RUSSIAN APPROACH TO NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT ABROAD

Leonid Yanko

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CONTENTS

WHAT IS …?

NPP CONSTRUCTION

is a large-scale and long-term project (not less than 10 years including preparatory stages) associated with INDUSTRIAL and SOCIAL CHANGES in the country which implies investment of BILLIONS of DOLLARS

THEREFORE

Treatment of both MONEY and TIME require proper organization and management

MAIN GOALS ASSOCIATED WITH NPP PROJECT

SAFETY:

- **Prevention** of accidents at nuclear power plants
- **Mitigation** of consequences of an accident if any

EFFICIENCY:

Use of the **Project Resources** should be **Optimized** aiming at progress in industrial and social spheres as well as at promotion of "spin-off effects" like enhancement of educational level, improvement of living standards etc.

WHAT IS …?

Nuclear Power INFRASTRUCTURE

is a comprehensive system of software and hardware arrangements established both at the State level and throughout the operating and regulating organizations dealing with nuclear power

Main Components

- Legal frame (laws and regulations)
- Human resources (knowledge, skills, safety awareness)
- Science and technical support (R&D centers, electrical grid, university science)
- Financial resources (mid- and long-term planning)
- Public involvement (information, participation in discussions)
- Nation-wide emergency planning and preparedness

NPP Construction Needs:

- workers' township
- roads
- electricity transmission lines and grids
- social services
- setting up new and loading existing factories

Building and installation staff rises up to 9 000 people

During the construction more than 12 000 people should be employed

ASSISTANCE TO FOREIGN COUNRIES IN DEVELOPING INFRASTRUCTURE (MAIN STAGES AND ACTIVITIES)

1. **From late 1950-es till beginning of 1970-es:**
   1) science and technology transfer to East European countries,
   2) beginning of education of foreign students in the USSR
2. **From beginning of 1970-es till mid-1980-es:**
   1) development of industrial capabilities to take part in joint construction of NPPs,
   2) large-scale program of education and training in Russia

RUSSIA (USSR) EXPERIENCE (2)

3. **Around year 2000:** training of managers, operators and maintenance staff from India, China and Iran at Russian operating NPPs

4. **Recent years:**
   1) consulting on creation of national legislation and Regulatory Body,
   2) new financial schemes for project implementation,
   3) creation of Public Information Centers,
   4) planning and implementation of education and training programs to ensure proper staffing of the NPPs in customer countries

Late 1950-es - First USSR technical assistance agreements on construction of pilot nuclear power plants

NPP Rheinsberg

NPP Bohunice A-1

AREARS of INTERNATIONAL COOPERATION

- R & D centers
- Construction of pilot nuclear power plants
- Science and technology information exchange
- Joint Institute for Nuclear Research as the ground for the teamwork of Russian and foreign experts
- Nuclear personnel training

RUSSIAN (USSR) TECHNICAL ASSISTANCE in NPP CONSTRUCTION

- Multilateral cooperation within the Council for Mutual Economic Assistance (COMECON)
- **1973**: INTERATOMENERGO - association of Bulgaria, CSSR, Hungary, GDR, Poland, Romania, USSR and Yugoslavia for cooperation in nuclear power
- **1979**: International Treaty on sharing responsibilities in manufacturing and supplies of NPP equipment

THE TREATY MEMBER-STATES SPECIALIZATION

- **CSSR** – reactor vessels, turbines, steam generators, pipings
- **Bulgaria** – biological shield, condensers, pumps
- **Hungary** – refuelling machines, special water treatment equipment
- **GDR** – bridge cranes, fuel transportation equipment
- **Poland** – pressurizers, heat exchangers, diesel generator, in-core instrumentation
- **Romania** – batteries
- **Yugoslavia** – bridge cranes, feedwater and special pumps

- **1978**: total NPP capacity in Bulgaria, Czechoslovakia, East Germany and the USSR amounted to 11,870 MW.
- **1980-es**: **COMECON countries became self-reliant in nuclear power industry**

