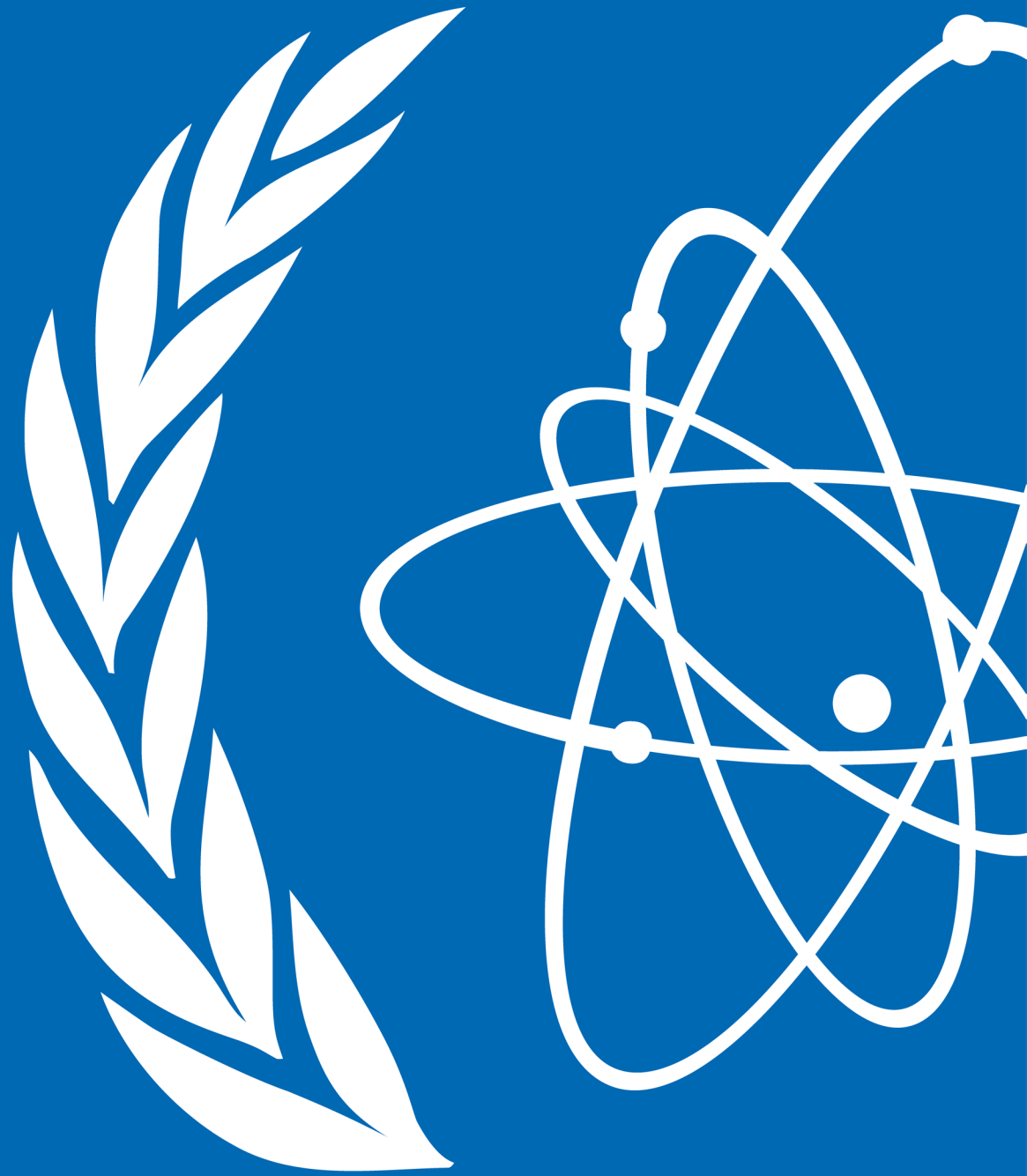
Milestones in the Development of a National Infrastructure for Nuclear Power (Revision 2)

