

Nuclear Power in Africa: Opportunities and Challenges

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International Atomic Energy Agency

Nuclear Industry Congress Africa
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Outline

- **Africa is growing**
- **World nuclear power expansion**
- **The IAEA Milestones Approach**
- **Common challenges for newcomers**
- **Challenges and opportunities for Africa**
- **IAEA services**
- **Conclusions**

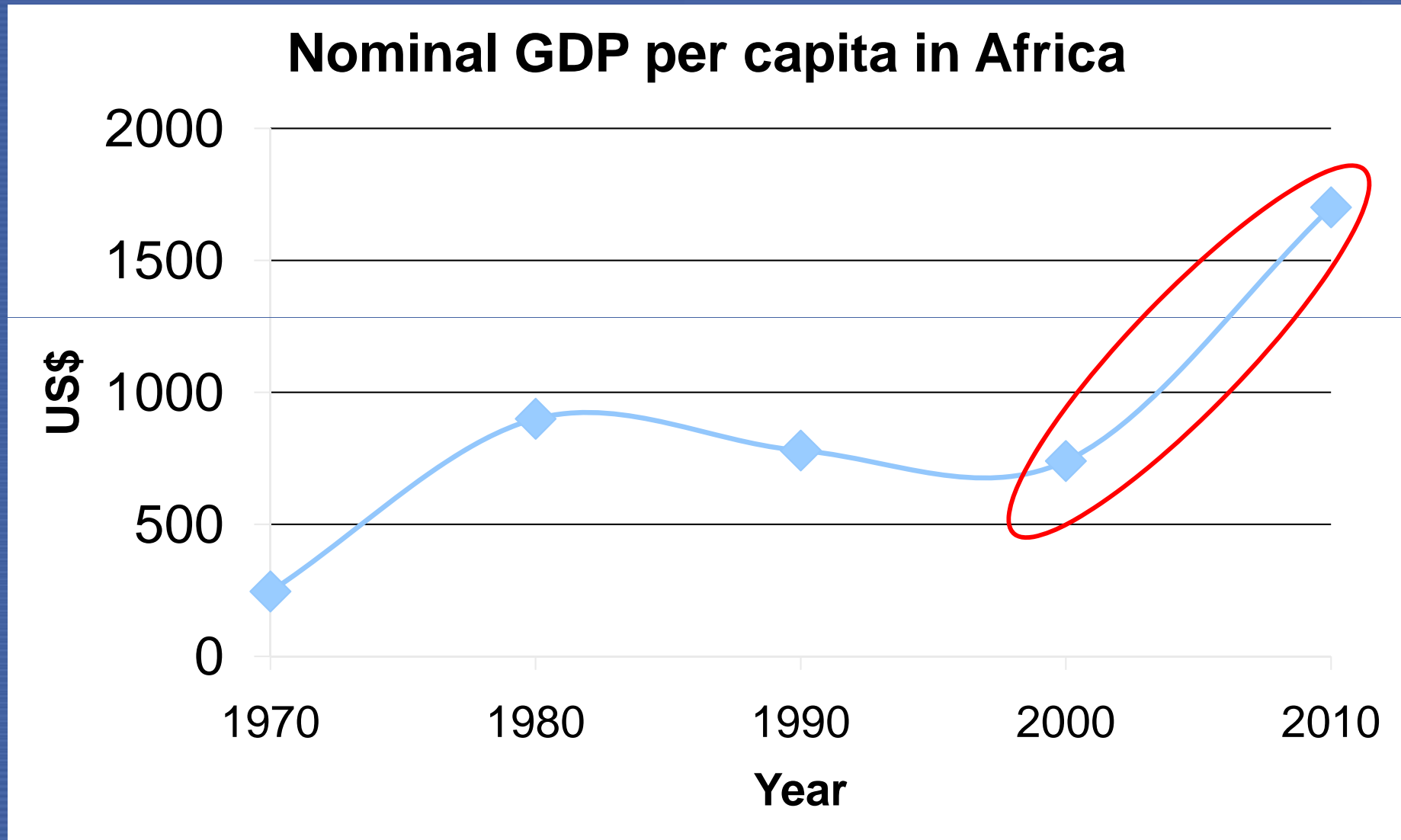
Africa Unplugged



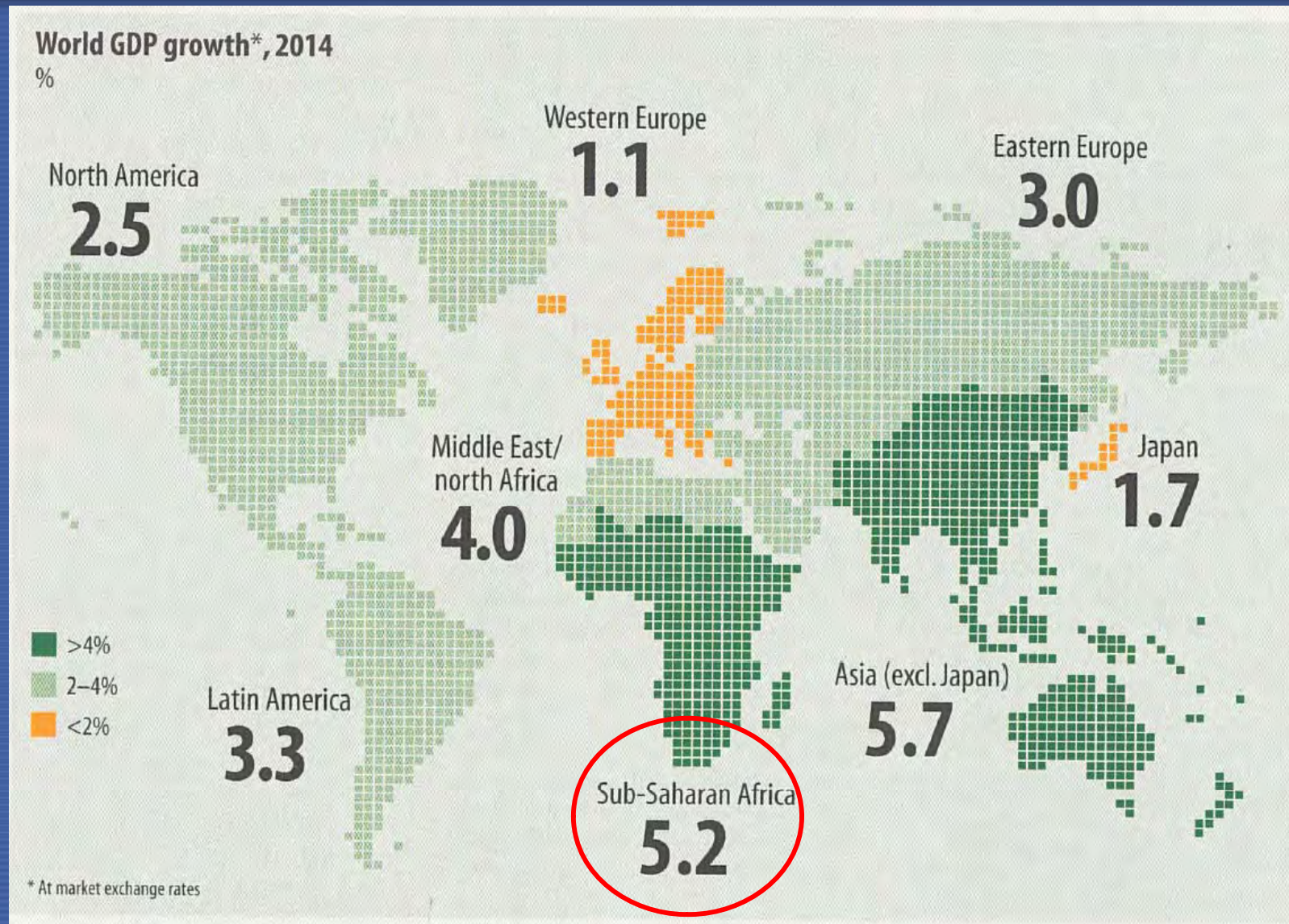
Earth at Night
More information available at:
<http://apod.nasa.gov/ap081005.html>

Astronomy Picture of the Day
2008 October 5
<http://apod.nasa.gov/>