EDUCATION & TRAINING

- **1971 – 1984**: over 5 000 NPP specialists from COMECON countries have been educated and trained in the USSR
- Many of them worked in leading positions at nuclear power plants, state nuclear power committees and ministries of their countries

FINLAND LOVIISA NPP: SUCCESSFUL COOPERATION

- Main nuclear reactor components for Loviisa NPP (440 MW) were designed and manufactured in the USSR
- Western solutions for I&C and safety systems have been integrated in Soviet design for the first time due to cooperation with Finnish companies
- After modernization, Loviisa NPP lifetime has been extended till 2030 increasing its capacity up to 510 MW for each unit

FINLAND LOVIISA NPP: PERSONNEL TRAINING EXPERIENCE

Training has been performed mainly in the period 1974-1976 in the Novovoronezh training center:

- about 60 specialists as operating shift personnel for the 1st and 2nd units
- about 50 specialists as supporting personnel

TIANWAN NPP: POST-USSR PERIOD CONSTRUCTION

- AES 91/99 design (1000 MW) was the result of on-going cooperation between Russian and Finnish companies
- AES 91/99 with some modifications was implemented at Tianwan NPP in China (2 units)

SURROUNDING AREAS INFRASTRUCTURE

Tianwan NPP Units 1-2 spurred:

- development of transport and communications
- creation of new jobs and new educational institutions
- improving living standards
- increasing the importance of the area across the country
- the nearby small fishing town of Lianyungang turned into a fashionable city

Volume of training conducted

The Iranian personnel enrolled for training (739 persons) has successfully mastered Russian language

For the moment the training has been conducted to the extent of 5887 persons x month. Thus theoretical training has been conducted to the extent of more than 90 % from planned volume. Theoretical preparation and part of practical lessons were carried out at Novovoronezh training center and Balakovskaya NPP, Russia

Personnel at NPP site

Now 203 persons of the Iranian personnel work along the Russian specialists at Bushehr NPP

43 persons have received final certificates on training completion

Practical training

A large-scale practical training on the Busher NPP of Iranian personnel, which completed the theoretical part has begun in the second half of 2008. This training was performed in accordance with individual programmes and generalized schedule.

A number of groups of Iranian personnel (56 specialists: welders, metrologists, defect control specialists, specialists on load-lifting mashines) has been trained in specialized Russian organizations.

RUSSIA-VIETNAM COOPERATION: NOWADAY EXAMPLE

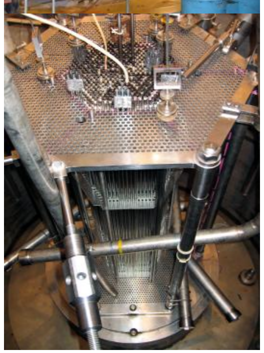
- 2002: Agreement on cooperation in peaceful use of nuclear energy
- 2009: Political decision of the Vietnamese Government to invite Russia to build first NPP in Vietnam without tender
- October 2010: Intergovernmental Agreement on cooperation in construction of the first NPP in Vietnam

RUSSIA-VIETNAM COOPERATION AREAS

- Russian Government loan to support project implementation (terms and conditions being negotiated)
- Nuclear legislation and regulatory activities (cooperation of the Regulatory Bodies)
- Intergovernmental Agreement on creation of a Nuclear Research Center with research reactor in Vietnam (draft document being negotiated)
- Site investigation assessment and approval
- Education (50 students began education in Russia in September 2010)
- Creation of Public Information Center on the basis of Hanoi Technical Institute