Webinar #9

Webinar Series on Nuclear Infrastructure Publication Updates

10 June 2025

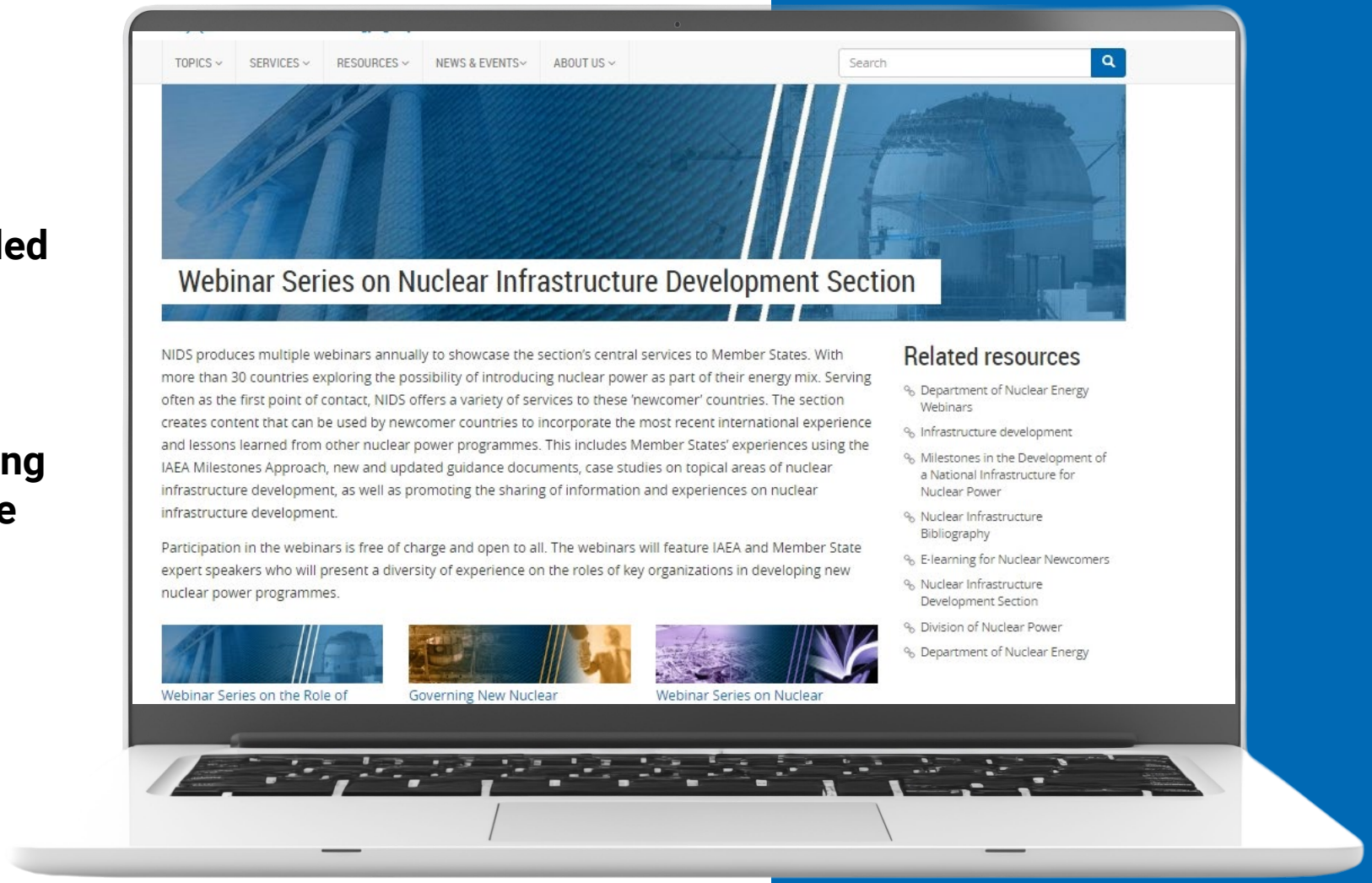


Housekeeping

The webinar is recorded

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

Q&A button for all questions or Chat window



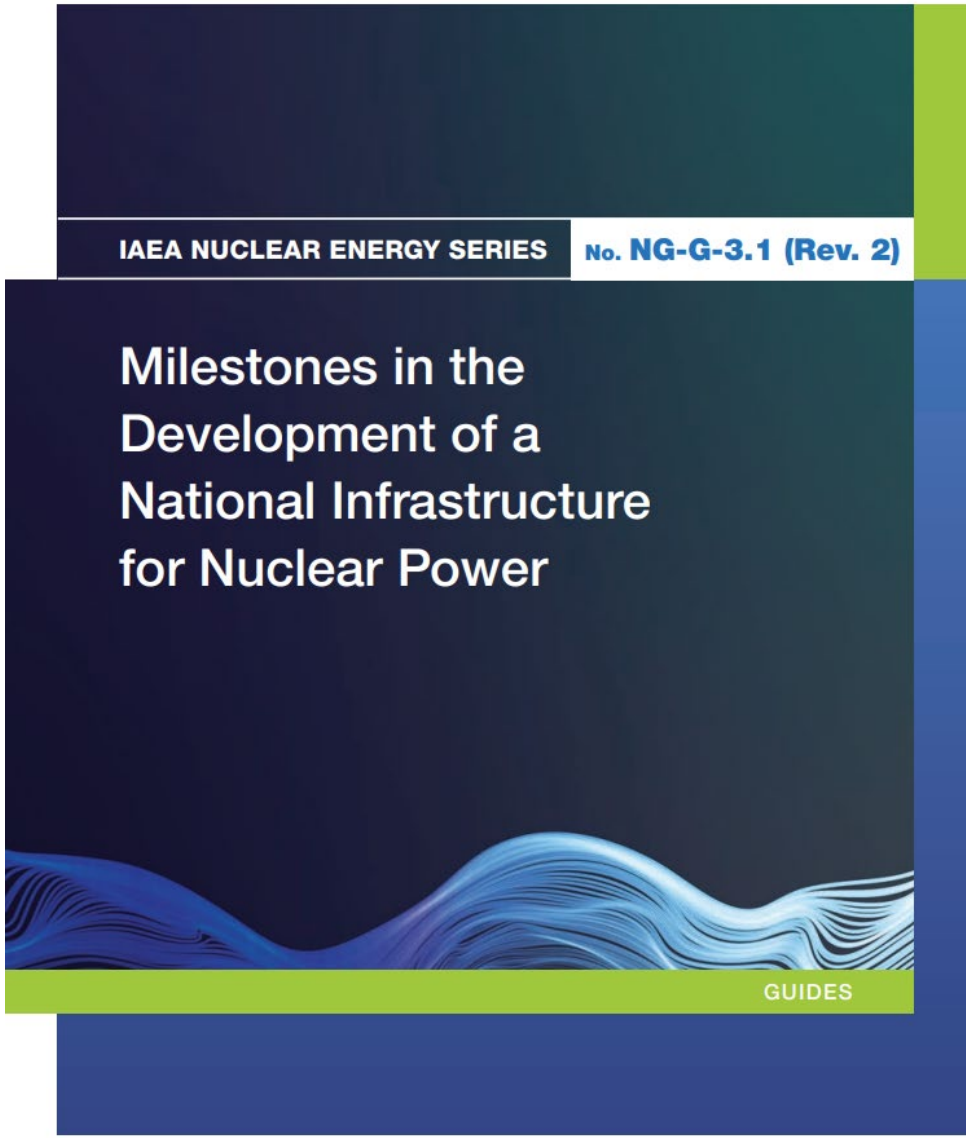
Objectives

1

Present to Member States the publication on Milestones in the Development of a National Infrastructure for Nuclear Power Rev. 2 (NG-G-3.1)

2

Through presentations and open discussions with two Member States, the webinar will also allow participants to interact and share practical experiences on the development of a national infrastructure for nuclear power



Our speakers today

Mehmet CEYHAN
Nuclear Infrastructure Development Section, IAEA

Winnie NDUBAI
Director of Strategy & Planning, NuPEA, Kenya

Maksim MAZURENKA
Head of Division, Regulatory Body (Gosatomnadzor), Republic of Belarus

Opening remarks by Ms Liliya DULINETS

Section Head, Nuclear Infrastructure Development Section,
Department of Nuclear Energy, IAEA

- Previously worked as Deputy Director, Nuclear Energy Department, Ministry of Energy of the Republic of Belarus
- Over 15 years of experience in the nuclear power program implementation:
- Nuclear power plant project management
- State management in environmental protection
- International cooperation in the energy field
- Worked over 10 years at the Thermal Power Station
- Graduated from the Belarusian Technical University

Mr Mehmet CEYHAN

- Nuclear Engineer, MSc
- Technical Lead, Nuclear Infrastructure Development Section, IAEA
- > 30 years of experience at national and international levels in
  - Regulatory framework
  - Nuclear safety, security and safeguards
  - Nuclear power technologies
  - Nuclear fuel cycle
  - Nuclear infrastructure development
- Coordinator of a number of IAEA Integrated Nuclear Infrastructure Review (INIR) Missions
- Team Leader for Uganda INIR Phase 1 Mission, Kazakhstan INIR Phase 1 Follow-up Mission, Poland INIR Phase 2 Mission, and Philippines INIR Phase 1 Follow-up Mission

Webinar Series on Nuclear Infrastructure Publication Updates

Milestones in the Development of a National Infrastructure for Nuclear Power Revision 2
10 June 2025

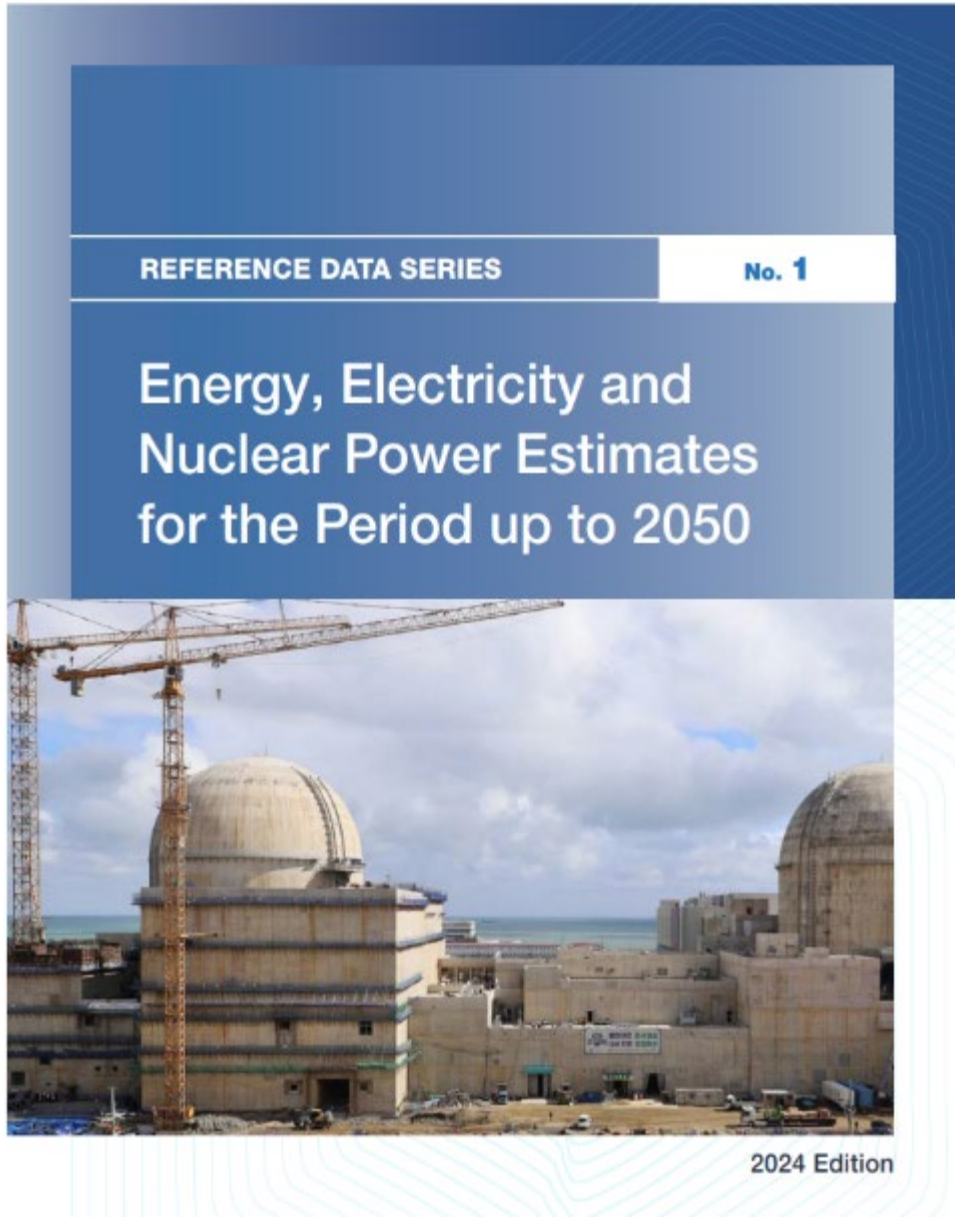
IAEA Milestones Approach and Highlights from Revision 2

