of Belarus
- Graduated from the Belarusian Technical University





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Developing a Roadmap for New Nuclear Power Programmes

Mr. Mehmet Ceyhan

- Nuclear Engineer (Infrastructure)
Nuclear Infrastructure Development Section (IAEA)
- More than 30 years of experience at the national and international levels in Nuclear safety, technologies and infrastructure
- Team Leader and Coordinator for a number of IAEA Integrated Nuclear Infrastructure Review missions





IAEA

International Atomic Energy Agency
Atoms for Peace and Development

An Overview: Developing a Roadmap for a Nuclear Power Programme

Mehmet Ceyhan

Nuclear Infrastructure Development Section

Webinar on Developing a Roadmap for New Nuclear Power Programmes,
24 May 2023

Outline



- Introduction
- Roadmap for nuclear power programme
- IAEA's competency framework for nuclear power infrastructure

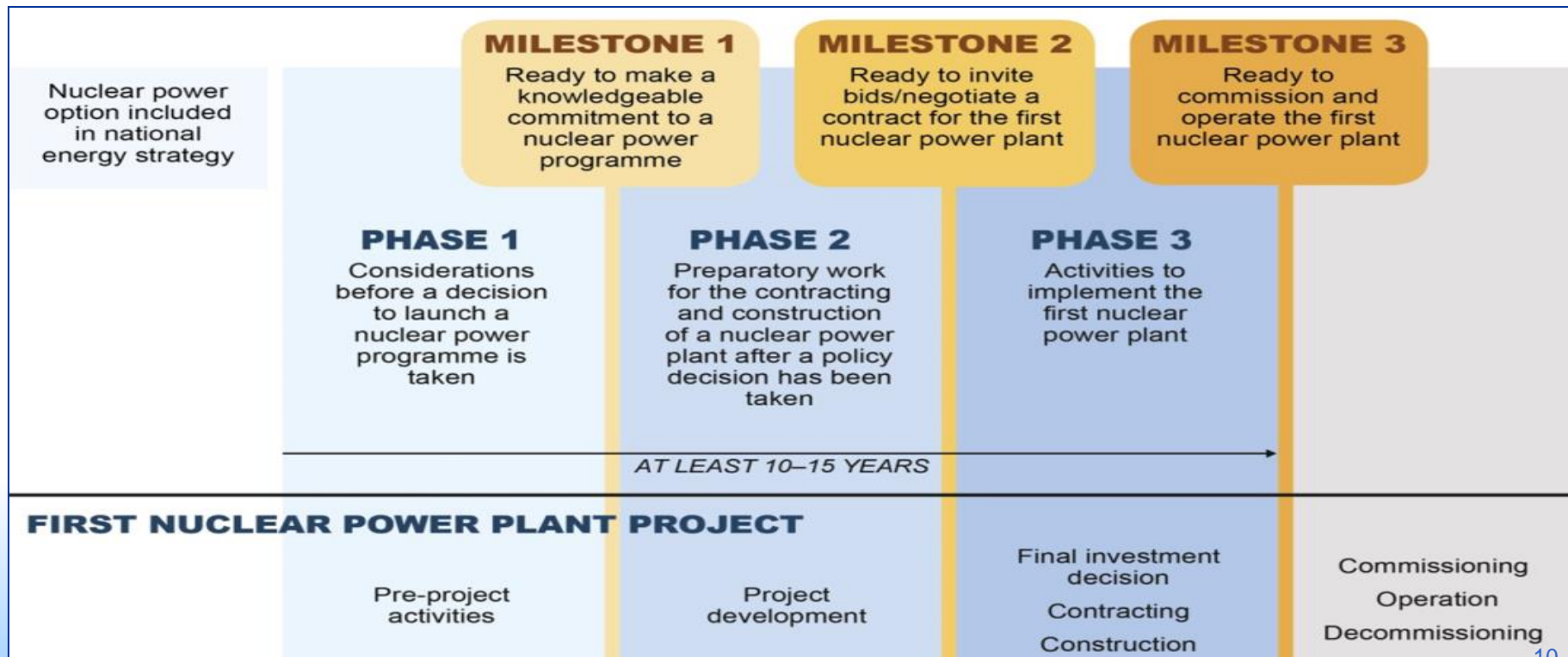
Introduction

- Nuclear power programme covers nuclear power plant projects and related infrastructure
- Significant number of infrastructure elements needs to be developed inline with the timeline of the NPP project implementation
- There are numerous activities which needs to be implemented by different organization to develop infrastructure required by a nuclear power programme
- Failing to timely develop certain infrastructure elements may cause delays in
- Developing a comprehensive roadmap helps avoiding those delays

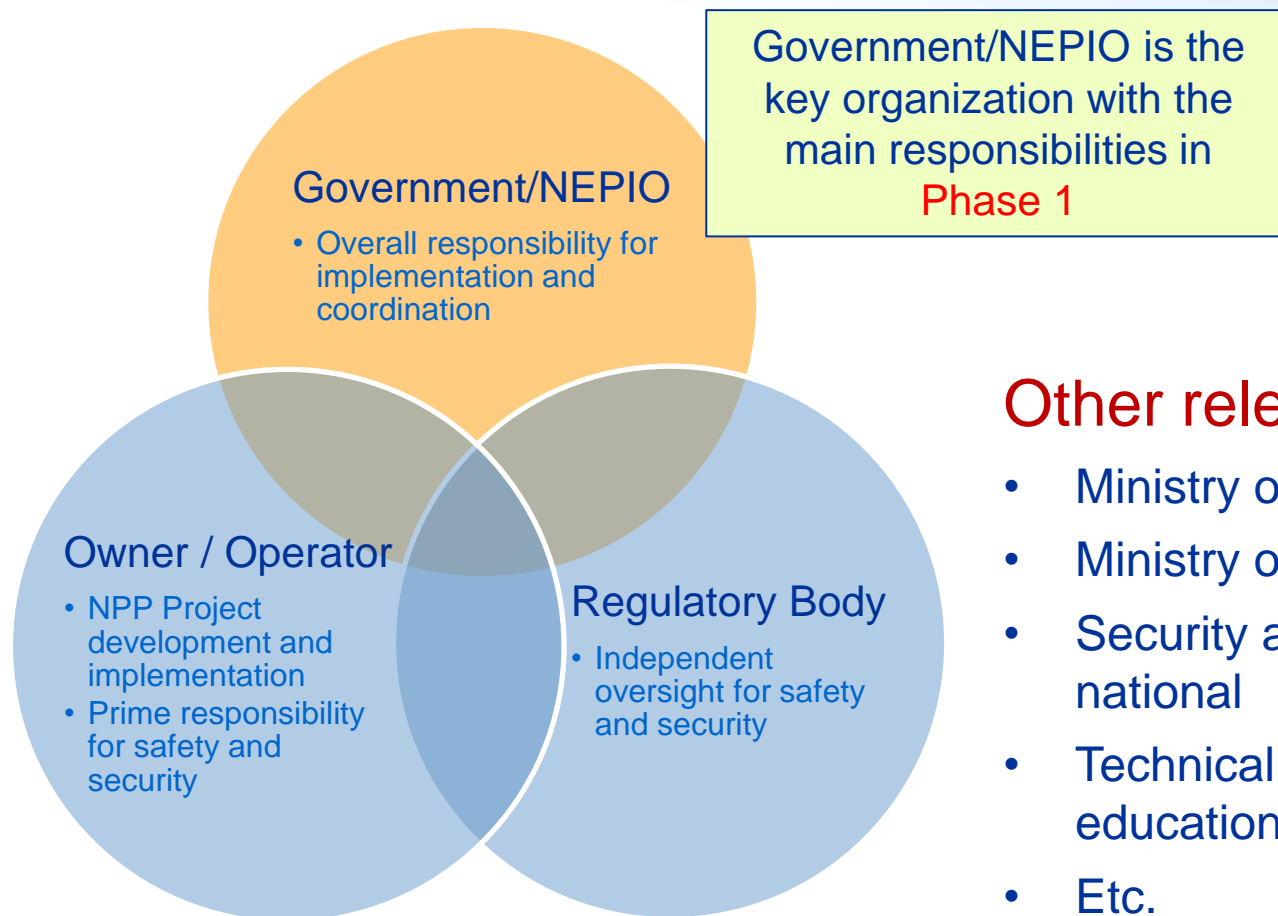
Roadmap for Nuclear Power Programme

Schedule and timeline of main activities for

- implementation of the first nuclear power project,
- the development of the national infrastructure for nuclear power



Key Organizations



Other relevant organizations

- Ministry of Energy
- Ministry of Environment
- Security authorities, local and national
- Technical and educational/academical institutions
- Etc.