Russian Nuclear Research Reactors





NRR in operation

Worldwide...............272

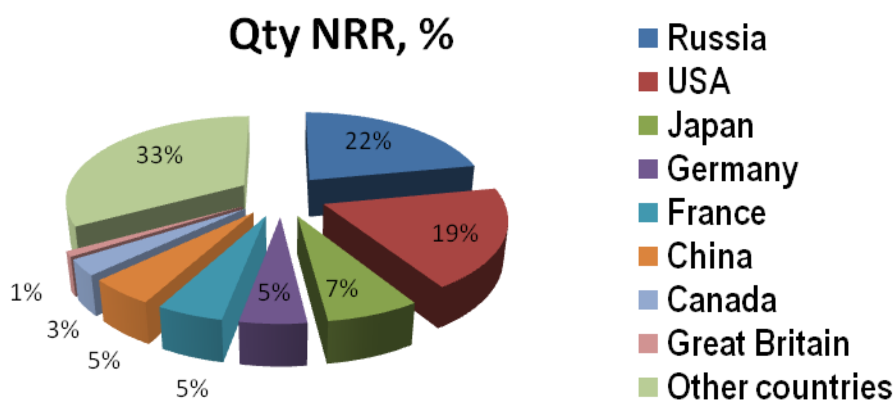
In Russia...................62

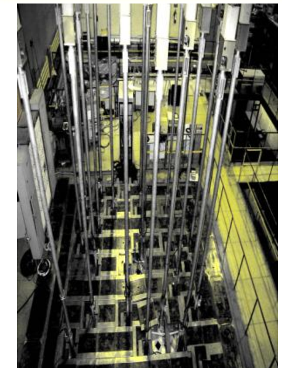
Russia has most research reactors (62), followed by USA (54), Japan (18), France (15), Germany (14) and China (13).

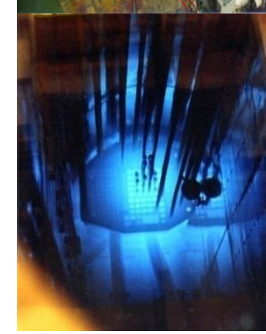
Many developing countries, including Bangladesh, Algeria, Colombia, Ghana, Jamaica, Libya, Thailand and Vietnam, also have research reactors.

About 20 research reactors in the world are planned or under construction, and 361 have been shut down or decommissioned.

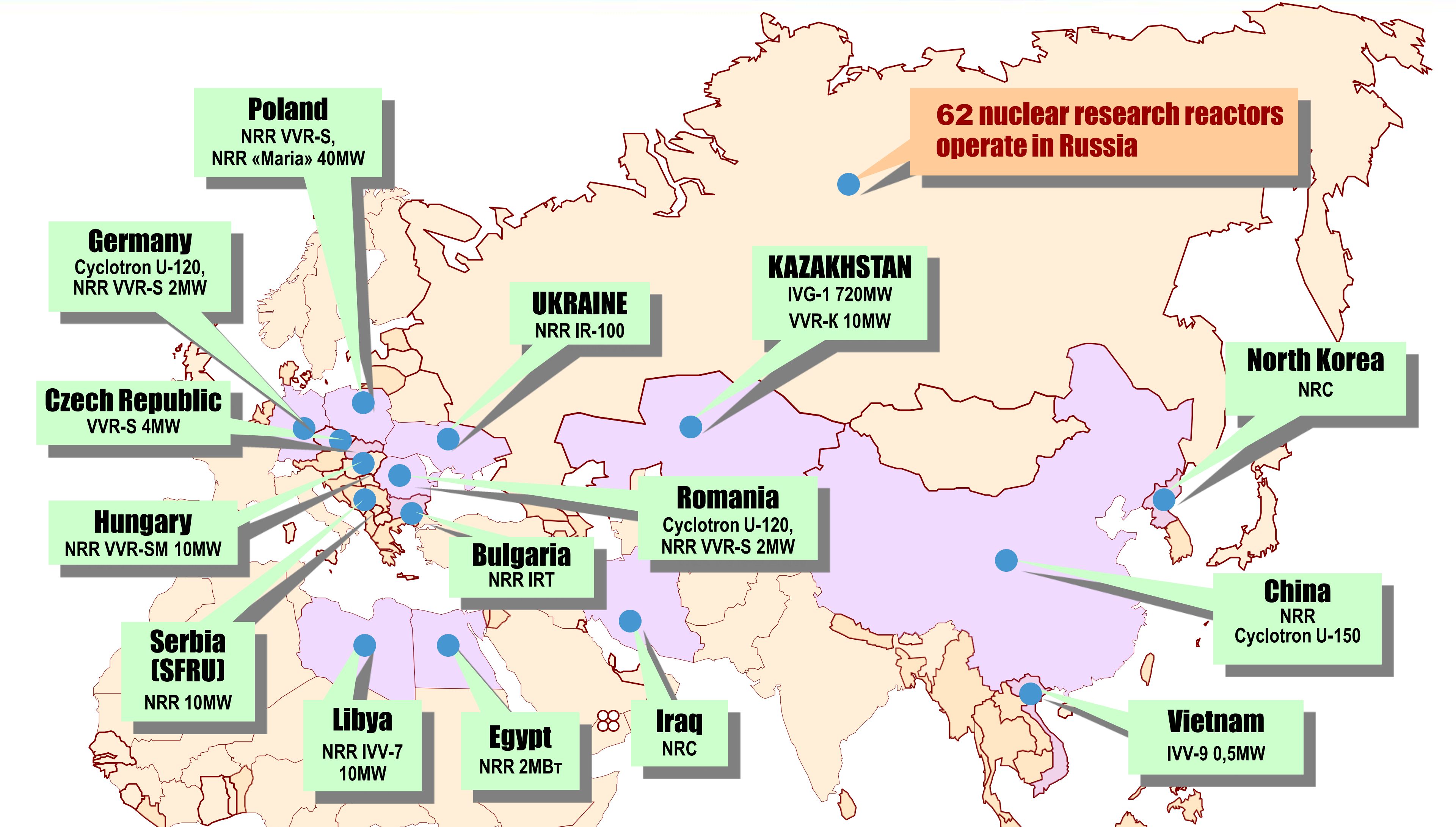
19 research reactors of Russian design were constructed outside Russia.