Africa is Growing



Africa is Growing



Nuclear is an Option



“Access to stable sources of energy is vital both for developing countries and for developed countries. Overall demand for energy is growing steadily as the world population increases. In order to meet that growing demand, we need to tap all available sources of energy.”

“It is clear that many countries believe that nuclear power will have an important part to play in addressing one of the key challenges facing the world in the 21st century - securing adequate and sustainable supplies of clean energy.”

Yukiya Amano

IAEA Director General



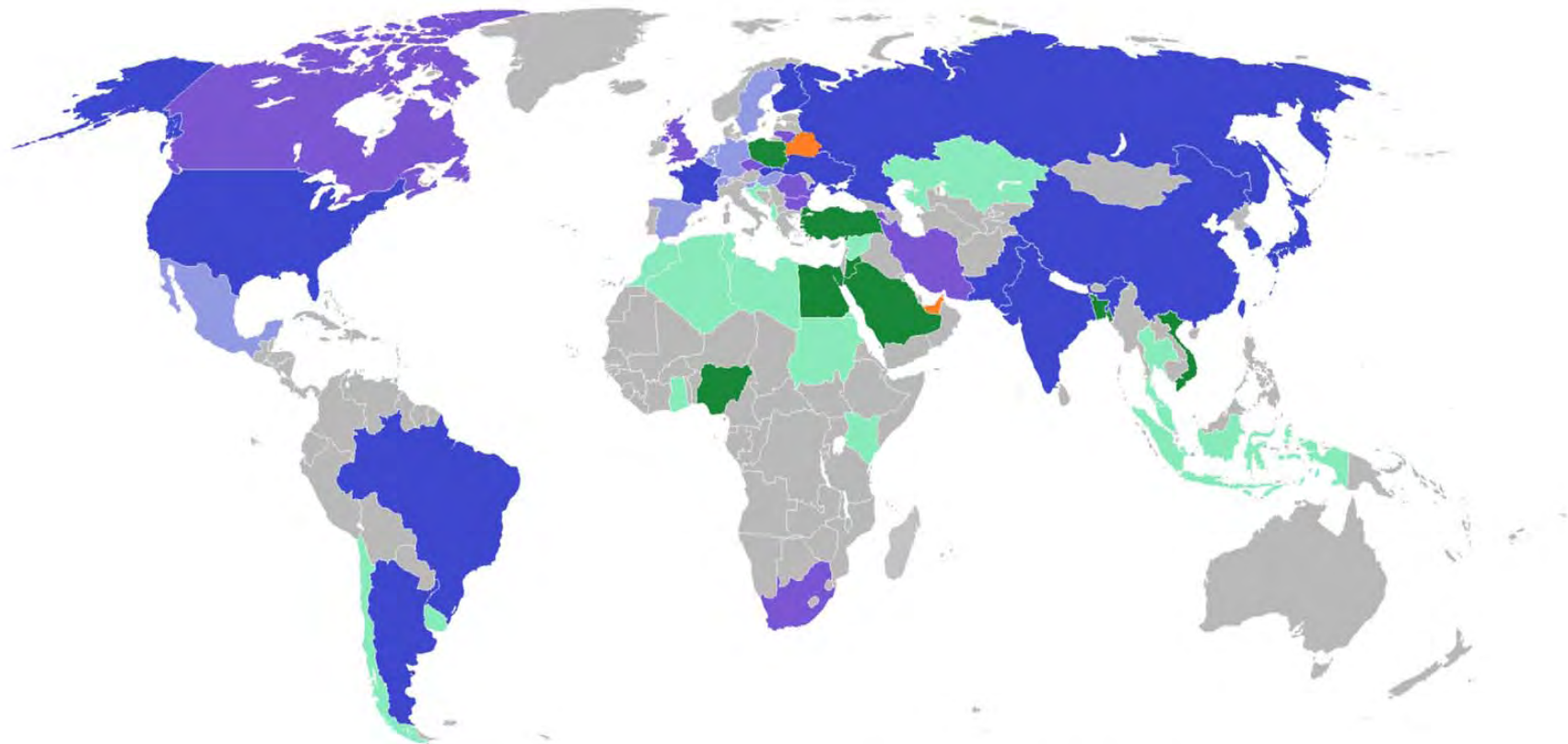
IAEA Ministerial Conference on Nuclear Power in the 21st Century