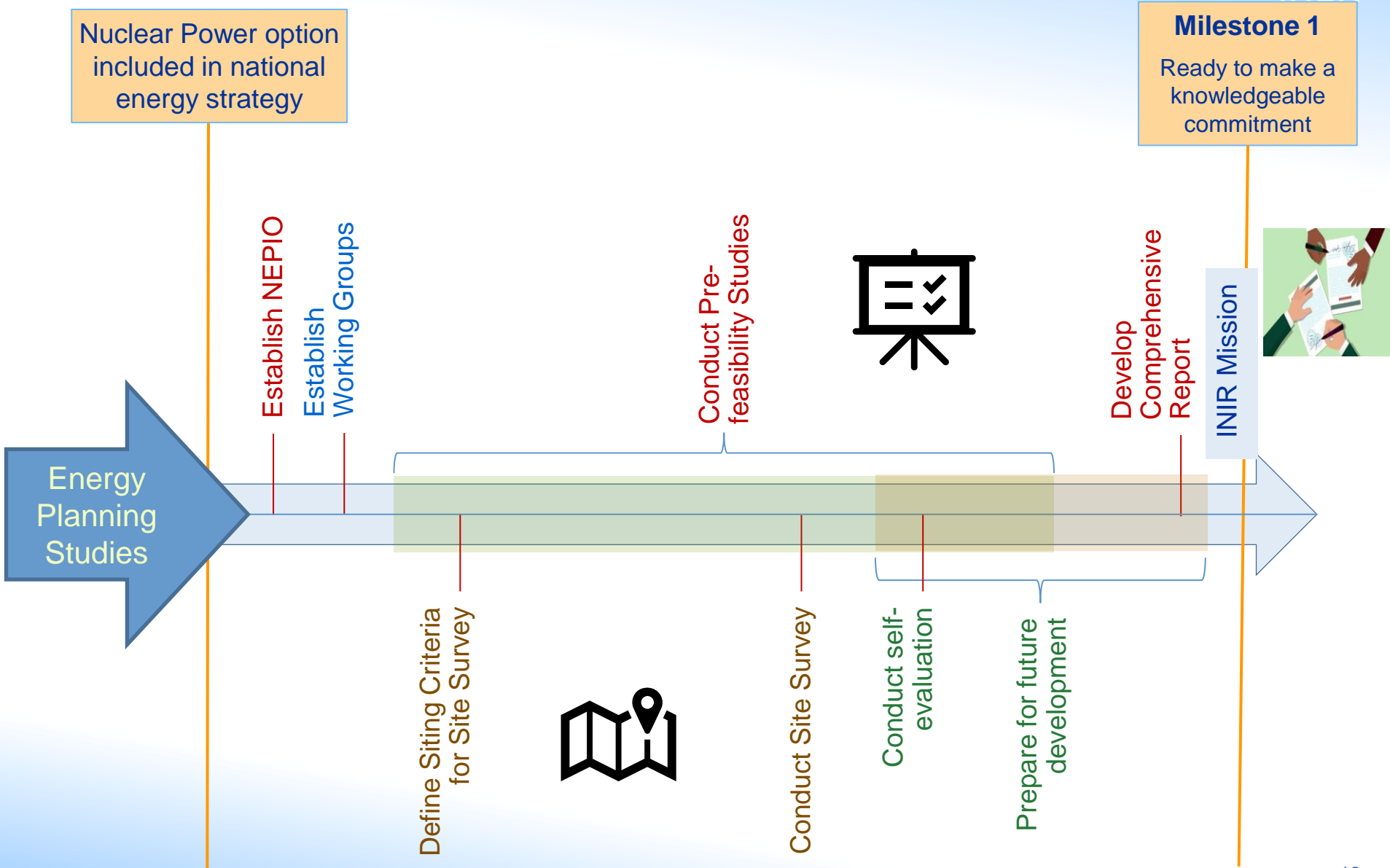
All organizations

- to implement necessary activities in the current Phase
 - to make preparations for the next Phases
- of the nuclear power programme

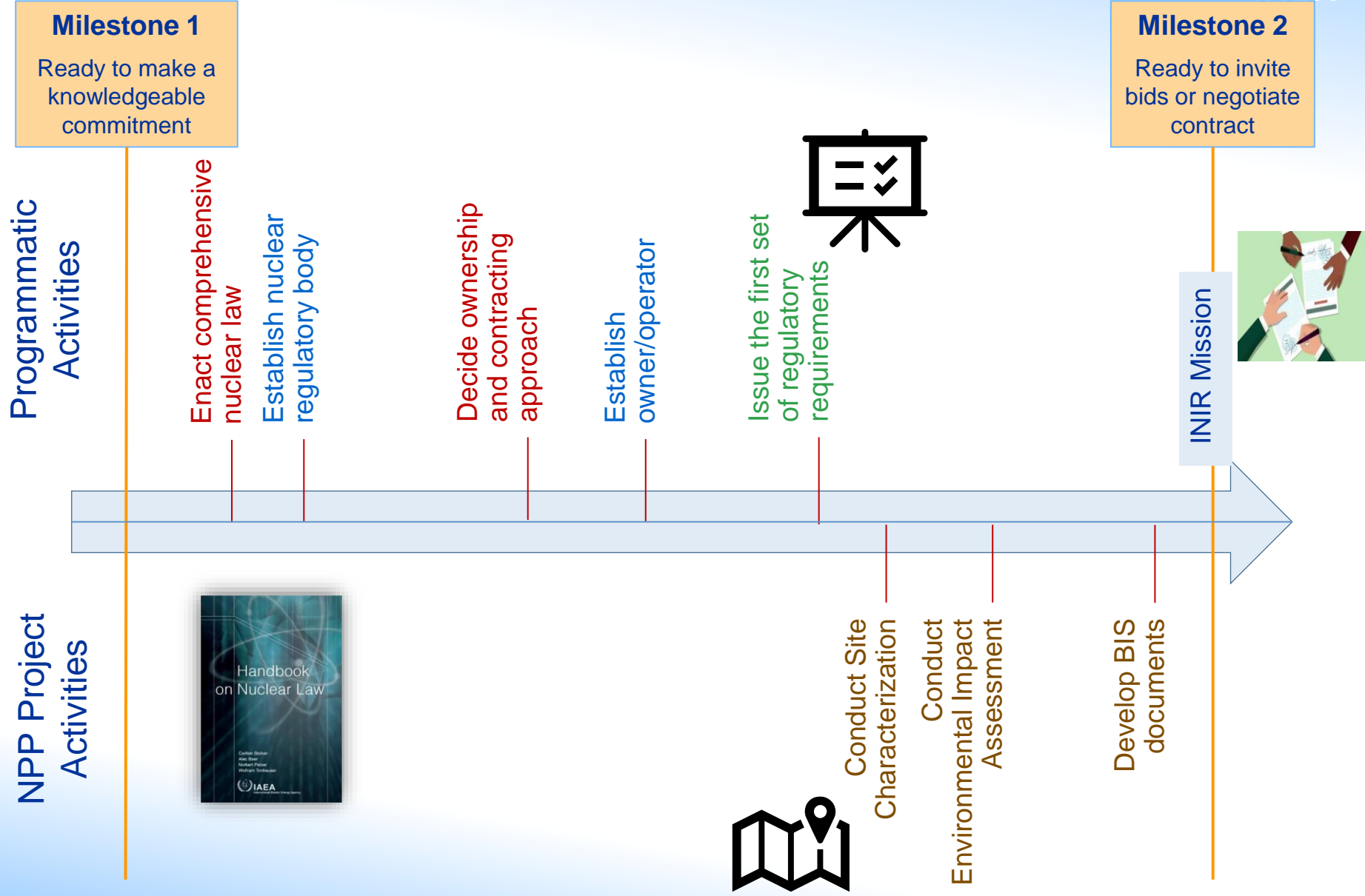
Key activities in Phase 1: Consider

Nuclear Power option included in national energy strategy

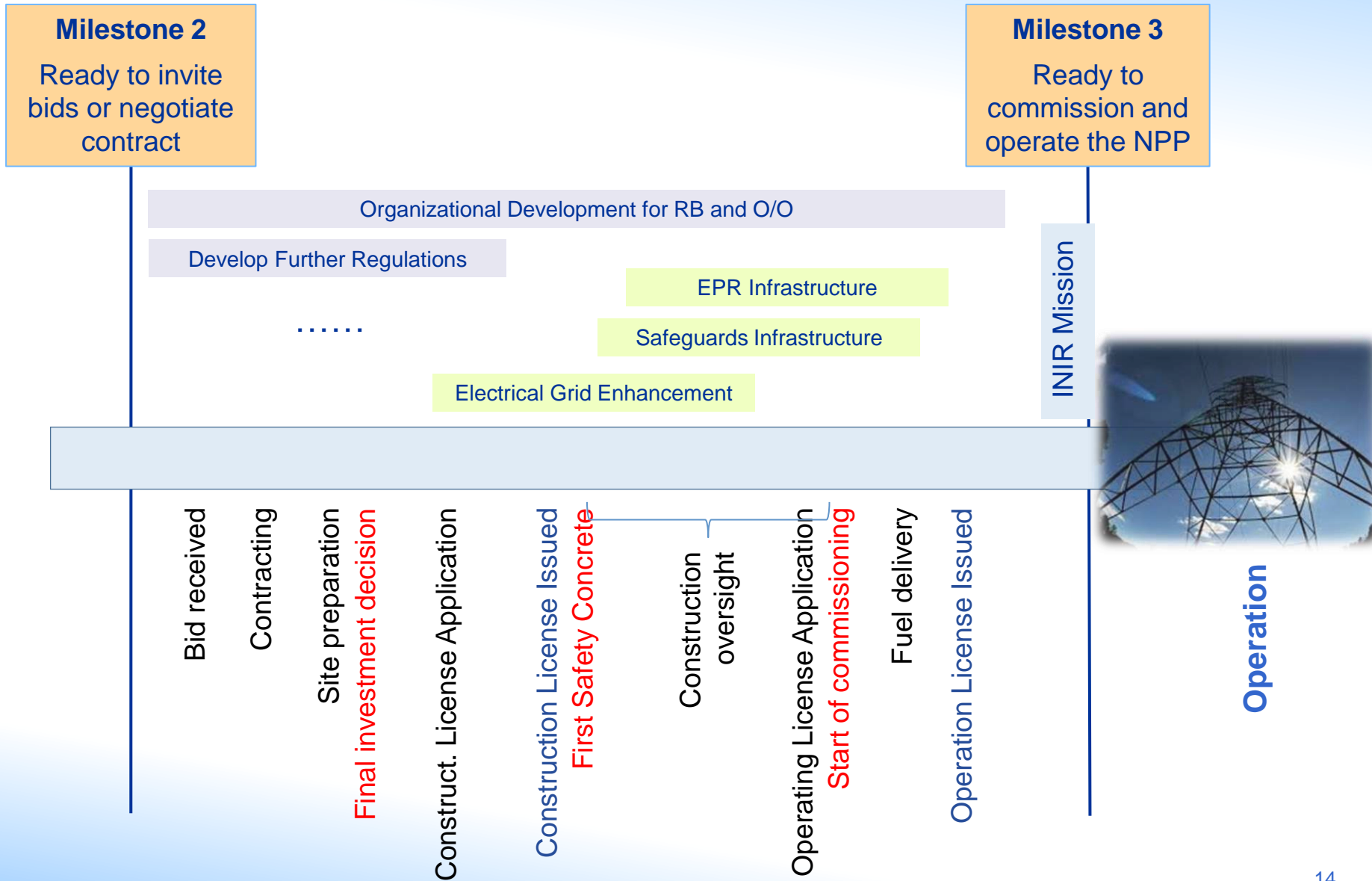
Milestone 1
Ready to make a knowledgeable commitment