Mehmet CEYHAN

Technical Lead
Nuclear Infrastructure Development Section
Nuclear Power Division
Nuclear Energy Department

Growing interest in nuclear power worldwide

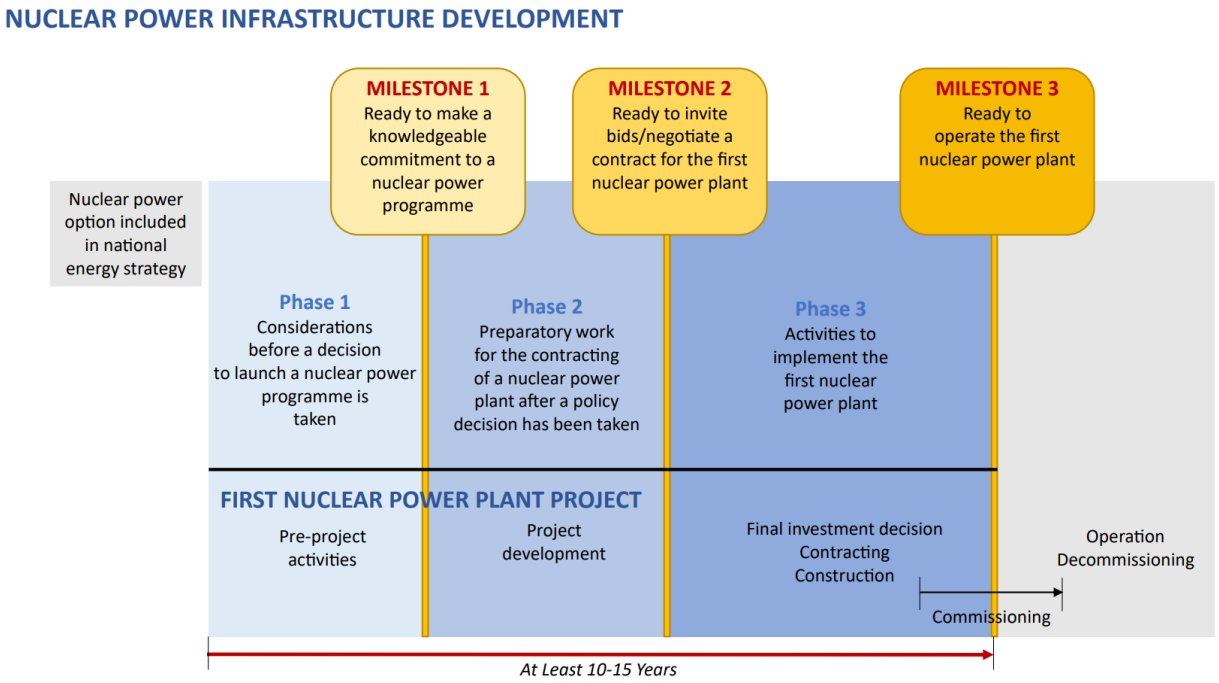
- Total electrical generating capacity is expected to increase by about 12% by 2030 and to more than double by 2050.
- In the **high case**, nuclear electrical generating capacity is projected to increase to 2.5 times the 2023 capacity by 2050.
- In the **low case**, nuclear electrical generating capacity is projected to increase by about 11% by 2030 and then increase by about 24% by 2050.

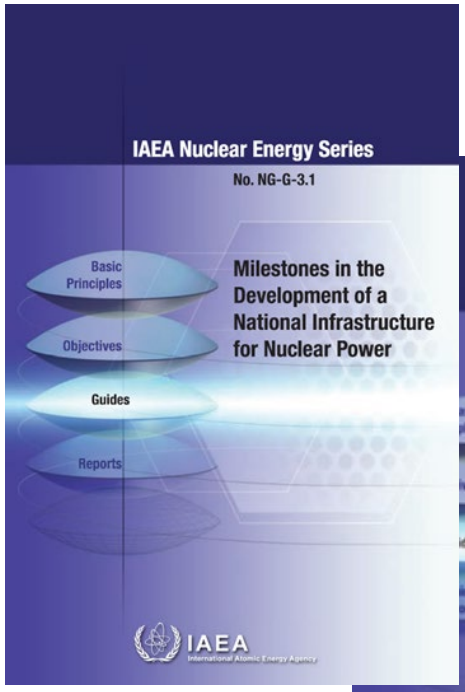


IAEA Milestones Approach

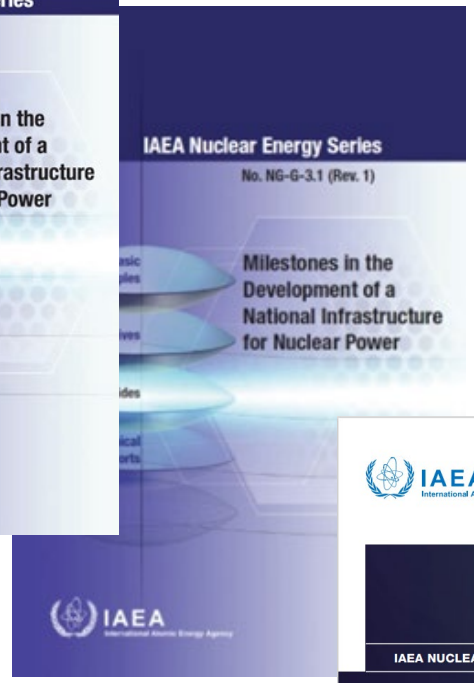
A phased and comprehensive management guide on creating an enabling environment for successful and sustainable nuclear power programme

- 3 Phases (Consider – Prepare – Construct)
- 3 Milestones (Decide – Contract – Commission)
- 19 Infrastructure Issues

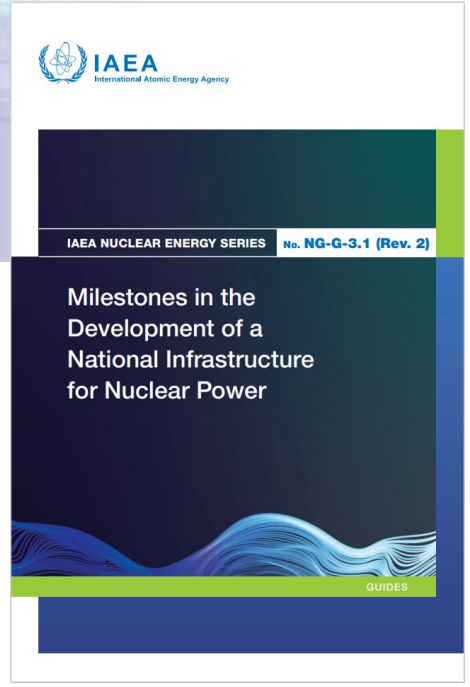




2007



2015



2024

Infrastructure Issues

- Soft infrastructure issues
- Hard infrastructure issues
- National level with some international elements
- Some are interrelated
- All needs certain actions in each phase of the nuclear power programme

Approach to Early Engagement with Countries Considering Nuclear Power

Observed Need

- Growing energy demands
- Need for secure and reliable electricity
- Mitigation of climate change
- Advanced reactor technologies, particularly, small modular reactors
- Additional Member State requests for support (no national TC project)

Pre-Phase 1:

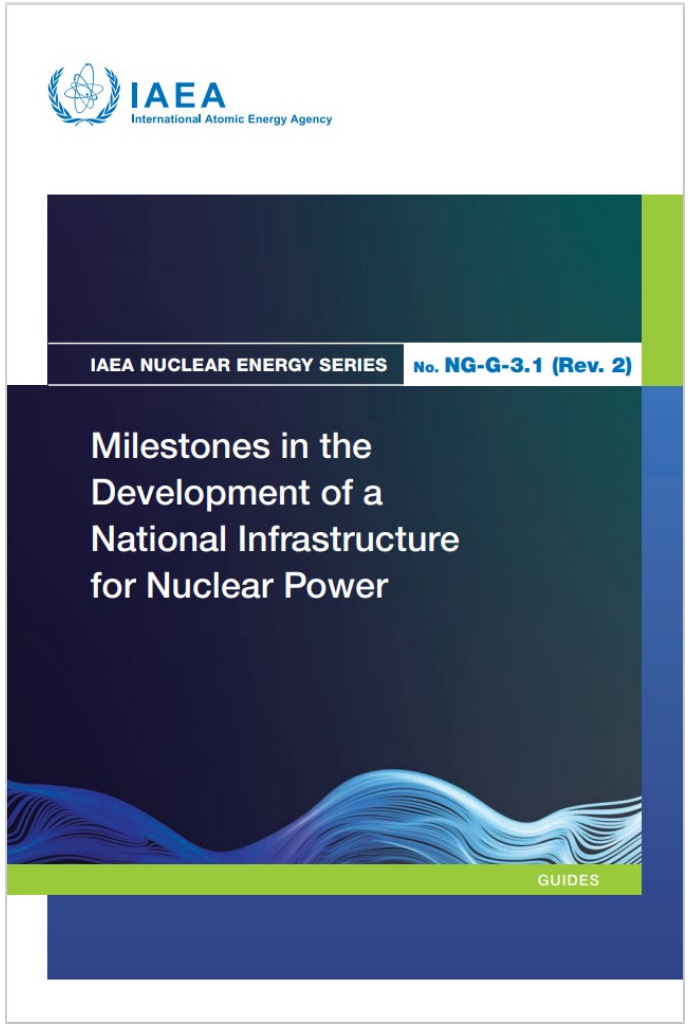
- Countries who expressed an interest or a renewed interest in nuclear power
- Countries who do not have or have stopped in the past a TC project on infrastructure development.
- The funding mechanism allows to support them to (re)initiate their programme and expedite phase 1.

Activities:

- Raise awareness
- Support development of nuclear power roadmaps
- Prepare countries for Phase 1
- Coordinated with PESS
- Funded by U.S.A, France, Korea, and possibly by TC

Milestones Publication – Revision 2 (2024)

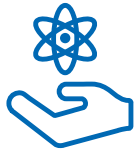
- Published online as pre-print in 2023 and printed in 2024
- Drivers for revision
  - 2 front-runners started operation (UAE and Belarus)
  - Interest for SMRs
  - Lessons learned from over a decade implementation
- Inputs
  - INIR missions from 2015 – 2022
  - IAEA meetings (Conf, TM, CS, IWPs, ..)
  - Recent IAEA publications relevant nuclear power infrastructure
  - Feedbacks from experts in operating countries and embarking countries
- Nature of modifications
  - Improvements or clarifications of existing text
  - New concepts or ideas (such SMR annex)
  - Alignment to the recent IAEA publications



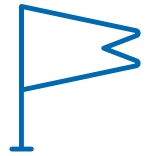
Milestones Approach and SMRs

IS THERE A NEED TO
- **DEVELOP AN HRD PLAN?**
- **WASTE MANAGEMENT APPROACH?**
- **INDUSTRIAL INVOLVEMENT APPROACH?**

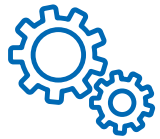
- **IS THERE A NEED FOR A NATIONAL POSITON?**
- **DEVELOP PRE AND FEASIBILITY STUDIES?**



- **DO SAFETY, SECURITY AND SAFEGUARDS REGIMES APPLY?**



- **IS THERE A NEED FOR AN APPROPRIATE SITE?**



- **IS THERE A NEED FOR A LICENSING PROCESS?**

- **IS THERE A NEED FOR A LEGAL FRAMEWORK?**

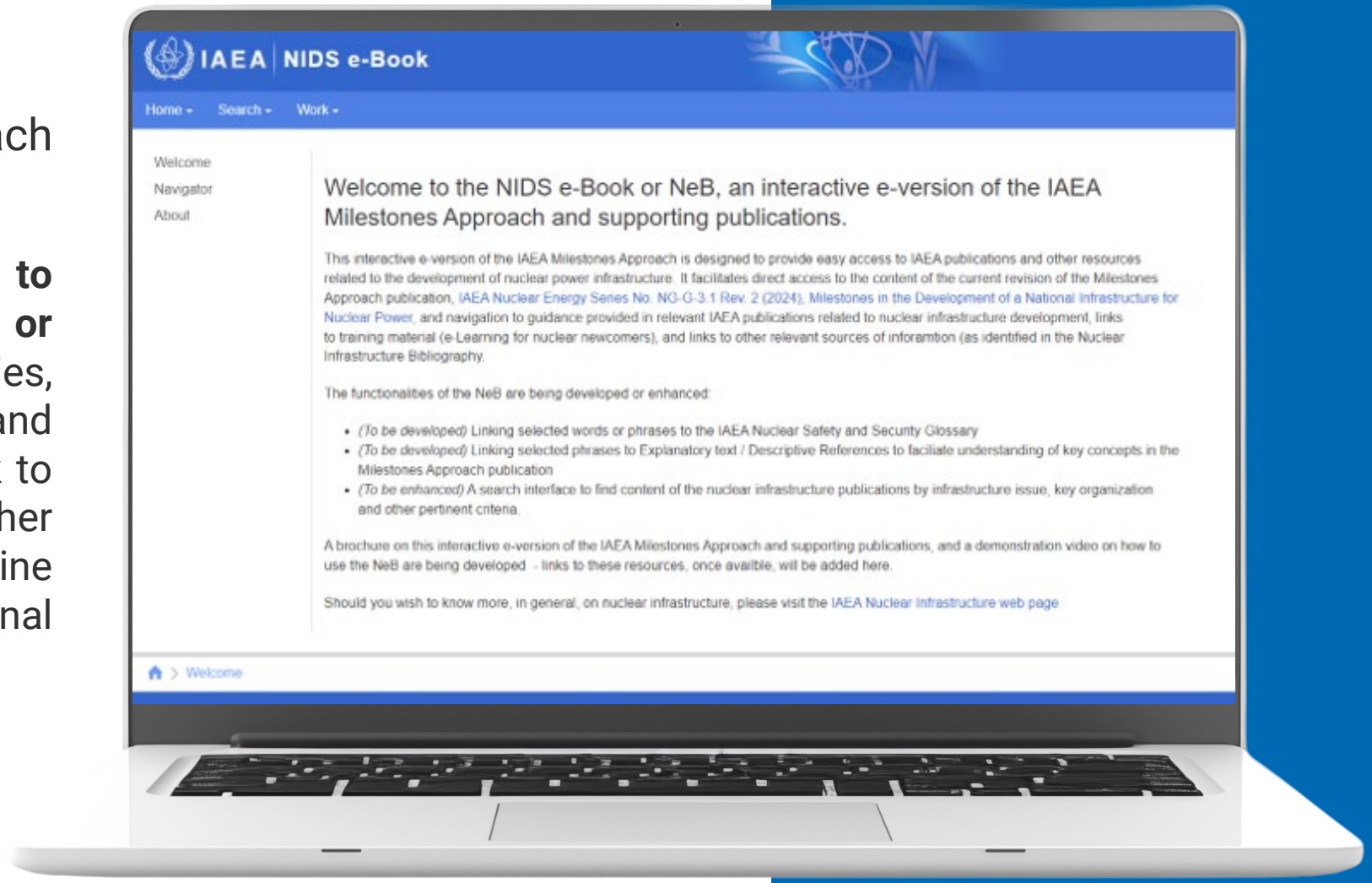
- **IS THERE A NEED FOR PUBLIC SUPPORT & STAKEHOLDERS ENGAGEMENT?**

- **IS THERE A NEED TO DEFINE CONTRACT & OWNERSHIP MODELS?**

- Some infrastructure activities **are less demanding** – financing, siting, EPR, RWM, grid, etc
- Some infrastructure activities **needs to be accelerated** – Regulatory framework, HRD, Management, etc
- Some infrastructure activities **needs to start earlier** – Management (i.e, O/O setup), HRD, etc
- Some infrastructure activities **may need new solutions** depending on the deployment models and new and innovative reactor and fuel types – Legal framework, safeguards, nuclear security (in the case of deployment in remote locations)

Nuclear Infrastructure Development e-Book (NeB)

- **Navigate** the Milestones Approach NG-G-3.1 (Rev. 2 June 2024)
- **Immersive experience with links to more than 120 publications or resources** (Nuclear Energy Series, TECDOCs, Nuclear Safety Series and Nuclear Security Series (direct link to NSS-OUI), e-Learning modules, other IAEA publications, brochures, online resources, IAEA web pages, external web pages)
- **Easy navigation**



- **Visit** https://nucleus-apps.iaea.org/NEB/

Additional features will continue to be added

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Thank you!