What Makes Nuclear Power Unique

- Long-term Government commitment needed
- High level of safety and security
- Capital intensive investment
- Well-trained human resources
- Control nuclear materials
- Long-term nuclear waste management
- Public perception



Who are the Newcomers



Operating

Operating with plans to expand

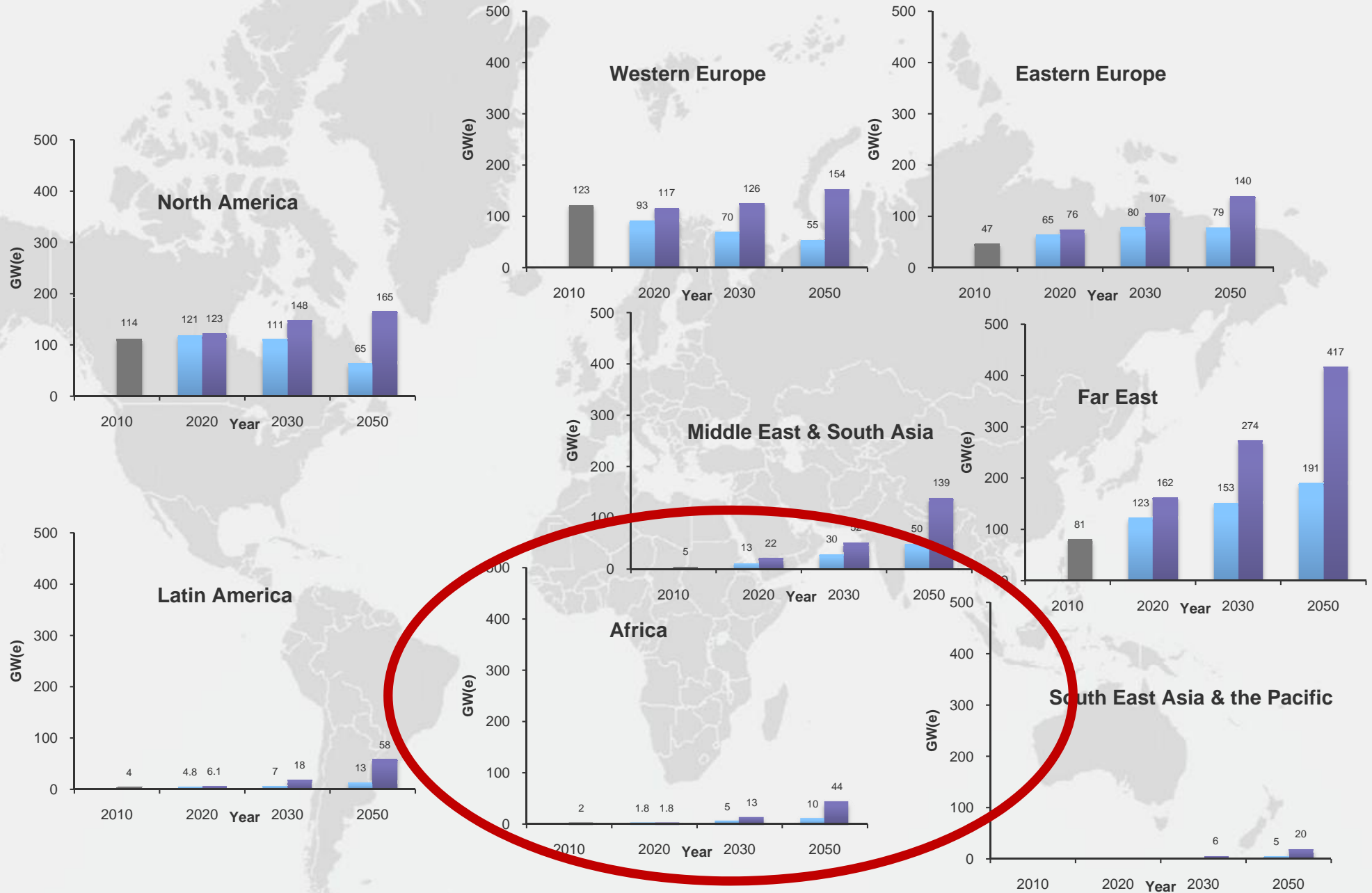
Considering nuclear power introduction

Operating and Constructing

1st NPP Under Construction

Decided to introduce nuclear power