Key activities in Phase 2: Prepare



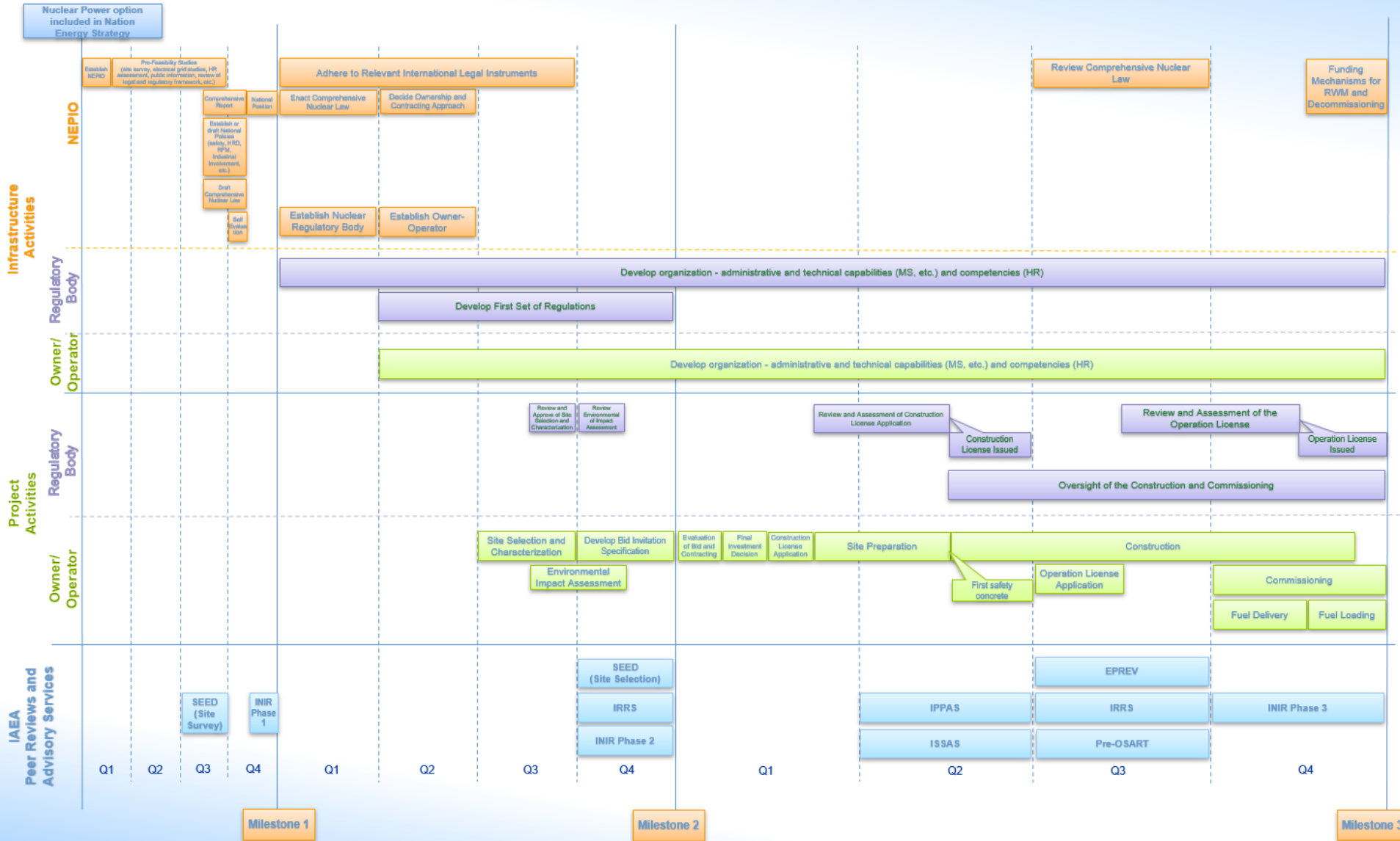
Key activities in Phase 3: Construct



Typical Elements of a Roadmap for Nuclear Power Programme

- Timeline of the nuclear power plant project
 - Activities mostly to be performed by Owner/Operator and Regulatory Body
- Main activities to develop infrastructure elements
 - Timelines
 - Responsible organizations
 - Required competencies needed
 - External support needed by the organizations
 - ...
- Decisions needed from the higher authorities

High Level Roadmap for Nuclear Power Programme



IAEA Competency Framework for Nuclear Power Infrastructure



- The Competency Framework (CF) builds on the Milestones Publication and other supporting documents by identifying key **activities** to be implemented in each **phase**, the responsible **organization** and the **competencies** required for their implementation
- **Main purpose** is to assist Member States in planning activities for infrastructure development and identifying the competencies required to implement them
- It also helps to identify the areas that the IAEA support is needed to develop capacities and infrastructure

Nuclear Infrastructure Competency Framework



The screenshot shows a web browser window displaying the IAEA Competency Framework website. The browser address bar shows the URL <https://nucleus.iaea.org/competency-framework/>. The website header includes the IAEA logo and the text "IAEA Competency Framework". Below the header, there are tabs for "About" and "Database", and a version number "Version: 201903111021".

On the left side, there are search filters for Phase, Issue, Organization, Reference, Activities, and Competences, each with a dropdown menu set to "Any". Below these filters are "Search" and "PDF" buttons.

The main content area displays a detailed view of a competency entry. The entry is structured as follows:

N.	1.1.1
Phase	Phase 1
Issues	01. National Position
Organization(s)	Government
Activity	Establish a mechanism (NEPIO) mandated by a high level authority in the government to coordinate the activities for the nuclear power programme and define its terms of reference.
Competency	Ability to navigate the governmental policy making process. Ability to define the roles and responsibilities of a NEPIO, including a comprehensive review of all the issues relevant to making a knowledgeable commitment to a nuclear power programme. Ability to estimate the human and financial resources required by the NEPIO. Ability to secure a strong government commitment, including the human and financial resources needed by the NEPIO. Ability to identify relevant stakeholders and secure their participation in meetings.
References	NG-G-3.1 (Rev. 1), Section 3.1.1; NG-T-3.6 (Rev. 1), Section 2
Lessons	

At the bottom of the page, there are links for "Contact Us", "Disclaimer", and "Terms of use", and a copyright notice: "© Copyright 2017 Atomic Energy Agency. All rights reserved."

<https://nucleus.iaea.org/competency-framework/>

Take Away

- Roadmap is a schedule and timeline of main activities for the implementation of the first nuclear power project and for the development of required infrastructure
- Developing and following a roadmap for nuclear power programmes may help the successful implementation of a new nuclear power programme by avoiding delays in development of required infrastructure elements
- IAEA Nuclear Infrastructure Competency Framework is a useful tool to develop roadmaps for national nuclear power programmes



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Thank you!





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Developing a Roadmap for New Nuclear Power Programmes

Mr. Boldsaikhan Purevsuren

- Officer of Nuclear and Clean Energy, Nuclear Energy Commission (NEC) of Mongolia
- Work experience in NEC since 2012
- Bachelor of Science of Physics in National University of Mongolia, Master of Engineering in Nuclear power plant in KINGS
- Research articles including public health effects of radioactive, machine learning based approach for SMR





NUCLEAR ENERGY COMMISSION

NUCLEAR ENERGY POLICY IN MONGOLIA

Boldsaikhan Purevsuren

Officer,
THE NUCLEAR TECHNOLOGY DEPARTMENT
EXECUTIVE OFFICE,
THE NUCLEAR ENERGY COMMISSION

Contents

- Overview of Mongolia
- Conventions and Treaty
- Law and Regulations
- Working group
- Roadmap of the Nuclear power program (draft)

Mongolia at glance



Population: 3.5 million

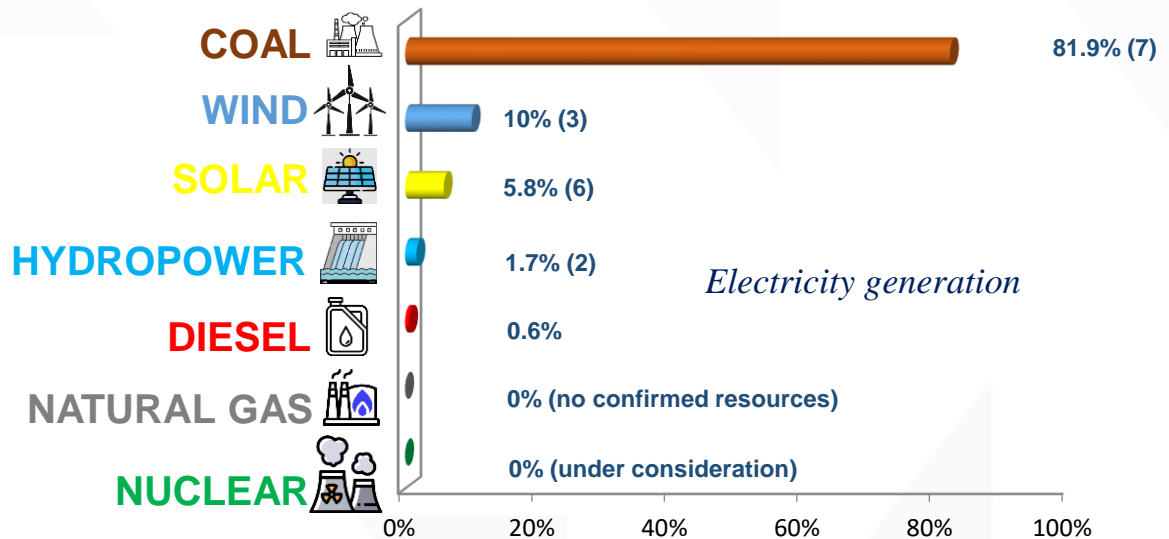
Territory: 1.5 million km²

Avg temperature: +20 C -25 C

Four Seasons

Uranium Estimated reserves: 1 million tons

Confirmed reserves: 160 thousands tons



Coal Estimated reserves: 173.1 billion tons

Confirmed reserves: 31.7 billion tons

Conventions and Treaty

CONVENTIONS

- Convention on the Physical Protection of Nuclear Material, 1986,
- Convention on Early Notification of a Nuclear Accident, 1987
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, 1987
- International Convention for the Suppression of Acts of Nuclear Terrorism, 2005

TREATIES

- NPT, 1969
- Comprehensive Safeguards Agreement, 1972
- AP, 2001
- Treaty on the Prohibition of Nuclear Weapons, 2021

PREPARED TO JOIN

- Convention on Nuclear Safety;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of RWM;
- Amendment to the Convention on the Physical Protection of NM; and
- mSQP;

Policy document

NATIONAL SECURITY CONCEPT OF MONGOLIA

- Develop a nuclear energy sector in accordance with national interests and the principle of use for peaceful purposes. Develop nuclear production facilities for use, processing, conversion and enrichment of radioactive materials.

VISION 2050

- Develop a low-carbon, productive, and inclusive green economy and contribute to international efforts to mitigate climate change.

NEW REVIVAL

- To implement environmentally friendly, science and advanced technology-based energy projects. (Nuclear, green-hydrogen, natural gas, and renewable energy projects)

NUCLEAR ENERGY

- To use nuclear energy widely in the economic and social sectors, and to increase energy sources by producing nuclear energy with technology that is friendly to human health and the environment.

Law and Regulations

Nuclear Energy Law

- Licensing & requirements for Nuclear installations

Nuclear weapon free status

- to regulate relations pertaining to the preservation of the territory of Mongolia in its entirety, including its air space, land, waters and the sub-soil free from nuclear weapons, which constitutes an important factor for ensuring Mongolia's security.