Maksim MAZURENKA

20+ years of high-level experience in national and international nuclear safety oversight, including:

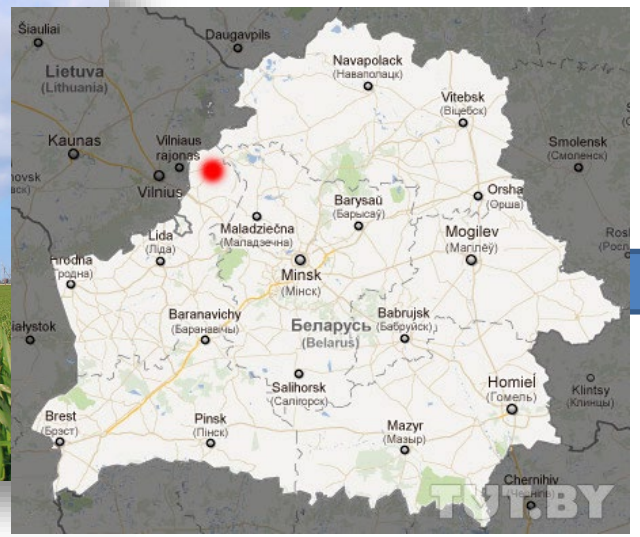
- Leadership in nuclear safety culture and safety oversight
- Licensing and supervision of nuclear installations, including Belarusian NPP
- Emergency preparedness and response at national level (CBRN included)
- Technical regulation and legal writing in nuclear safety
- Member of Scientific and Technical Councils and Regulatory Commissions
- Active participation in IAEA safety and infrastructure initiatives
- Regulation of nuclear and radiation safety infrastructure
- Contributor to strategic planning, project management, and international cooperation in nuclear oversight

Application of the Milestone Approach in Belarus

Maksim Mazurenka
Regulatory Body (Gosatomnadzor),
Republic of Belarus

BASIC INFORMATION ON NUCLEAR PROGRAMME

Belarusian NPP – the only corresponding to the definition of the Article 2 of CNS



- **Location:** Ostrovets, Grodno region
- **Design:** AES-2006 (Russian design with 2 VVER-1200 reactors)
- **Construction:** Nov 2013 – Nov 2023
- **General Contractor:** "ASE" (Russian Federation), "turn key"
- **Operator:** SE "Belarusian NPP"

Another facilities

- Scientific nuclear installations in "JIPNR-Sosny"
- Critical assembles («Giatsint», «Kristall»)
- Subcritical assembly «Yalina»
- Yavar non-irradiated nuclear material storage facility
- Nuclear material storage facility

Future perspectives

- NPP-2 or UNIT-3 of Belarusian NPP – *discussing*
- RW disposal facility – *commissioning expected after 2030*
- Nuclear Research Center - *discussing*

“NATIONAL POSITION” ELEMENT AS A FOSTERING FACTOR FOR INFRUSTRUCTURE DEVELOPMENT

National position element - “foundation” of the whole national nuclear infrastructure:

- **Commitment to safety** – means commitment to internationally adopted approaches to safety defined in IAEA standards – the basis for another 18 elements;
- **NEPIO mechanism** – results in defining all relevant stakeholders, strategic planning of the infrastructure development, as well as mechanism of managing of such development;
- **Defining state institutions**, that involved in a NPP project – results in implementing all activities on all infrastructural elements development

At the phase 1 **National position** plays vital role to start the activity in a right manner

At phase 2 and 3 **updated National position** significantly fosters the activity on main elements of nuclear infrastructure development.

“NATIONAL POSITION” STATUS AT PHASE 1 & 2

INIR 1 and 2:

- 18.06-29.06.2012
- Covered both phase 1 and phase 2
- 17 recommendations, no gaps regarding “National position” element
- NEPIO – Inter-Ministerial Commission, headed by first deputy Prime Minister; Department of Nuclear Energy of the Ministry of Energy serves as secretariat for Commission
- NEPIO reports covered all areas of NG-G-3.1 publication
- “Good practices” regarding NEPIO activities (*high level authority its report to; top-management staff; frequency of the meetings enough to solve any issue on the highest level of decision making*)
- Government role – defined in resolution of the Security Council of Belarus (*2008*) and in the Law “On the use of atomic energy” (*2008*)
- Appropriate agreements with vendor - 2 bilateral agreements between governments (*“On cooperation in the use of nuclear energy for peaceful purposes” (2009) and “On cooperation in construction of the NPP on the territory of the Republic of Belarus”* (*2011*))
- The responsibilities of the key national organizations as well as other relevant issues were managed through the Comprehensive Plan of main organizational measures for NPP construction in the Republic of Belarus (*approved by the Government in 2009*)

“NATIONAL POSITION” STATUS AT PHASE 3

INIR 3:

- 24.02-04.03.2020
- 7 recommendations, 6 suggestions, 5 good practices
- NEPIO is intented to keep operational
- 2 “Good practices” (*engagement and leadership of high level decision makers regarding close program and project monitoring; utilizing international peer review services at appropriate times in the developmetn of nuclear infrastructure*)
- The roles and responsibilities of the main stakeholders defined in updated Law “On the use of atomic energy” (*updated in 2009, 2011 and 2021; at the moment – replaced with another one law*)
- agreements and memorandums with 7 (*vendor included*) countries in the field of peaceful use of nuclear energy as well as cooperation under umbrella of Commonwealth of Independent States, with 7 countries – on cooperation with regulatory authorities, with 5 countries – intergovernmental agreements on early notification about nuclear incidents and exchange information in the field of n&r safety
- Member or observer in Regulatory Cooperation Forum (RCF), WENRA, WWER forum, ENSREG, WANO and IAEA (for sure)

USING MILESTONES APPROACH PUBLICATION FOR FURTHER INFRUSTRUCTURE DEVELOPMENT

The Decree of the Government № 535 “About the main directions of the unified state policy in the field of ensuring nuclear and radiation safety” (August 2023):

- States the national commitment to safety fundamentals (SF-1)
- Based on safety infrastructure elements from IAEA NG-G-3.1 and SSG 16 (rev. 1) “Establishing the Safety Infrastructure for a Nuclear Power Program”
- Contain strategic level measures for further development of each safety infrastructural element
- Takes into account potential expansion of the nuclear program (*as energy program, as scientific non energy nuclear projects*)

TRYING TO USE MILESTONES APPROACH PUBLICATION FOR POTENTIAL EXPAND OF NPP PROGRAMME

- NG-G-3.1 does not contain direct info of how infrastructural elements should be expanded in case of expanding nuclear program
- Need to elaborate approach for evaluating the readiness of national infrastructure for expanding (*activities on defining self-evaluation criteria and peer-review mechanism for national nuclear infrastructures is planned under umbrella of CIS structures*)
- Possible difficulties expected with the elaboration of mechanism for expanding such elements as:

– "human resource development" (*need to expand national educational system for preparing specialists that are not needed for current NPP program (e.g. to newly appeared national sub-contractors, national experts (for various types of safety expertise for a new project);*

– "industry involvement" (*need to expand pool of available national sub-contractors, manufactures for a new upcoming technology*)

NG-G-3.1 possibly might be added with some annex on infrastructure considerations for expanding NPP program

Contacts:
Department for nuclear and radiation safety (Gosatomnadzor)
https://gosatomnadzor.mchs.gov.by
gosatomnadzor@mchs.gov.by

Maksim Mazurenka
Head of division
mazurenko@gosatomnadzor.gov.by

„Personally, I am convinced that humanity needs nuclear energy. It must develop, but with absolute guarantees of safety. " A.D. Sakharov

Dr Winnie NDUBAI

20+ years of experience in the energy sector, with leadership roles in:

- National energy policy and strategic planning
- Nuclear infrastructure development
- Capacity building in energy and petroleum sectors
- Technical studies for Kenya’s nuclear power roadmap
- Research coordination and stakeholder engagement
- Former Chief Business Strategy Officer at KenGen
- Academic background includes:
- PhD & MSc in Finance
- BA in Economics, University of Nairobi
- Postgraduate Diploma, Maastricht School of Management

NUCLEAR POWER & ENERGY AGENCY

APPLICATION OF THE MILESTONES APPROACH IN KENYA'S NPP

IAEA Webinar Series
10th June, 2025

DR. WINNIE NDUBAI
DIRECTOR, STRATEGY & PLANNING

NuPEA

KENYA VISION 2030 Towards a globally competitive and prosperous nation.