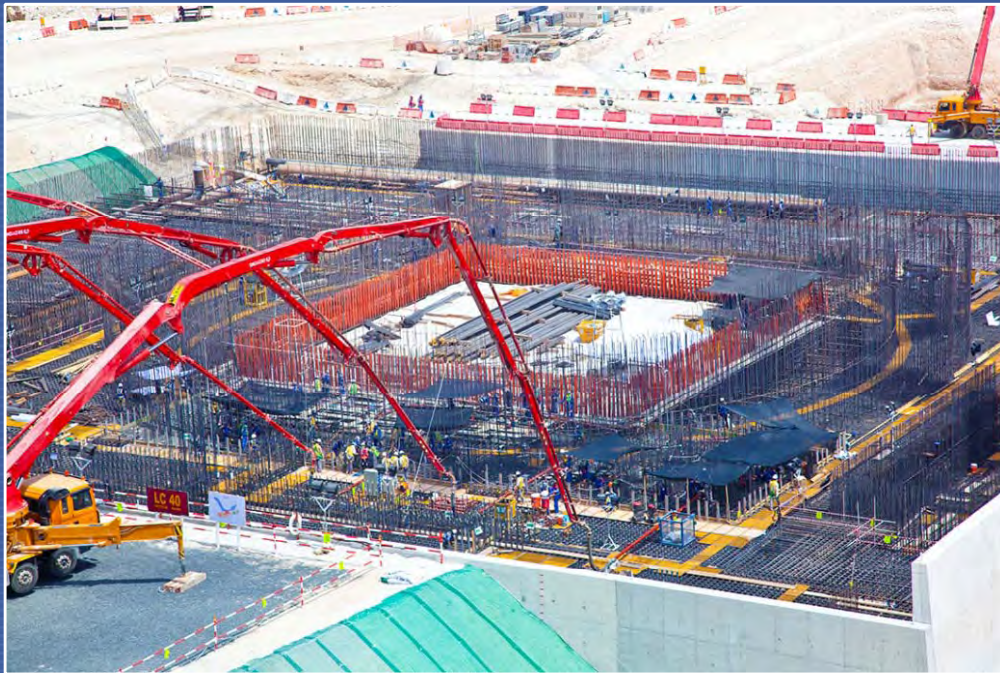
NUCLEAR POWER DEVELOPMENT TO 2050



Newcomers with 1st NPP Under Construction

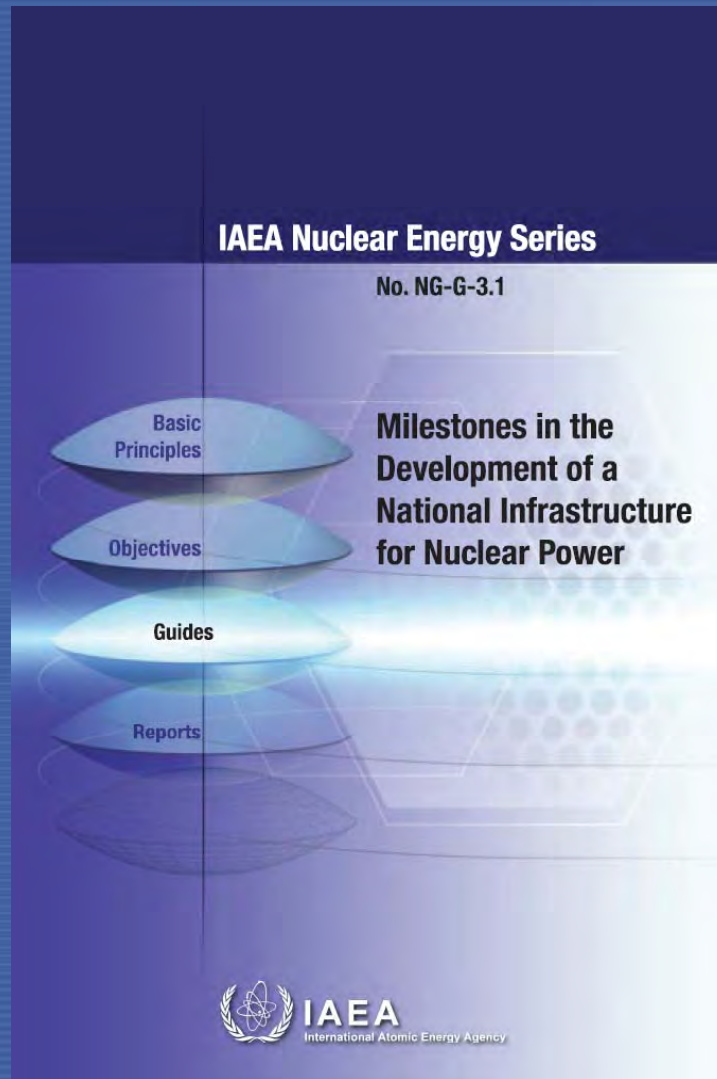
UAE – Unit 1, July 2012
Unit 2, May 2013

Belarus – Unit 1, Nov 2013



As many as 5 countries could have their first reactors under construction in the next 5 years

The Milestones Approach to Nuclear Power



- Phased
- Comprehensive
- Integrated

The Milestones Approach to Nuclear Power

Phase 1:
Decide!



Phase 2:
Prepare!