NEW REVIVAL

- To implement environmentally friendly, science and advanced technology-based energy projects. (Nuclear, green-hydrogen, natural gas, and renewable energy projects)








NUCLEAR ENERGY

- To use nuclear energy widely in the economic and social sectors, and to increase energy sources by producing nuclear energy with technology that is friendly to human health and the environment.

Regulations

- Basic regulation on radiation protection and safety (2016)
- Radiation Safety Standard (2015)
- Regulation on Security of Radiation Sources (2015)
- Radiation Safety Regulation on Exploration of Radioactive Mineral (2015)
- Regulation on Management of Radioactive Waste from Mining and Milling of Ores (2015)
- Regulation on Internal Control of Licensee (2015)
- Technical Regulation for Acid In-situ Leach Uranium Mining (2015)
- Mongolian Integrated Nuclear Security Support Plan (2015)
- Radiation Safety Regulation for Use of a Fixed Nuclear Gauge (2017)
- Radiation Safety Regulation for Use of Portable Nuclear Gauge (2017)
- Radiation Safety Regulation for Use of Sealed Sources in Well Logging (2017)
- Radiation safety regulation for uranium mining and milling (2018)
- Regulation on Safe transport of radioactive materials (2019)

HISTORY OF NUCLEAR FRAMEWORK OF MONGOLIA

Organizations (Establishment or Membership)		When
Joint Institute for Nuclear Research (JINR)		1956
Institute of Physics and Technology in Mongolian Academy of Science		1961
Nuclear Energy Commission under Government of Mongolia		1962
Nuclear Research Laboratory (now NRC) under National University of Mongolia		1965
International Atomic Energy Agency (IAEA)		1973
Central Radiological Laboratory		1976
Regional Cooperation Agreement (RCA)		1992
Nuclear Energy Agency (now Executive Office)		2008
Forum for Nuclear Cooperation in Asia (FNCA)		2010

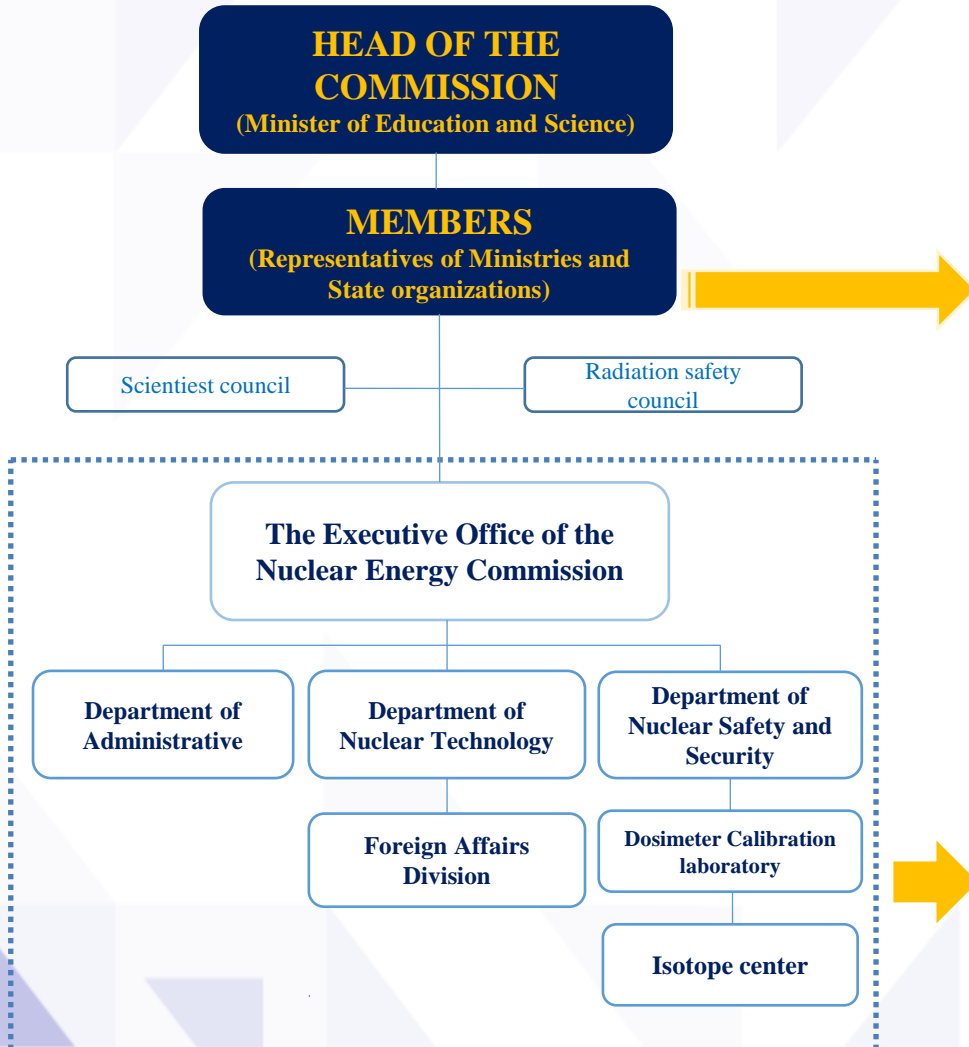


Nuclear Energy Commission

to coordinate activities as follows:

- the use of radioactive minerals and nuclear energy;
- To introduce nuclear technology;
- R&D;
- To ensure nuclear and radiation protection and safety;

Roles and Responsibilities



State Secretaries

1. Ministry of Energy
2. Ministry of Environment and Tourism
3. Ministry of Foreign Affairs
4. Ministry of Justice and Internal Affairs
5. Ministry of Mining and Heavy Industry
6. Ministry of Food, Agriculture and Light Industry
7. Ministry of Digital Development and Communications
8. Ministry of Economic Development
9. Ministry of Health

Head of Government Authorities

10. Head of Legal Department of the Cabinet Secretariat of the Government of Mongolia
11. Director of General Intelligence Agency
12. Director of Mineral Resources and Petroleum Authority
13. President of Mongolian Academy of Sciences
14. Director of the Innovation and Technology, Ministry of Science and Technology
15. Deputy Director of the Executive Office of the National Security Council

Secretary

16. Head of the Executive Office of the Nuclear Energy Commission

SCIENTISTS COUNCIL

The Scientists Council is responsible for providing professional and methodological advice, support, and assistance to the NEC on:

- The implementation of the State Policy;
- Major nuclear projects;
- Infrastructure and HRD; and
- The development of nuclear science and technology.

RADIATION SAFETY COUNCIL

The main purpose of the Radiation Safety Council is to advise, support and make recommendations to the NEC on:

- The implementation of the State Policy in areas of radiation protection and nuclear safety;
- The development of national nuclear radiation safety infrastructure as well as security and safeguards; and
- Coordination of measures at the national level, in the event of a nuclear or radiological emergency involving the public, mitigation of damage, limitation of proliferation, and remedial action.

Working Group



EXPLOITATION OF RADIOACTIVE MINERALS AND NUCLEAR ENERGY

NEW REVIVAL POLICY

MINUTES OF MONGOLIAN GOVERNMENT MEETING №16



MINISTRY OF ENERGY
MINISTRY OF MINING AND HEAVY INDUSTRY
MINISTRY OF EDUCATION AND SCIENCE



МОНГОЛ УЛСЫН
ЗАСГИЙН ГАЗАР

To implement the New Revival Policy of Mongolia and to intensify the implementation of development projects, and to fulfill objectives reflected in the energy sector, a joint order, “To Study a Possibility of Use of Nuclear Power in Mongolia”, was approved by the Minister of Education and Science, the Minister of Energy, and the Minister of Mining and Heavy Industry dated August 11, 2022.

1. National Position
2. Nuclear Safety
3. Management
4. Funding and Financing
5. Legal Framework
6. Safeguards
7. Regulatory Framework
8. Radiation Protection
9. Electrical Grid
10. Human Resource Development
11. Stakeholder Involvement
12. Site and Supporting Facilities
13. Environmental Protection
14. Emergency Planning
15. Nuclear Security
16. Nuclear Fuel Cycle
17. Radioactive Waste Management
18. Industrial Involvement
19. Procurement



Working Group

Key Documents

- Milestones in the Development of a National Infrastructure for Nuclear Power Series No. NG-G-3.1 (Rev.1), 2015
- Evaluation of the Status of National Nuclear Infrastructure Development (Series No. NG-T-3.2 (Rev.2), 2022)

Additional Relevant Documents:

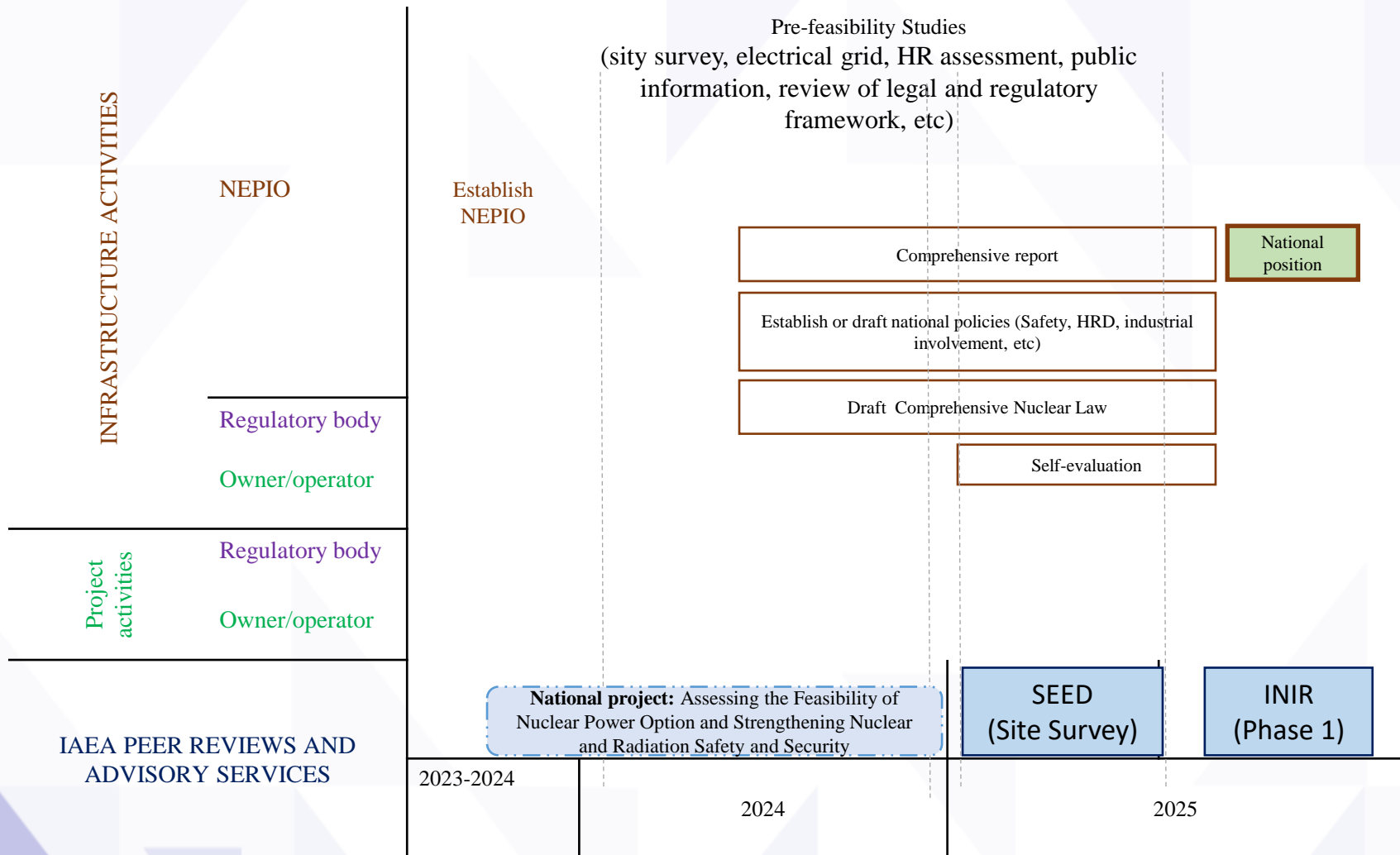
- Guidelines for Preparing and Conducting an Integrated Nuclear Infrastructure Review (INIR) (IAEA Services Series No. 34, 2017)
- Integrated Nuclear Infrastructure Review (INIR): Ten Years of Lessons Learned (IAEA TECDOC Series No. 1947, 2021)
- Roadmap to Operational Readiness (WANO New Unit Assistance Working Group, 2020)