COMPLETED PROJECTS of NRC of Russian design



IAEA RECOMMENDATIONS to NUCLEAR POWER INFRASTRUCTURE DEVELOPMENT

- Nuclear Energy Basic Principles, IAEA Nuclear Energy Series No. NE-BP (2009)
- Evaluation of the Status of National Nuclear Infrastructure Development (2008)
- Managing the First Nuclear Power Plant Project, IAEA-TECDOC-1555, IAEA, Vienna (2007)
- Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1, IAEA, Vienna (2007)

- Considerations to Launch a Nuclear Power Programme, IAEA, Vienna (2007)
- Basic Infrastructure for a Nuclear Power Project, IAEA-TECDOC-1513, IAEA, Vienna (2006)
- Potential for Sharing Nuclear Power Infrastructure between Countries, IAEA-TECDOC-1522, IAEA, Vienna (2006)
- Fundamental Safety Principles, Safety Standards Series No. SF-1, IAEA, Vienna (2006)
- Handbook on Nuclear Law, IAEA, Vienna (2003)
- INIR - Integrated Nuclear Infrastructure Review Missions - Guidance on Preparing and Conducting INIR Missions, etc.

MAIN INFRASTRUCTURE ISSUES

Legal
Regulatory bodies
International agreements
Technical facilities
Finance/Economics
Human resources
Public acceptance

- National Law of nuclear power
- Law establishing powers of the Regulatory Body
- Legislation on nuclear safety
- Law on radioactive materials and radiation
- Legislation to implement international conventions and agreements
- Legislation on nuclear accounting for and control of nuclear materials
- Legislation on nuclear liability
- Law on emergency notification of nuclear incidents
- Law on foreign investments

- Laws/Acts/Rules/Codes/Guides/Standards/Regulations

MAIN INFRASTRUCTURE ISSUES

Legal
Regulatory bodies
International agreements
Technical facilities
Finance/Economics
Human resources
Public acceptance