Phase 3:
Construct!



Milestones in the Development of a National Infrastructure for Nuclear Power (NG-G-3.1)

- National position
- Nuclear safety
- Management
- Funding and financing
- Legislative framework
- Safeguards
- Regulatory framework
- Radiation protection
- Electrical 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

Common Challenges of Newcomer Countries

IAEA activities with newcomers have identified several common challenges:

- National position development and decision-making
- Financing
- Legal and regulatory framework
- Stakeholder Involvement
- Human resource development

National Position: Coordination

- The Nuclear Energy Programme Implementing Organization (NEPIO)
 - Prepares the studies for the Government decision-making
 - Coordinates all of the stakeholders



Experts from KNEB and IAEA met in Nairobi in February 2013

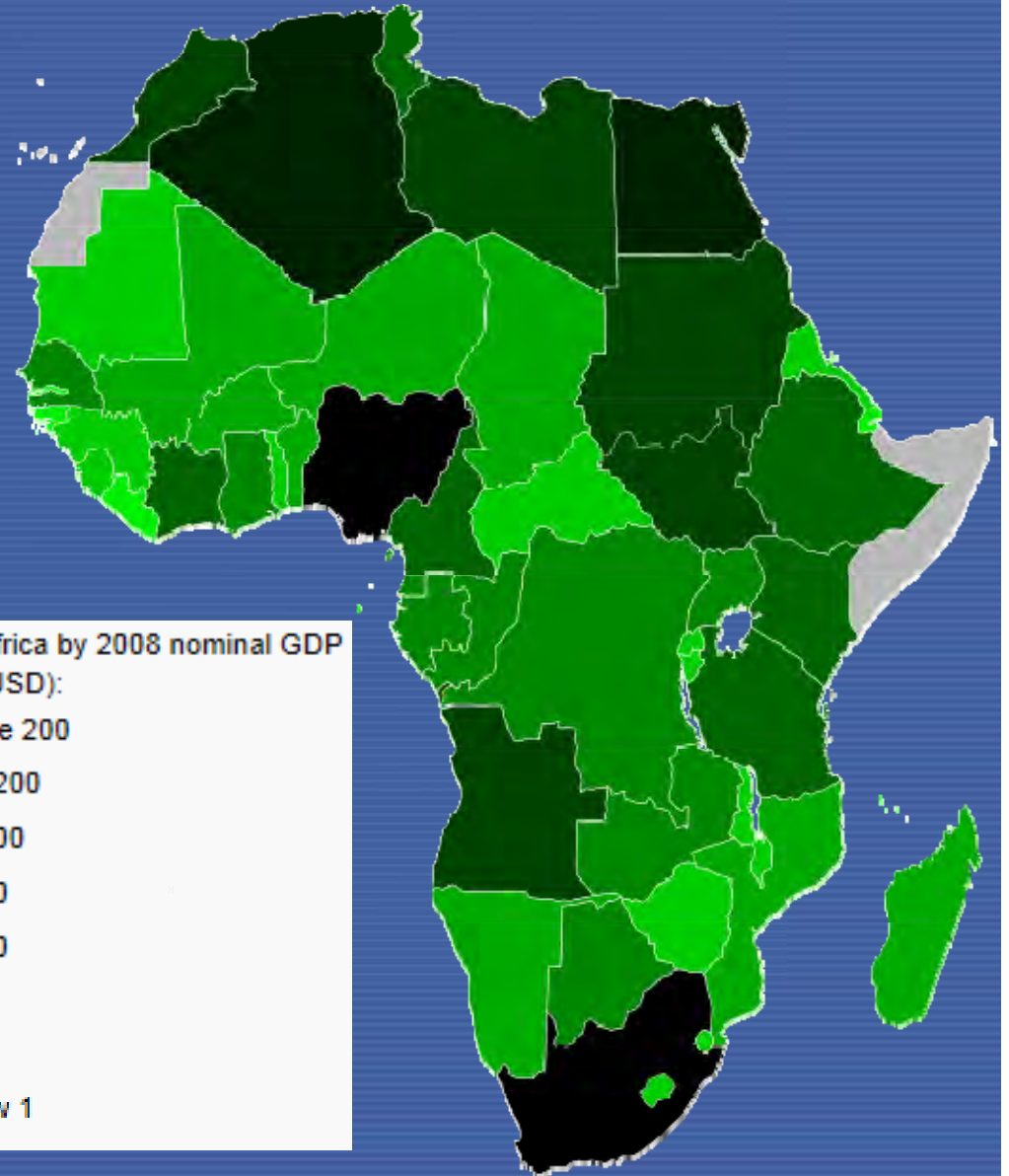
Role of the Government

- Setting national policies including for spent fuel, waste and industrial involvement
- Putting in place the legislative framework and assigning responsibilities
- Committing funding for the NEPIO, regulatory body
- Ensuring the availability of competent human resources
- Ensuring safety, security and safeguards



Financing the First NPP

- For many newcomers, the first NPP project is the largest investment undertaken by the country



Financing: Contractual Approaches

- Bid invitation
- Strategic partnership
- Build-own-operate (*First time in nuclear*)



Prime Ministers of the Russian Federation and Turkey sign the Intergovernmental Agreement for the Akkuyu project, May 2010, establishing the first BOO project.

Legislative and Regulatory Framework

- Legal framework establishes all of the responsibilities for the nuclear power programme
- Legislation should cover:
 - Safety
 - Security
 - Safeguards
 - Liability



Bangladesh passed comprehensive nuclear law in May 2012 and established an independent regulatory body (BAERA).