Working Group

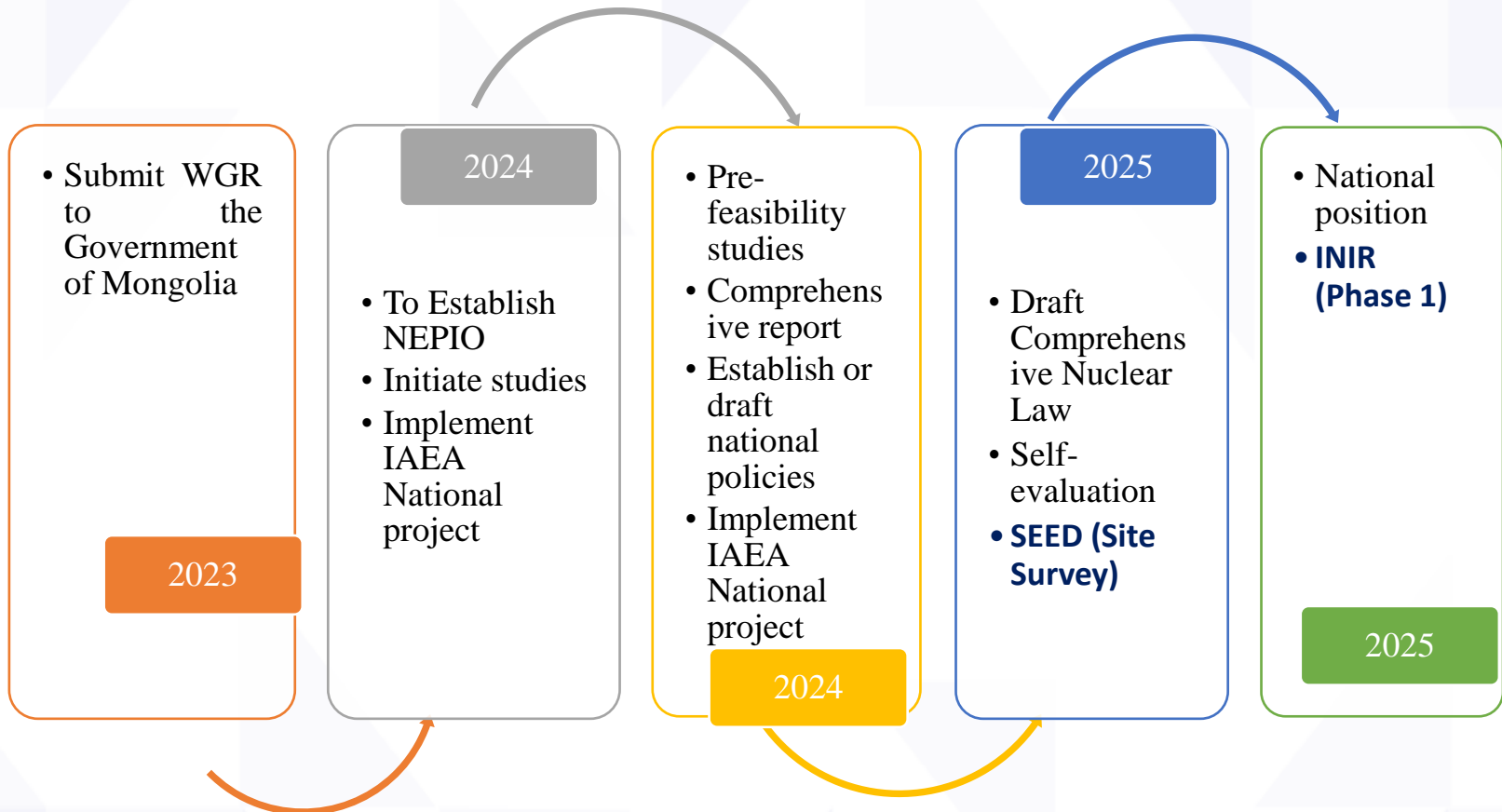
report including a establishment of NEPIO, a set of actions and research activities with a relevant budget which were based on the IAEA's Nuclear Power Infrastructure Development Milestones and other documents. Also it includes proposals of the preliminary feasibility study obtained by evaluating 19 elements of the nuclear infrastructure; and guidelines, plans, and associated costs for the implementation of the nuclear power program as well as the development and strengthening of existing national infrastructure.



TENTATIVE TIMELINE FOR NUCLEAR POWER PROGRAMME



TENTATIVE TIMELINE FOR NUCLEAR POWER PROGRAMME



Thank you for your attention

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Web page: www.nea.gov.mn



MAY 2023

Developing a Roadmap for New Nuclear Power Programmes

Mr. Erick Ohaga

- Director, Nuclear Energy and Infrastructure Development at Nuclear Power and Energy Agency (NuPEA)
- President of the Institution of Engineers of Kenya (IEK)
- Fellow of the Institution of Engineers of Kenya
- Consulting Engineer with Engineers Board of Kenya
- MSc in Nuclear Engineering, Masters of Business Administration, BSc in Electrical Engineering
- 17 years of experience in energy and nuclear policy development