- Independent Regulatory Body
- Nuclear regulatory process
- Nuclear regulatory codes and standards
- Staffing
- Environmental Regulator
- Environmental codes and standards
- Transparency

- Nuclear accident coordination
- Licensing / Inspection / Enforcement

MAIN INFRASTRUCTURE ISSUES

- Legal
- Regulatory bodies
- **International agreements**
- Technical facilities
- Finance/Economics
- Human resources
- Public acceptance

International agreements:

- Non Proliferation Treaty and Additional Protocol obligations
- Spent Fuel Management
- Enrichment and fabrication
- Long Term fuel supply guarantees
- Relationships with NSG
- Trade security

International cooperation

- Effective Legal Framework
- Efficient Regulatory Body

MAIN INFRASTRUCTURE ISSUES

- Legal
- Regulatory bodies
- International agreements
- **Technical facilities**
- Finance/Economics
- Human resources
- Public acceptance

- Site selection
- Reliable grid availability
- Spent fuel management arrangements
- Standard calibration laboratory facilities
- Safeguards plan and equipment
- Emergency response facilities/ organisation
- Communication and Transport infrastructure

MAIN INFRASTRUCTURE ISSUES

- Legal
- Regulatory bodies
- International agreements
- Technical facilities
- **Finance/Economics**
- Human resources
- Public acceptance

- Funding for construction
- Liability insurance
- Decommissioning and spent fuel fund system
- Electricity trading arrangements
- Government guarantees
- Government incentives

MAIN INFRASTRUCTURE ISSUES

- Legal
- Regulatory bodies
- International agreements
- Technical facilities
- Finance/Economics
- **Human resources**
- Public acceptance

- Adequate knowledge and skills for the Regulatory Body and Utility staff
- Adequate safety and radiation awareness among management and workforce
- Project management expertise
- Emergency response knowledge
- Education and training facilities
- Planned development of necessary skills

Human resources

University graduates / foreign experts/ recruitment /training/retraining

АСЭ·ASE

MAIN INFRASTRUCTURE ISSUES

РОСАТОМ

- Legal
- Regulatory bodies
- International agreements
- Technical facilities
- Finance/Economics
- Human resources
- **Public acceptance**

- Open communication
- Information
- Education
- Awareness of energy needs and options
- Awareness of sustainable development options
- Public participation in decision making
- Long term nuclear policy
- Long term public participation and involvement in benefits of operation

SCHEDULING and IMPLEMENTATION of REQUIRED INFRASTRUCTURE ELEMENTS

Nuclear power option included within the national energy strategy

MILESTONE 1
Ready to make a knowledgeable commitment to a nuclear programme

MILESTONE 2
Ready to invite bids for the first NPP

MILESTONE 3
Ready to commission and operate the first NPP

Nuclear Development Programme

PHASE 1

Considerations before a decision to launch a nuclear power programme is taken

Pre-project

PHASE 2

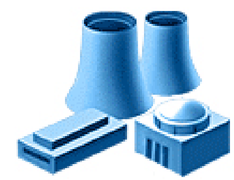
Preparatory work for NPP construction after a policy decision has been taken

Project decision making

PHASE 3

Activities to implement a first NPP

Construction



Operation / decommissioning

Feasibility study

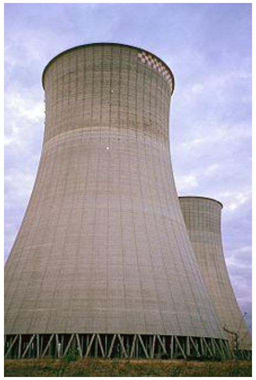
Bidding process

NPP commissioning

Source: Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA

RATHER than CONCLUSION

Over 50 years of successful international cooperation proves that attention to all issues of INFRASTRUCTURE starting from the earliest phase of NPP construction project facilitates successful introduction of nuclear power



Thank You for Your Attention!

2 Dmitrovskoye sh., Moscow, 115184, Russia

Tel.: +7 (495) 737-9037
E-mail: post@atomstroyexport.ru