Stakeholder Involvement

- Engaging stakeholders and the public through honest and open dialogue is important for long-term support and to avoid delays
- Government, regulator body and owner/operator all have roles



Educating kids about nuclear power in South Africa (J. Mangena, Department of Public Enterprises)

Human Resources



UAE Regulatory Authority Management Team, July 2012

- UAE bridged the “experience gap” by using consultants and hiring foreign nationals in key positions
- With a policy to “Emiratize” the workforce over time, Emiratis work along side experienced personnel who provide training and mentoring

Human Resources

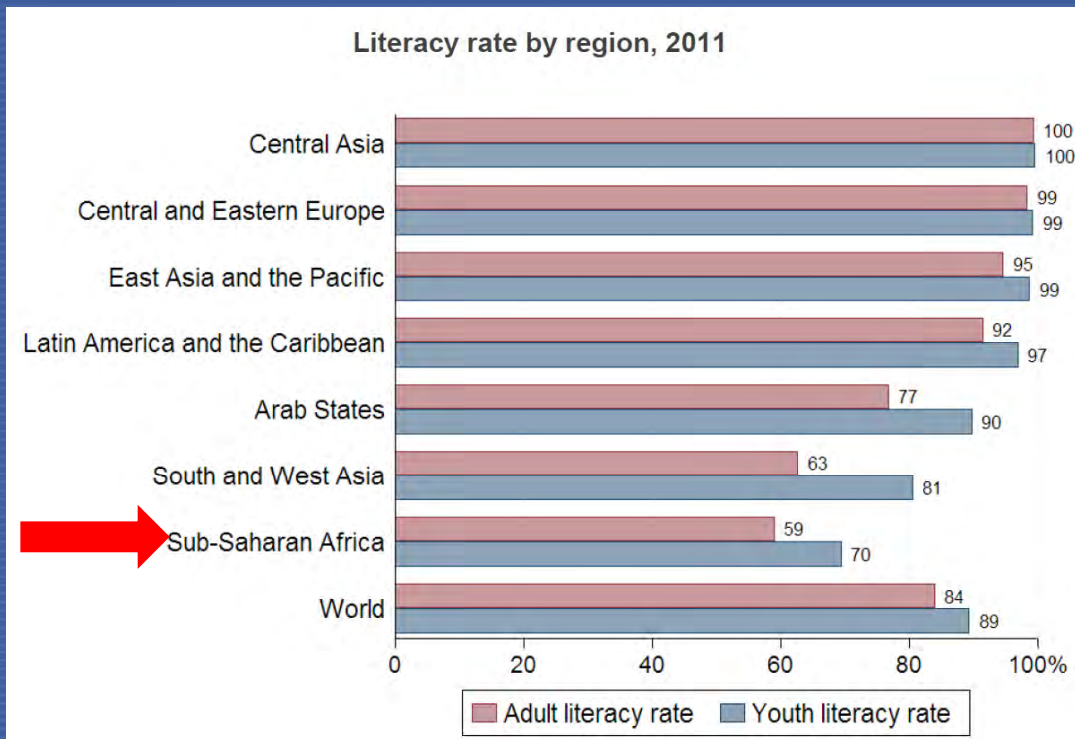
- Ensuring human resources should be in place to commission and operate the first nuclear power plant starts early

Source: Lee Peddicord TAMU, USA

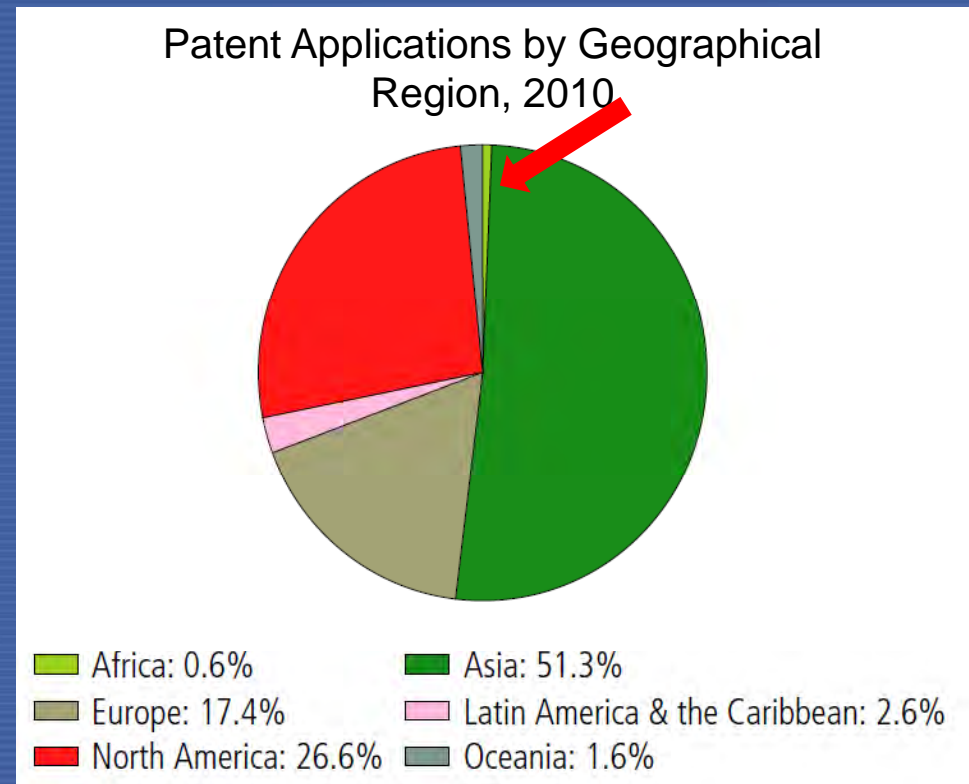


Challenges for Africa: Human Resources

- General level of science and technology should be enhanced



Source: UNESCO Institute for Statistics, Sep 2013



Source: World Intellectual Property Organization

Opportunities for Africa: Human Resources

- Learn from countries with experience
- Work together—regional approach
- Local participation to develop nuclear industry