NUCLEAR POWER & ENERGY AGENCY

Development of Roadmap for Nuclear Power Program

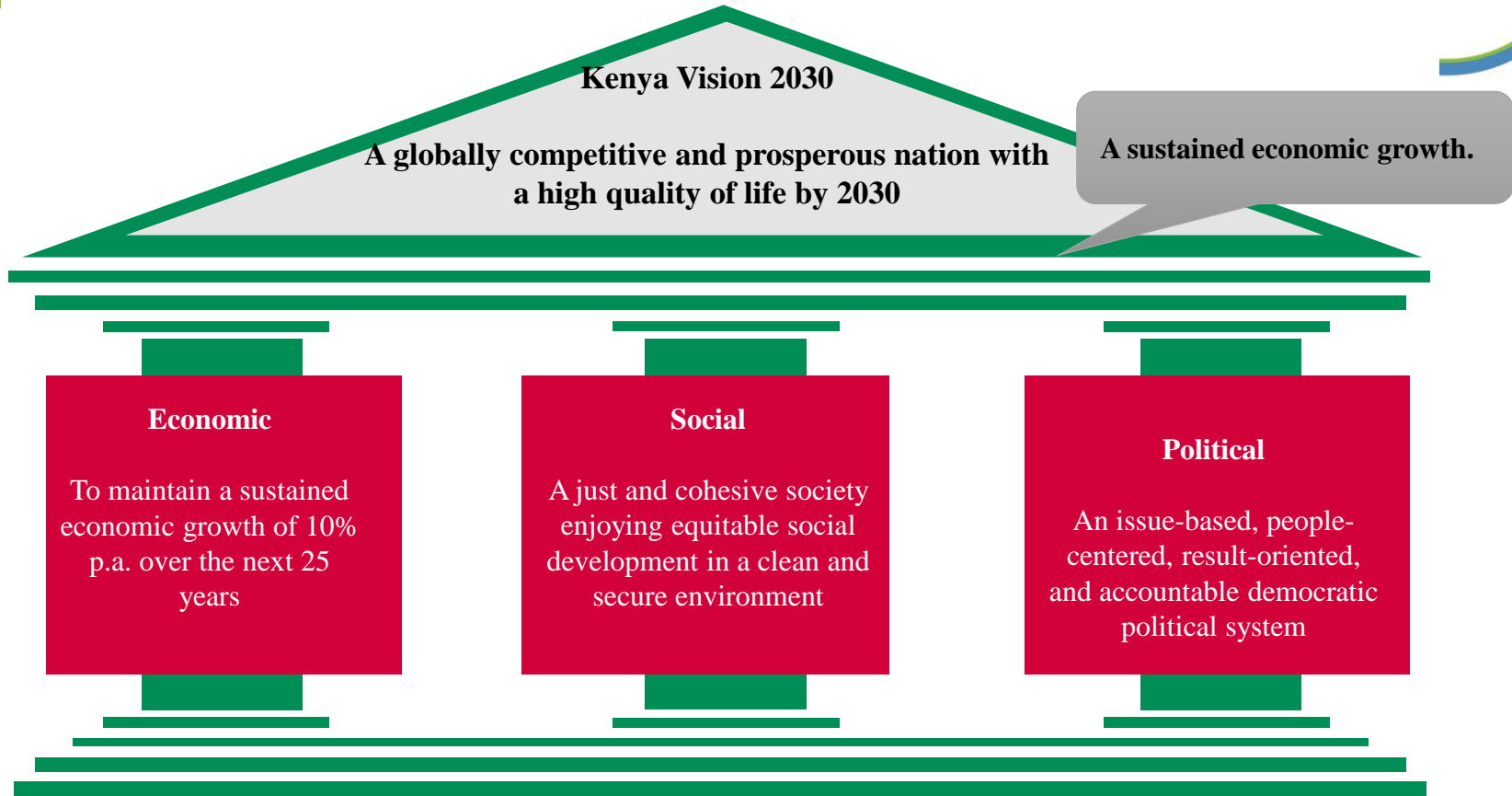
By Eng. Erick Ohaga

NuPEA



Energy is a Key Enabler for Vision 2030

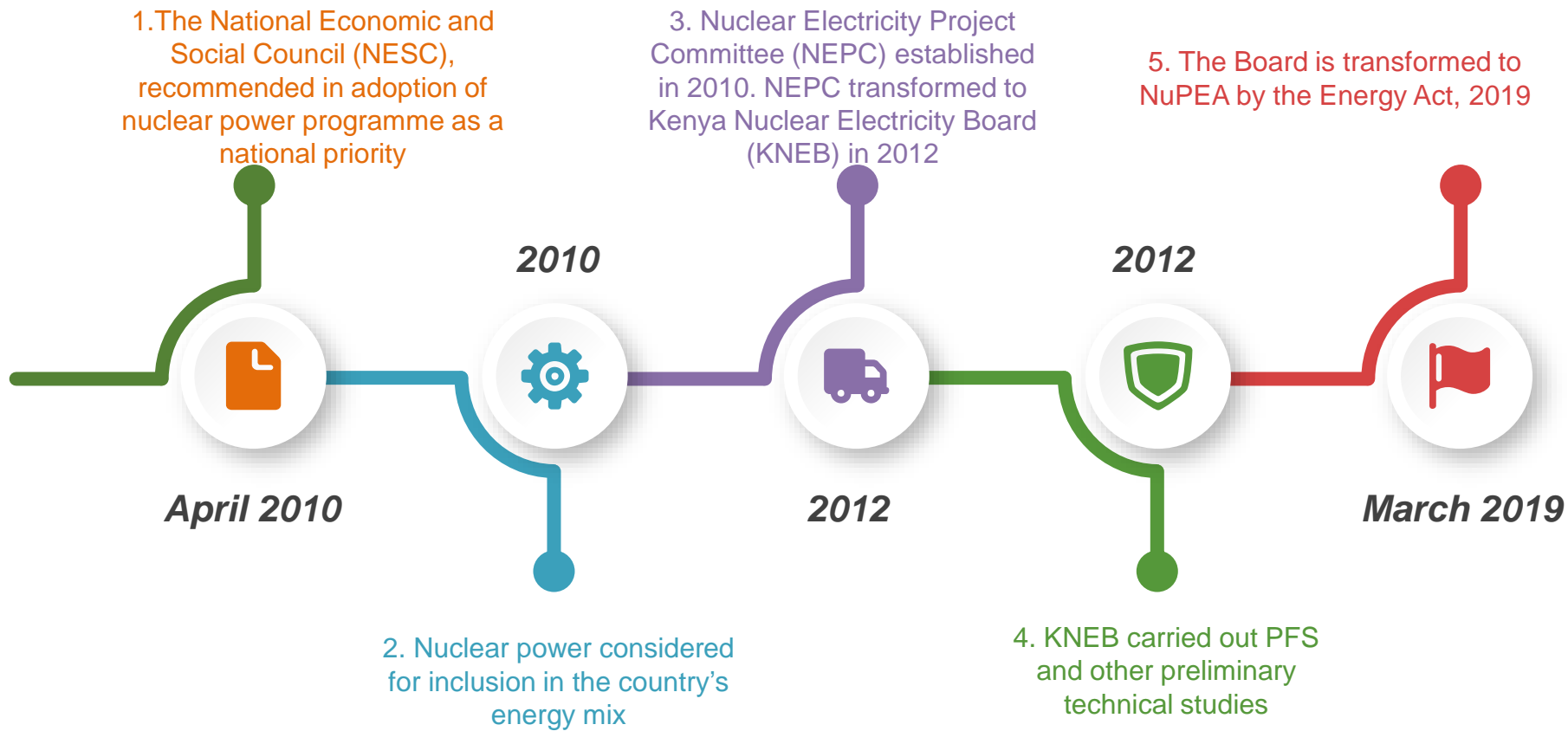
NuPEA



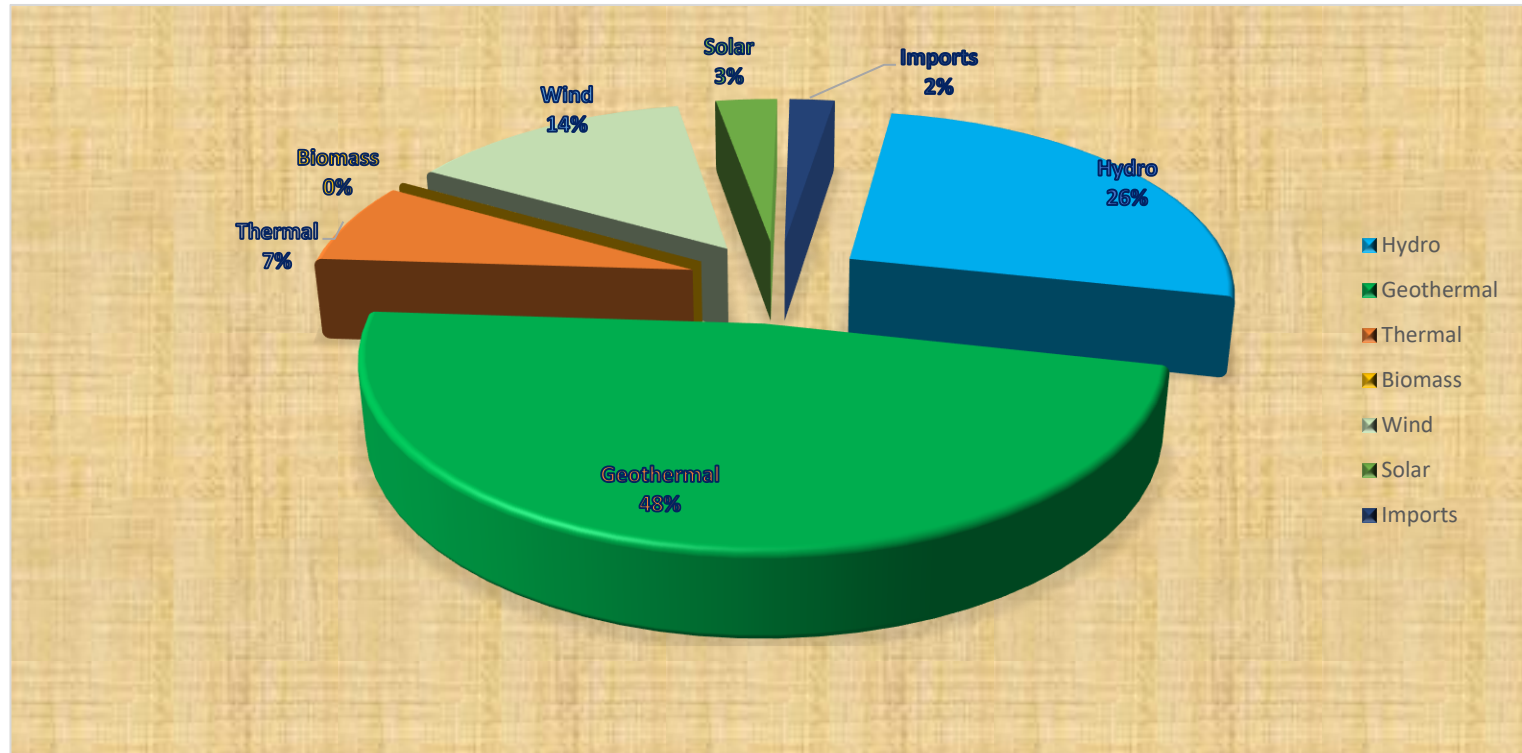
Key Enabler:

A vibrant power sector that meets electricity required to drive flagship projects and programmes