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PRESENTATION OUTLINE

NuPEA

1. Kenya – Country Context
2. Application of IAEA Milestone Approach in Kenya's NPP Development
3. Infrastructure Development under Milestone Approach
4. Conclusion

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KENYA

COUNTRY CONTEXT

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KENYA'S INSTALLED POWER CAPACITY (2025)

ENERGY SOURCE	CAPACITY (MW)	% SHARE
Geothermal	963	29%
Hydro	830	25%
Thermal	698	21%
Wind	432	13%
Solar	199	6%
Imports	199	6%
Total Capacity	**3,321**	**100%**

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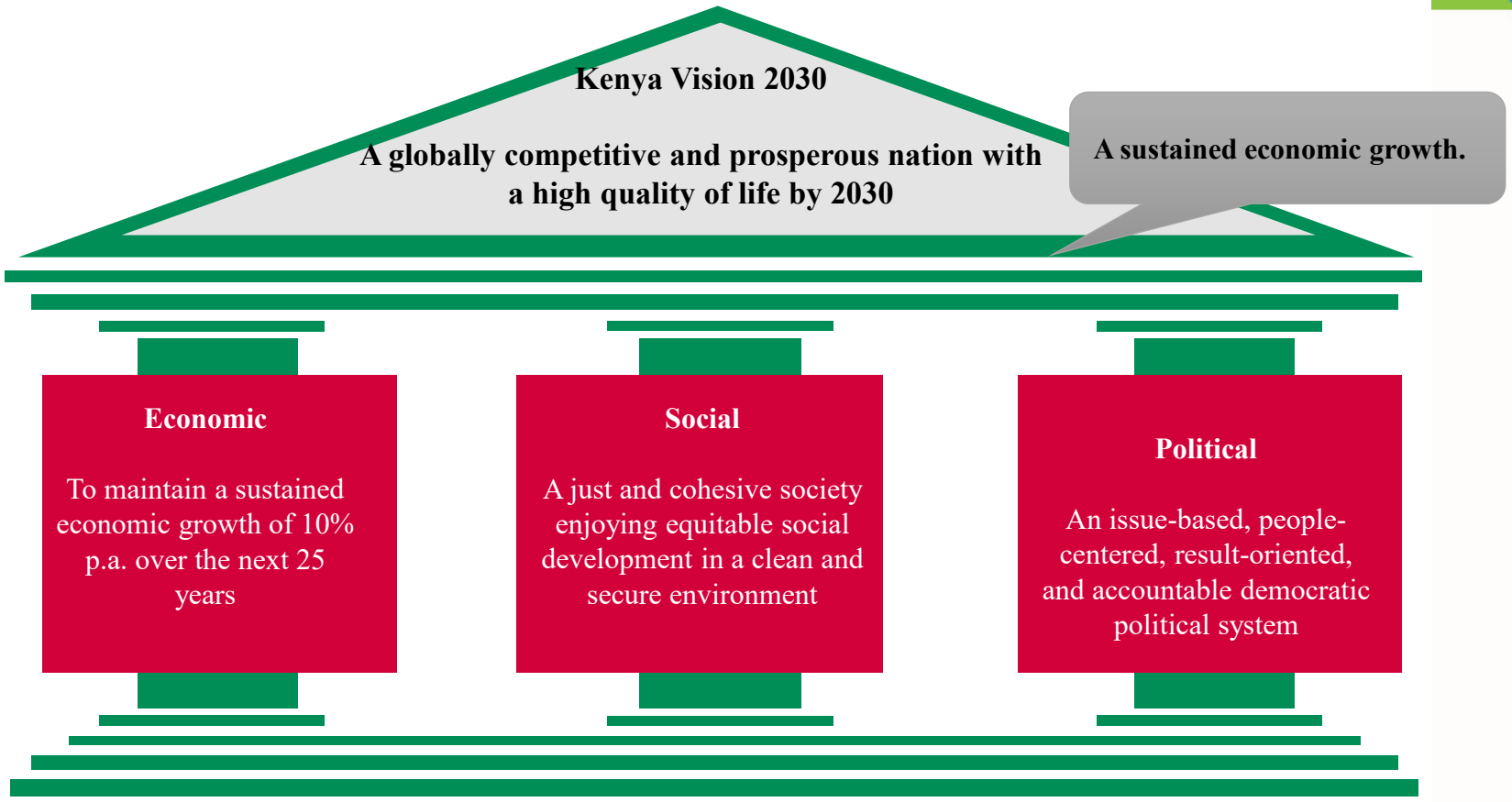
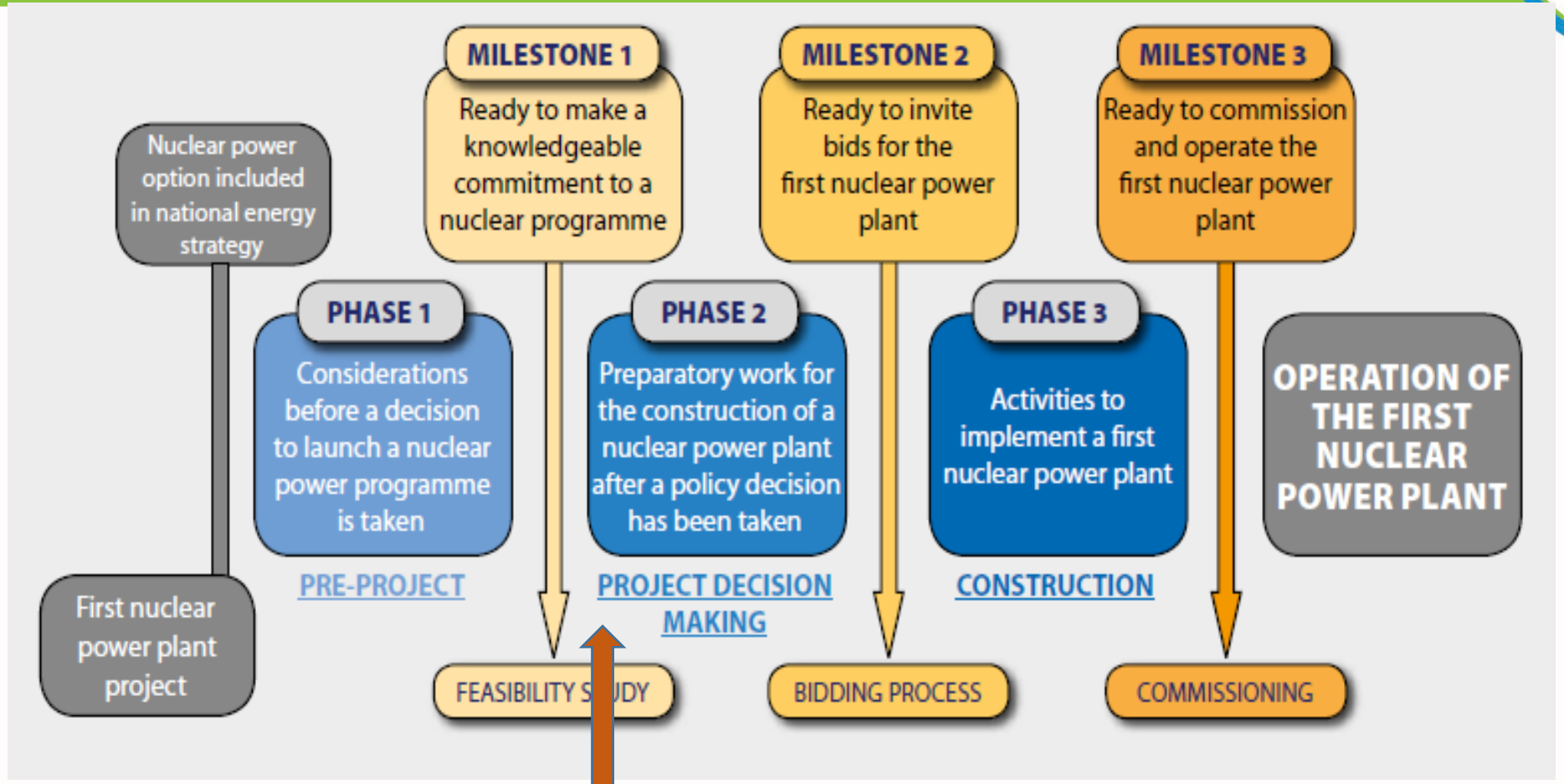
Energy is a Key Enabler for Vision 2030



Key Enabler:

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

Kenya's NPP is Based on Milestone Approach



10 – 25 years

We are here

Key Issues for Consideration in Undertaking a Nuclear Power Programme

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KENYA'S USE OF THE IAEA MILESTONE APPROACH PUBLICATION IN NPP DEVELOPMENT

'Experience and Lessons Learnt'

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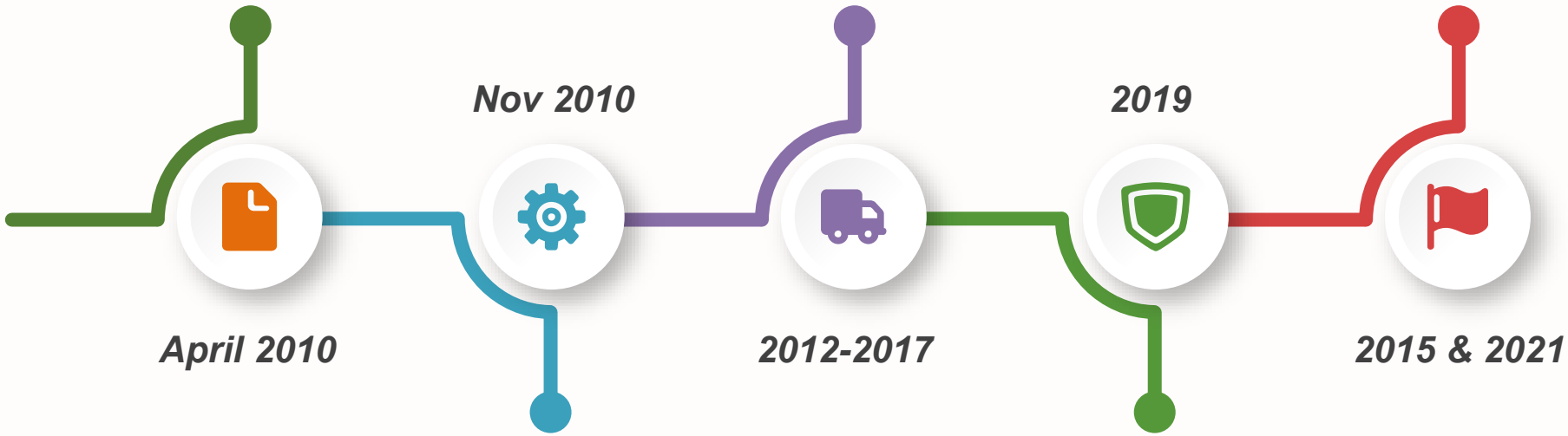
National Position Development



Kenya's Use of the Milestone Approach

1. To understand the commitments and obligations associated with the introduction of nuclear power.
2. Consolidation of nuclear infrastructure development in various phases
3. Understanding the capabilities needed by various actors (institutional and support bodies) for development and operation of a safe, secure and sustainable NPP
4. Resource allocation, bidding and budgeting.

INFRASTRUCTURE DEVELOPMENT UNDER IAEA MILESTONE APPROACH

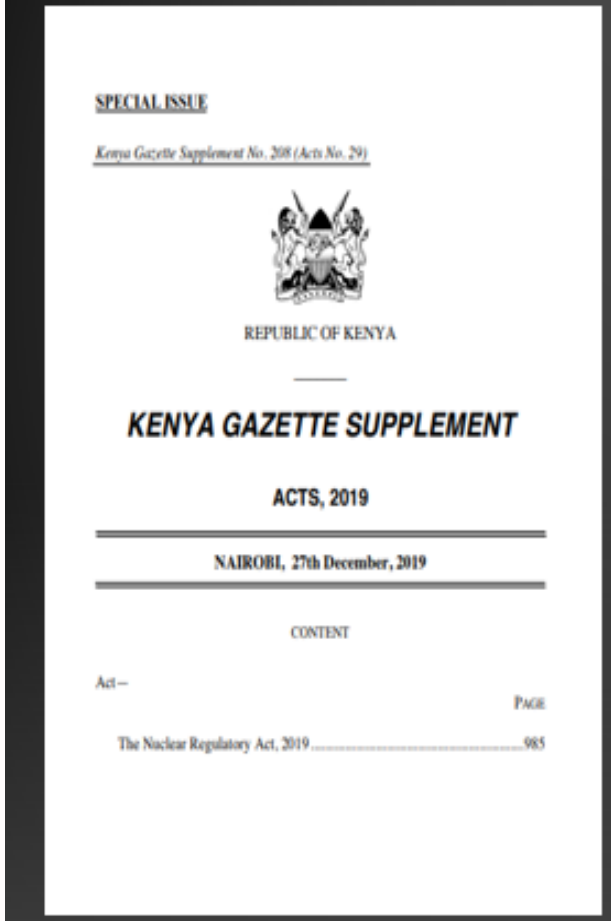
(few examples)

Key Nuclear Organizations

The Milestone Approach identifies three key organizations in development of nuclear power infrastructure, with responsibilities evolving as the programme advances;

- NEPIO
- Nuclear Regulatory Body
- Owner/Operator

Legal Framework:
Nuclear Regulatory Act, 2019



SPECIAL ISSUE

Kenya Gazette Supplement No. 208 (Acts No. 29)

REPUBLIC OF KENYA

KENYA GAZETTE SUPPLEMENT

ACTS, 2019

NAIROBI, 27th December, 2019

CONTENT

Act—

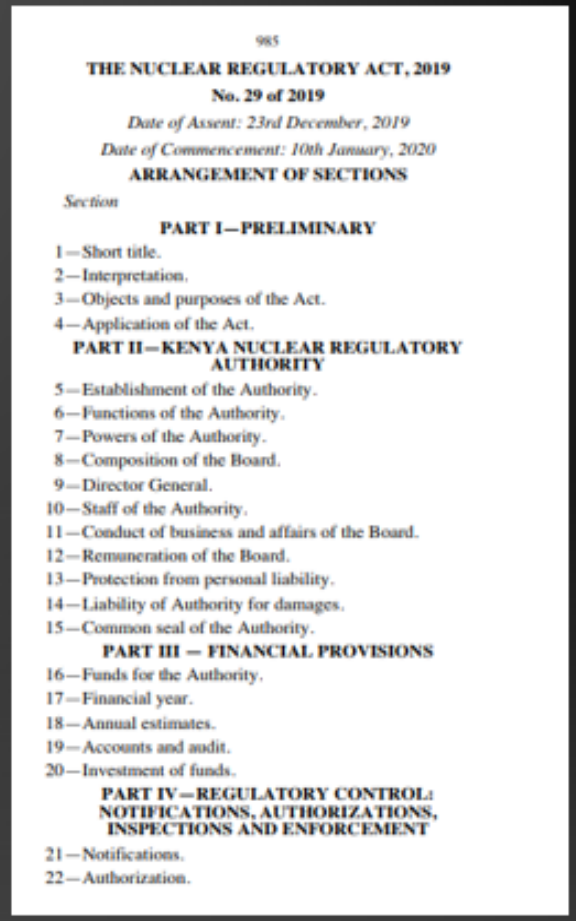
PAGE

The Nuclear Regulatory Act, 2019 985

The Nuclear Regulatory Act
NAIROBI, 27th December, 2019
SUPPLEMENT No. 208
Acts ,20I9((Acts No. 29)

Date of Assent:27th December, 2019

Date of Commencement: 10th January, 2020



985

THE NUCLEAR REGULATORY ACT, 2019

No. 29 of 2019

Date of Assent: 23rd December, 2019

Date of Commencement: 10th January, 2020

ARRANGEMENT OF SECTIONS

Section

PART I—PRELIMINARY

1—Short title.
2—Interpretation.
3—Objects and purposes of the Act.
4—Application of the Act.

PART II—KENYA NUCLEAR REGULATORY AUTHORITY

5—Establishment of the Authority.
6—Functions of the Authority.
7—Powers of the Authority.
8—Composition of the Board.
9—Director General.
10—Staff of the Authority.
11—Conduct of business and affairs of the Board.
12—Remuneration of the Board.
13—Protection from personal liability.
14—Liability of Authority for damages.
15—Common seal of the Authority.

PART III — FINANCIAL PROVISIONS

16—Funds for the Authority.
17—Financial year.
18—Annual estimates.
19—Accounts and audit.
20—Investment of funds.

PART IV—REGULATORY CONTROL: NOTIFICATIONS, AUTHORIZATIONS, INSPECTIONS AND ENFORCEMENT

21—Notifications.
22—Authorization.