IAEA Infrastructure Workshop, February 2013

Challenges for Africa: Electrical Grid



- 80% of African countries considering NP have installed generating capacity $< 10,000$ MW
- Grid stability and reliability issues

Opportunities for Africa: Grid Interconnections

- Regional approaches to enhancing electrical grids
- Several countries whose grid cannot support a NPP by itself

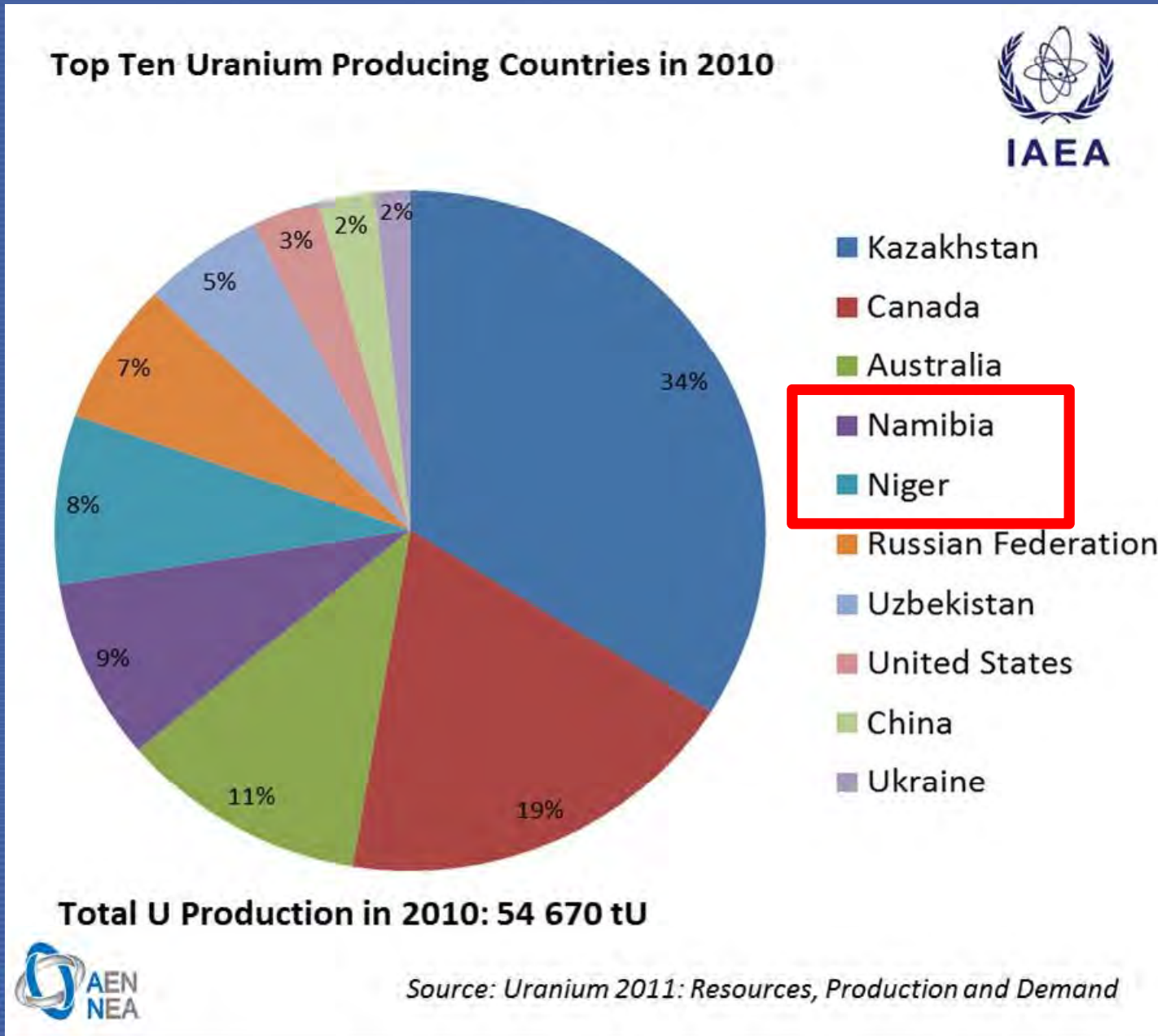


Opportunities for Africa: SMRs

- Many small and medium sized reactor designs may be available for near term deployment that can be used on grids with lower installed capacity.
- Several are being demonstrated now that may be available for deployment in the next 10 years.



Opportunities for Africa: Uranium



Opportunities for Africa: Regional Networks



Delegates of the first AFRA-NEST General Assembly participate in the Knowledge Marketplace (Tanzania, Sept 2013)

- **AFRA-NEST** is focused on maximizing the available infrastructure and expertise in Africa through networking of regional capabilities in nuclear education, science and technology.