Nuclear Power Programme Evolution

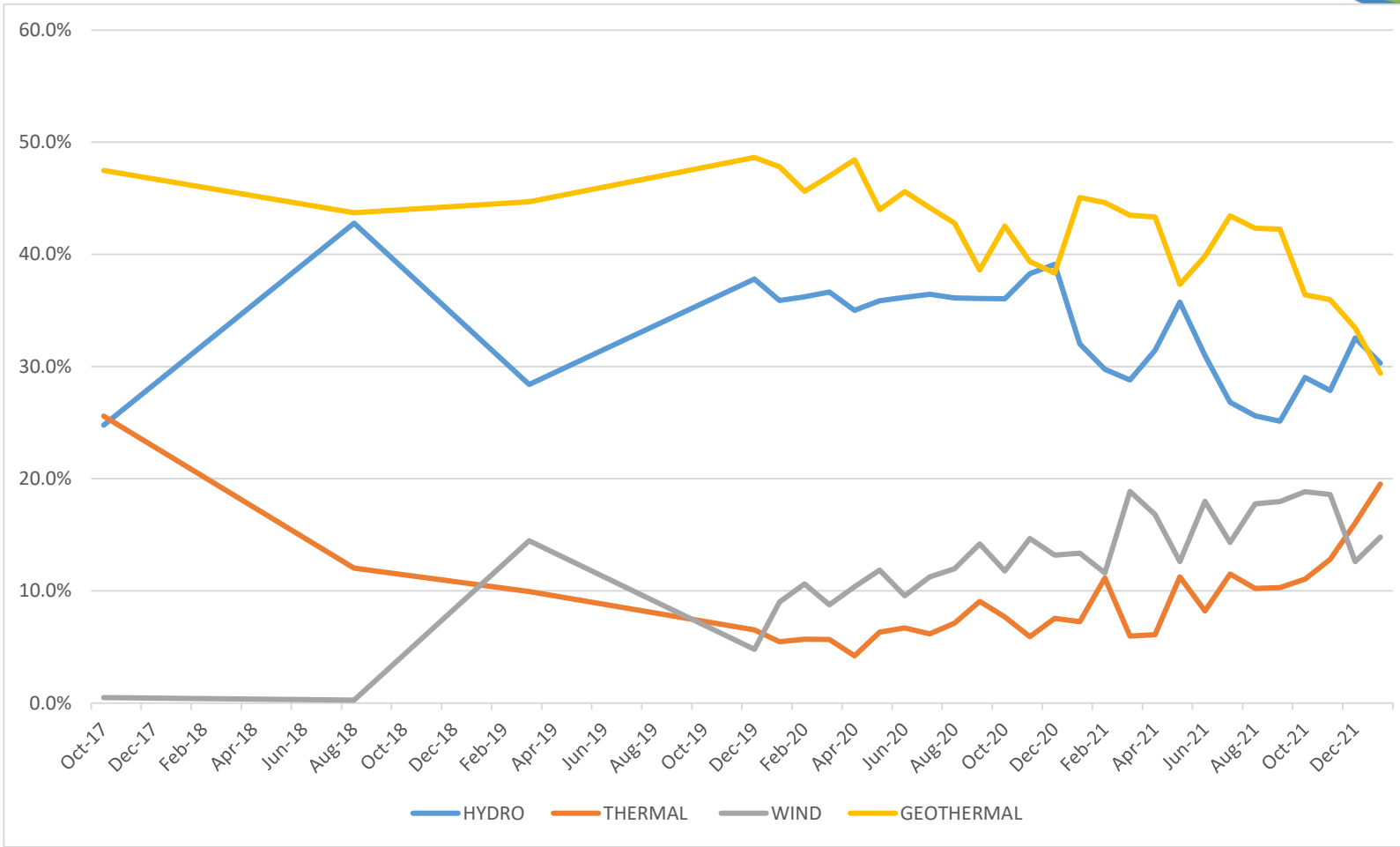


KENYA'S GENERATION MIX AS AT 2022

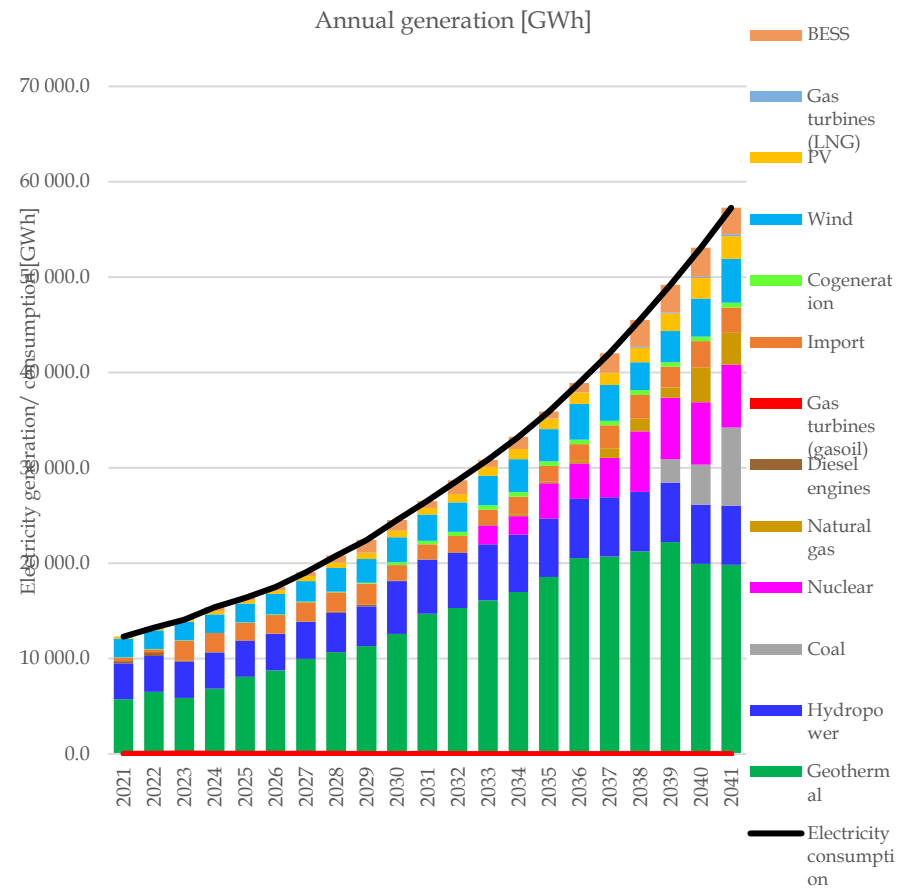
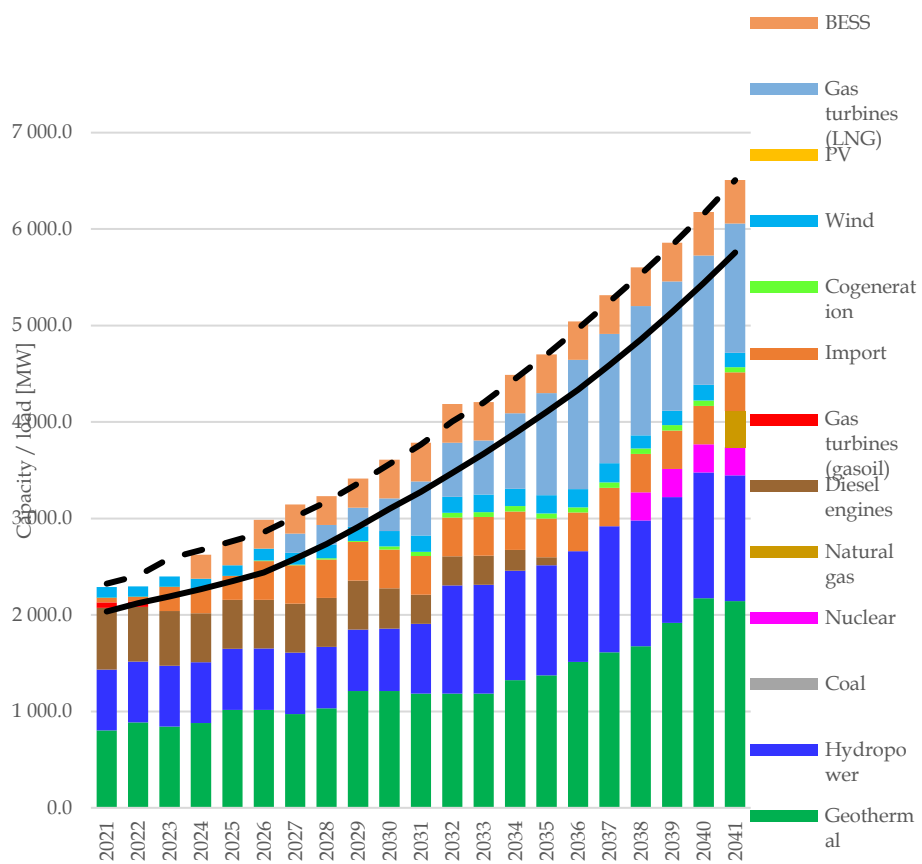