The Act is a Comprehensive Regulation of Nuclear Technology Applications in the Country

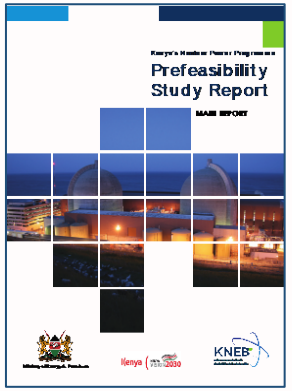
International Nuclear Treaties and Conventions

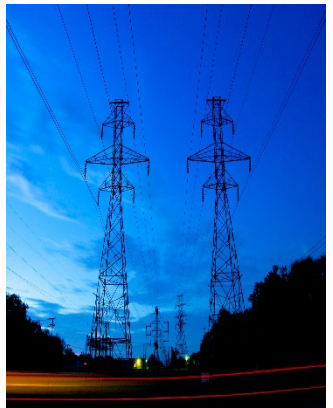
Ascension of International Treaties (Current)

- Convention on Nuclear Safety (the CNS) ;
- The Convention on Early Notification of a Nuclear Accident (the Early Notification Convention) ;
- The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention); and
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 1997 (the Joint Convention).

Technical Studies (Phase I and II)

- ❑ Pre-feasibility Study
- ❑ 15-year Comprehensive Plan for NPP
- ❑ National Electric Grid Study (for NPP)
- ❑ Reactor Technology Assessment
- ❑ Vendor Readiness Assessment
- ❑ Preliminary Siting Evaluation
- ❑ Preliminary Local Industry Capability Survey
- ❑ Strategic Environmental and Social Assessment (SESA)
- ❑ Preliminary HRD Strategy
- ❑ Preliminary Marine Sensitivity Study
- ❑ RFI developed
- ❑ Reactor Design requirements/specifications developed
- ❑ Seismic siting undertaken
- ❑ FS framework developed
- ❑ Nuclear Fuel Cycle roadmap developed





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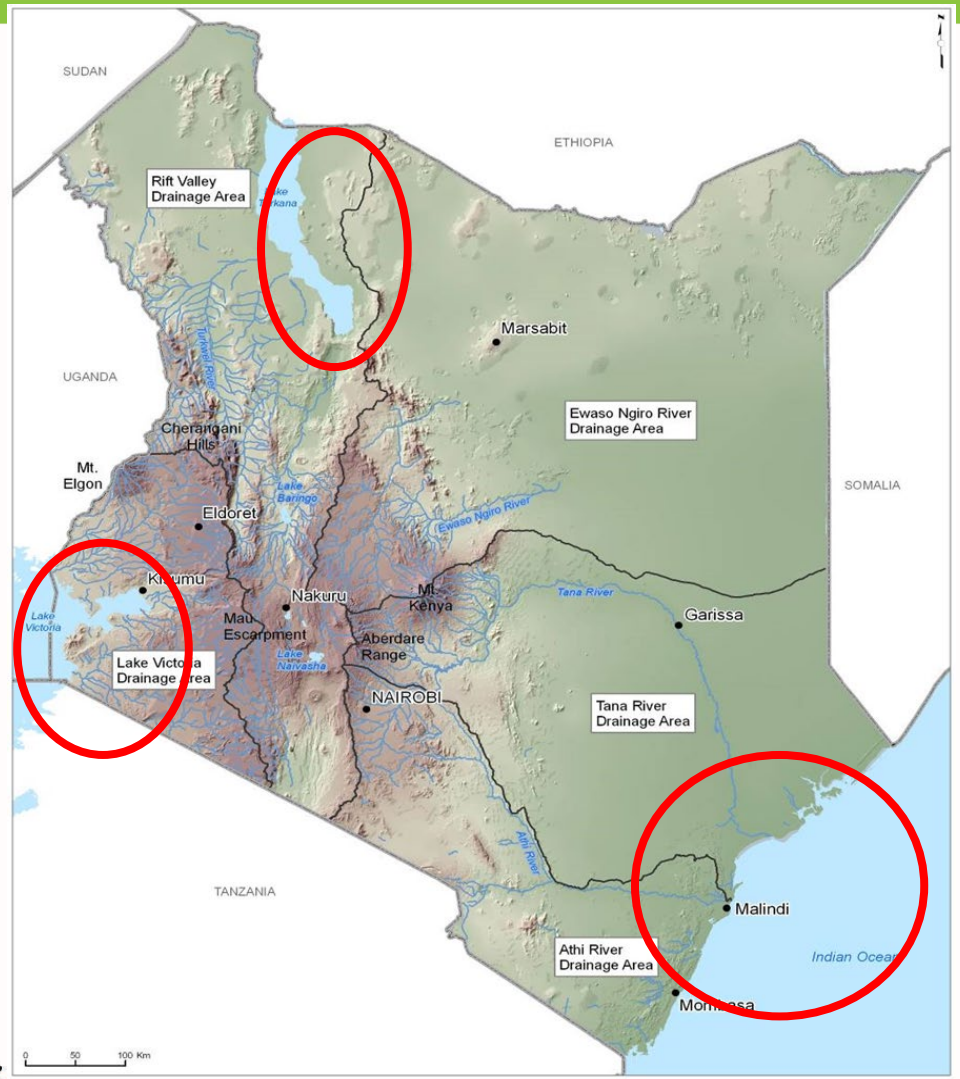
Site Selection of Nuclear Power Plants



- Preliminary Site Studies finalized.
- Detailed Site Selection Analysis to be undertaken on the best site (Kilifi County) and alternate site (Kwale County)

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Human and Institutional Capacity Development for the NPP

Comprehensive human resource development strategy developed for the programme

INSTITUTION	PROGRAM	No. TRAINED	ON GOING
KINGS	MSc. Nuclear Engineering	49	3
SEOUL NATIONAL UNIVERSITY	Energy Policy	4	1
KOREA INSTITUTE OF ADVANCED TECHNOLOGY	Nuclear Safety	8	-
TSINGHUA UNIVERSITY	MSc. Nuclear Engineering & Management	-	6
UNIVERSITY OF NAIROBI	MSc. Nuclear Science	68	23
KAIST-Kenya	MSc. Nuclear Engineering	-	-
Cumulative Total		**129**	**33**

Integrated Nuclear Infrastructure Review Mission (INIR)

- Undertook the INIR Phase I in 2015
- Nationwide Participation from all relevant institutions
- Finding: Kenya has made significant progress in its preparations to make a knowledgeable decision about introducing nuclear power
- An INIR action plan developed and implemented
- A Follow-Up INIR Mission undertaken from 08th to 11th June 2021

KENYA VISION 2030
Towards a globally competitive and prosperous nation.

ISO 9001 REGISTERED FIRM KEBS QUALITY MANAGEMENT SYSTEM EXCELLENCE

Valuable Additions in New Publication (Rev. 2)

1. Infrastructure considerations for SMR
2. The revised publication contains great additions, expansion and clarification of content for each phase, in each infrastructure issue
3. Good reference sources on all 19 infrastructure issues from the comprehensive bibliography in milestones publication (Rev. 2)

The Benefits of the Milestone Approach/Lessons Learnt

1. It provides a systematic approach to development of a new nuclear programme (*can be applied for expanding programmes*)
2. Availability of foundational basis for nuclear power programme analysis and decision making – national confidence building
3. Solid guidance on considerations for each phase (ordering of requirements and resource allocation)
4. Highlight of crucial stakeholders that should be included in each phase of NPP development – guides stakeholder mapping and engagement in different phases.

Conclusion

- The NPP is a long term and complex programme that requires consistent commitment to its implementation
- The IAEA Milestone Approach provides guidance in NPP development and/or expansion – it is an efficient and internationally credible mechanism for development of NPP programmes
- The IAEA offers infrastructure specific capacity building and review missions and support for countries in various stages of development.


Thank You!

Q&A Session

Mehmet CEYHAN
Nuclear Infrastructure Development Section, IAEA

Winnie NDUBAI
Director of Strategy & Planning, NuPEA, Kenya

Maksim MAZURENKA
Head of Division, Regulatory Body (Gosatomnadzor), Republic of Belarus

Upcoming webinar

IAEA Nuclear Infrastructure Development

Stakeholder Engagement in New Nuclear Power Programmes

20th August 2025
(tentative)

The materials from previous webinars under this series are available here:
Nuclear Infrastructure Publication Updates Webinar Series | IAEA

IAEA

Thank you!