AFRA-NEST



Impact of Nuclear Power

Industry Involvement : Contribution to Other Industries



Shipbuilding



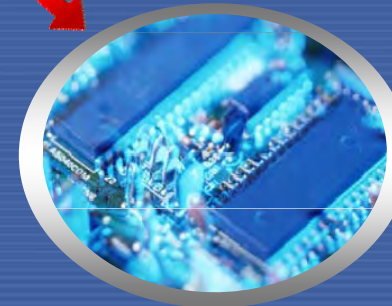
Chemistry



Machinery



Construction



Electronics



Metal



Environment

IAEA Assistance to Newcomers

- The IAEA offers a wide range of services to support the expansion of nuclear power
 - Guidance documents
 - Technical trainings, expert missions, and review services
 - Fellowships and scientific visits



Integrated Nuclear Infrastructure Reviews

- International expert review of infrastructure status
- Identifies areas for further action and makes recommendations



IAEA INIR mission team and South African counterparts, January-February 2013

Five Years of INIR Missions

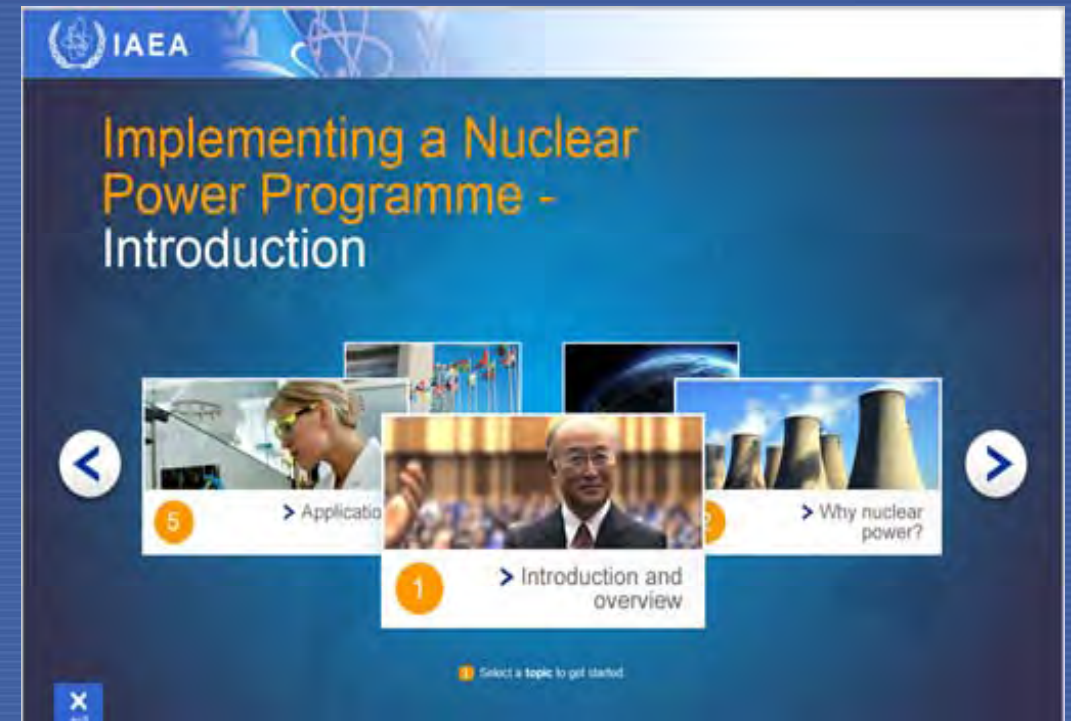
1. Jordan 2009
2. Indonesia 2009
3. Vietnam (phase 1) 2009
4. Thailand 2010
5. UAE 2011
6. Bangladesh 2011
7. Jordan (follow-up) 2012
8. Belarus 2012
9. Vietnam (phase 2) 2012
10. **South Africa** **2013**
11. Poland 2013
12. Turkey 2013



“The INIR mission has strengthened the expertise and also the cooperation amongst the nuclear industry in South Africa. This mission could not have come at a more important time for our country.”

IAEA E-Learning Series

- Milestones Approach
- HR Development
- Stakeholder Involvement
- Management of Nuclear Power Programme
- Construction Management
- Feasibility Study
- Systematic Approach to Training



<http://www.iaea.org/NuclearPower/Infrastructure/elearning/index.html>

Upcoming International Conference on HRD

IAEA International Human Resource Development Conference

May 2014
Vienna, Austria



**International Conference on
Human Resource Development for
Nuclear Power Programmes:
Building and Sustaining Capacity**

Strategies for Education and Training,
Networking and Knowledge Management

12–16 May 2014, Vienna, Austria

A graphic for the conference poster showing a group of white human silhouettes. Inside the silhouettes are various images related to nuclear energy: a woman at a computer, a man in a lab coat, a control room, and a nuclear reactor. The silhouettes are arranged in a cluster, suggesting a community or network of professionals.

Organized by the
 IAEA
International Atomic Energy Agency

www.iaea.org/meetings
CN-216

A QR code located in the bottom right corner of the poster graphic.

Conclusions

- Newcomers are moving ahead with their plans for nuclear power introduction
- The IAEA has developed the Milestones Approach to help guide Member States through this process
- Newcomers are responding to challenges in building the infrastructure in new ways
- The IAEA provides assistance to its member states with review missions and technical cooperation

Early 1960s Seoul, Korea



Early 1960s suburb Seoul, Korea



2013 Seoul, Korea



IAEA

2013 Seoul, Korea



Early 1960s Cheonggye-cheon Seoul, Korea



2013 Cheonggye-cheon Seoul, Korea



Early 1960s Countryside, Korea



2013 Countryside, Korea



2013 Countryside, Korea



2013 Countryside, Korea



Thank you for your attention