Peak= 2149MW, Installed= 3149MW

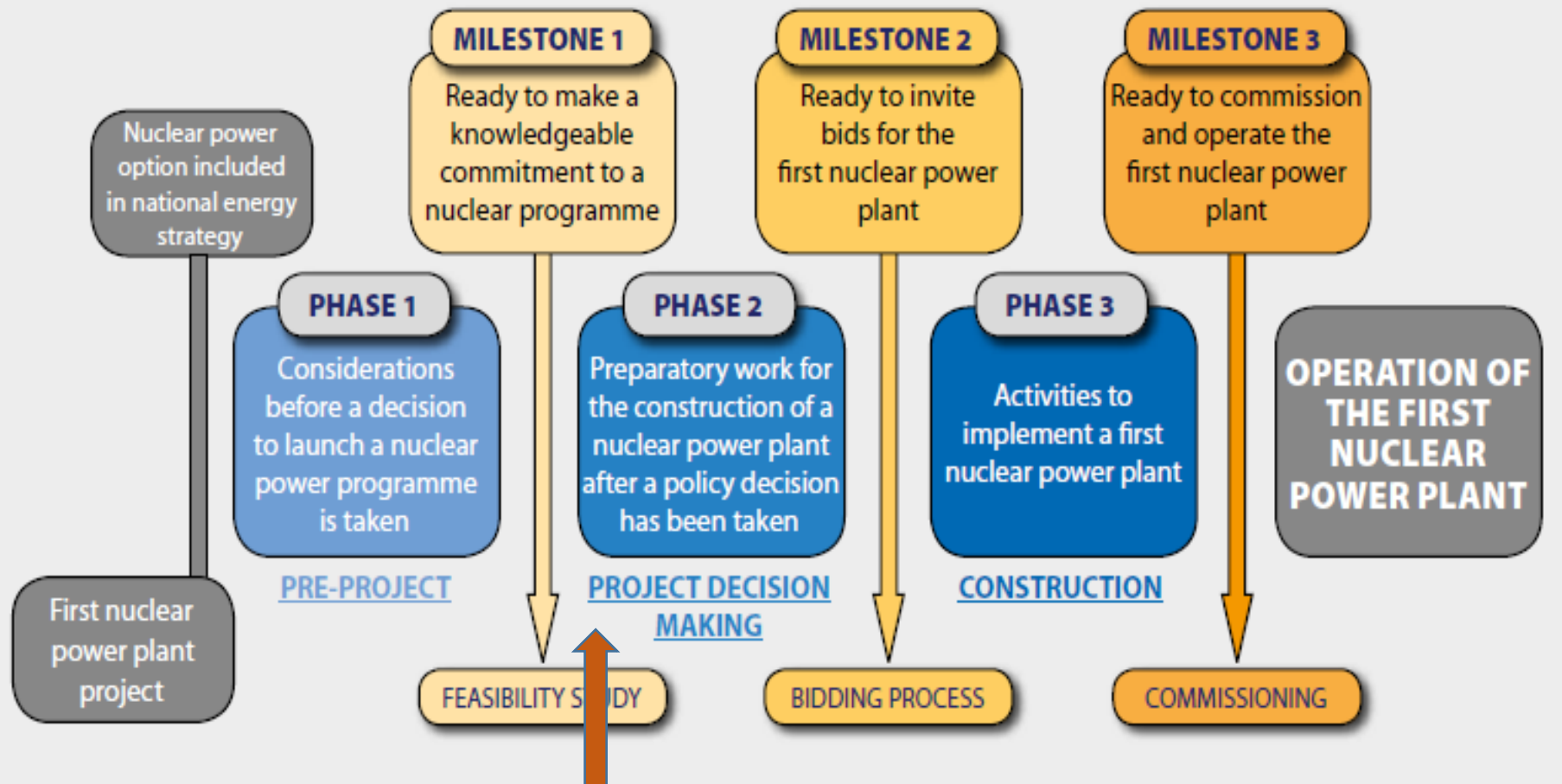
KENYA'S POWER DISPATCH TREND



KENYA'S GENERATION PROJECTIONS



Kenya's NPP is Based on Milestone Approach



10 – 25 years

We are here

National Infrastructure to be developed



National Position



Nuclear safety



Management



Funding and Financing



Legislative Framework



Safeguards



Radiation protection



Regulatory Framework



Electric grid



Human resources development



Stakeholder involvement



Site and supporting facilities



Environmental protection



Emergency planning



Security and physical protection



Nuclear fuel cycle



Radioactive waste

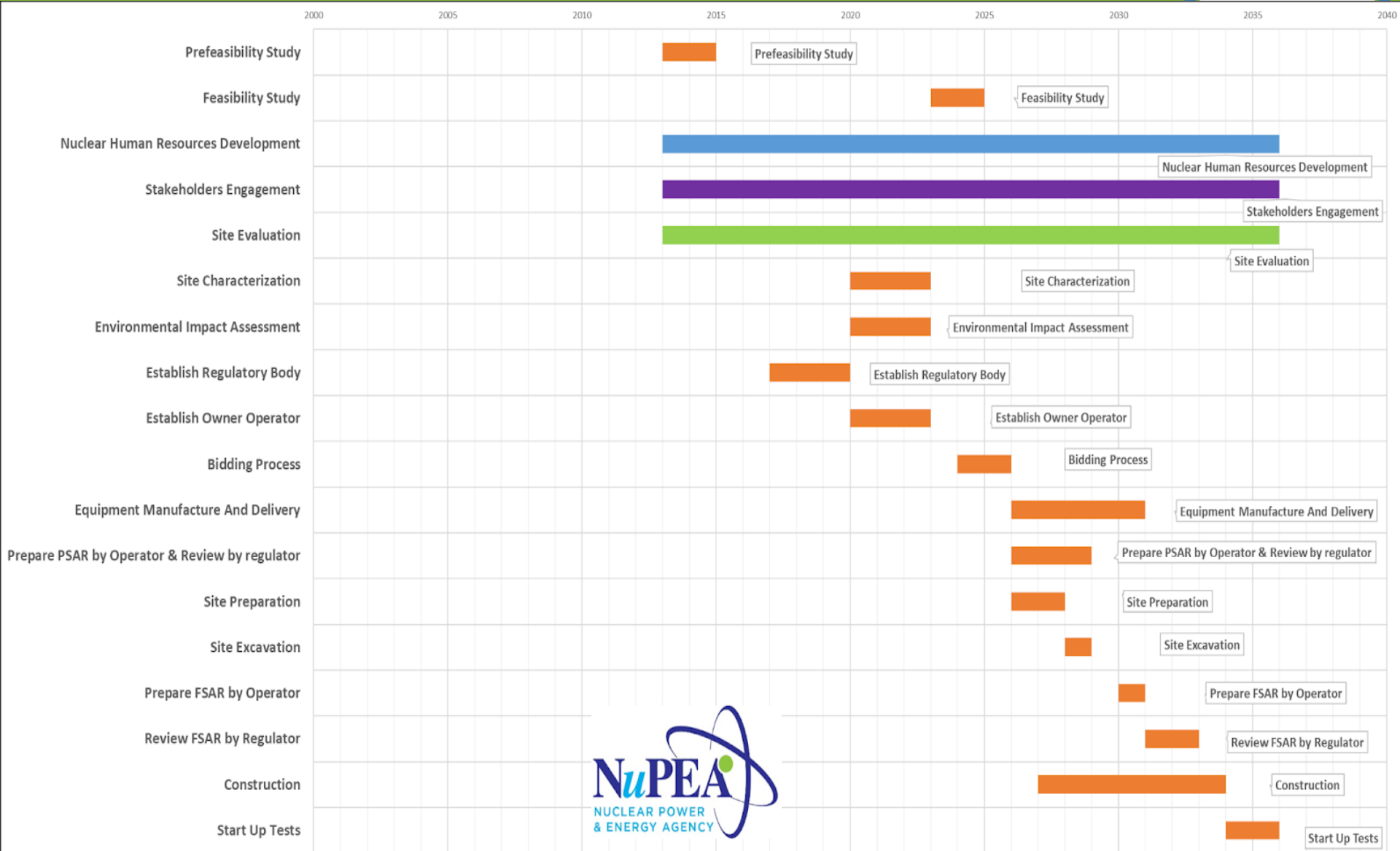


Industrial involvement



Procurement

15 Year Roadmap for the Nuclear Power Programme

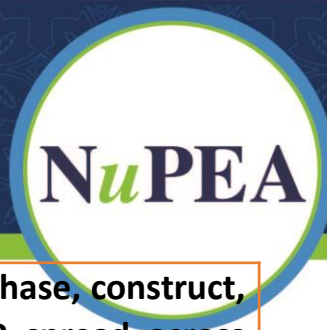


Roadmap to Development of NPP



Activities	Start	End	Explanation
Prefeasibility Study	2013	2015	<p>This stage starts with the policy decision to consider nuclear energy as a potential source for producing electricity within the national energy system and ends with the launch of a feasibility study for the first NPP project in terms of pre-investment.</p> <p>This initial stage is related to conceptual preparatory activities embracing all technical-economic-regulatory investigations needed for the justifications of a NPP project.</p> <p>The introduction of nuclear power and nuclear technology creates specific new requirements on the country's infrastructure and requires a national commitment on a long-term basis. The PFS informs the national commitment.</p>
Feasibility Study	2023	2025	<p>Project decision-making stage starts with the initiation of a feasibility study which looks at the introduction of nuclear energy as a reliable and economical source of energy to meet the demand of the national energy system and ends with the closure of a contract for the purchase of a NPP.</p> <p>This stage includes preparatory activities to create a national infrastructure to support the launching of the project and lead to the decision-making to go forward with it. It is essential to clearly understand the specific aspects of nuclear power, and to have a thorough knowledge of the tasks and activities to be performed along with the requirements, responsibilities, commitments, problems and constraints involved.</p>

Roadmap to Development of NPP



<p>Nuclear Human Resources Development</p>	<p>2013</p>	<p>2036</p>	<p>The knowledge and skills necessary to safely purchase, construct, license, operate, maintain and regulate an NPP spread across most scientific and engineering disciplines. a heightened attention to quality assurance for major systems and equipment. Operation and maintenance require this same special attention and differentiate nuclear plant operation from conventional power plants.</p> <p>Even if much of the initial knowledge and skills are to be provided by foreign sources of manpower, the need for the knowledge and skills to manage and oversee the project should exist within Kenya.</p>
<p>Stakeholders Engagement</p>	<p>2013</p>	<p>2036</p>	<p>There are normally two types of stakeholders; internal and external. Internal stakeholders are those involved in the decision making processes, while external stakeholders are most often affected by the potential outcome of the project, either directly or emotionally. The involvement of both stakeholder groups can be essential to achieving project goals and objectives and can contribute substantially to safety.</p> <p>Since nuclear energy has the potential for causing concern across national boundaries, a dialogue with neighboring countries shall also be undertaken.</p>

Roadmap to Development of NPP



Site Characterization	2022	2025	The main safety objective in site evaluation is protecting the public and the environment from the impact of normal and accidental releases of radioactive material. Site evaluation should determine how site characteristics influence design and operation, and demonstrate suitability of the site from a safety viewpoint.
Environmental Impact Assessment	2020	2023	EIA is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects. Particular attention is given in EIA for preventing, mitigating and offsetting the significant adverse effects of proposed undertakings Environmental studies should be performed for the potential or selected site for nuclear facilities and particular environmental sensitivities identified. Particular environmental sensitivities should be addressed in the bid specification where unique plant design provisions or construction techniques are necessary to address those sensitivities.

Roadmap to Development of NPP



<p>Establish Regulatory Body</p>	<p>2017</p>	<p>2020</p>	<p>The legal framework establishes the duties and responsibilities of the various organizations necessary for a successful program especially focusing on safety, security, safeguards and liability for nuclear damage. It should also implement any international instruments to which the nation is a party. The legislation should provide for complete Independence of the regulatory body.</p> <p>The regulatory body has already been established and it is now supposed to come up with regulations. Independent and competent regulatory organization provides the confidence of the public and the international community. The technical training, knowledge and capabilities of the regulator need be adequate for competent interaction with the owner/operator.</p>
<p>Establish Owner Operator</p>	<p>2021</p>	<p>2024</p>	<p>The owner-operator is the entity that will be responsible for constructing and operating and maintaining the NPP. A good example of an owner operator in Kenya is KenGen, LTWP et cetera.</p>

Roadmap to Development of NPP



<p>Bidding Process</p>	<p>2024</p>	<p>2026</p>	<p>Ultimate objective of the bidding process is to sign with the successful bidder(contractor) a contract that enables the licensing, construction, commissioning, operation and decommissioning of a NPP in an acceptable way for the owner.</p> <p>When starting the bidding process, the owner should have adequate human resources with basic technical and economic knowledge to evaluate the bids and conduct contract negotiations.</p> <p>The following bids will be considered: 1. Technical bids, Nuclear fuel bid(Technical), Financial bids, Commercial bid and finally Technology transfer and training bids.</p> <p>Main purpose of the BIS is to clearly present the Owner’s requirements: expectations and plans, Technical, commercial and financial, Conditions and circumstance under which the contractor will have to perform its responsibilities, Form and content of bids, Criteria on which the bids will be evaluated.</p>
<p>Equipment Manufacture And Delivery</p>	<p>2026</p>	<p>2031</p>	<p>Orders for long lead equipment should be made and contracts should be signed with the suppliers to offer technical support during installation and commissioning.</p> <p>Long lead equipment include the turbines and generators high inertia pumps, unit and standby auxiliary transformers et cetera</p>

Roadmap to Development of NPP



Prepare PSAR by Operator	2026	2027	A pre-requisite if a two-stage licensing process is adopted by the regulator. The operator must provide a safety analysis report covering each aspect and component of the NPP explaining the nature of the facility and its intended use and that the facility can be built and operated without any undue risk to the health and safety of the public. A preliminary report detailing the above should be prepared and submitted to the regulator before license to construct the NPP is granted.
Review PSAR by Regulator	2027	2029	The regulator should review the PSAR and once convinced that the facility can be safely constructed and will not compromise the health and safety of the public, it can grant a construction license.

Roadmap to Development of NPP



Site Preparation	2026	2028	Clearing the site off vegetation and surface material before excavation works begin
Review PSAR by Regulator	2027	2029	The regulator should review the PSAR and once convinced that the facility can be safely constructed and will not compromise the health and safety of the public, it can grant a construction license.

Roadmap to Development of NPP

NuPEA

Review FSAR by Regulator	2031	2033	The regulator should review the FSAR and once convinced that the facility can be safely operated and will not compromise the health and safety of the public, it can grant an operation license.
Construction	2031	2036	Construction of a nuclear power plant takes an average of 3 years. The additional 2 years are for contingency in case of delays.
Start Up Tests	2035	2037	This includes the first hot trial run, first criticality, trial operation tests and final handover.



Thank You!





MAY 2023

Developing a Roadmap for New Nuclear Power Programmes



Q&A Session



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Developing a Roadmap for New Nuclear Power Programmes

Next Series:

Webinar Series on Nuclear Infrastructure Publication Updates

- **Development of Management Systems in Countries Embarking on New Nuclear Power Programmes**

- **27 June 2023, 13:00(CET)**