РОСАТОМ

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

BEYOND FUKUSHIMA

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Tokyo
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Talk without emotions

РОСАТОМ

Radiation consequences for people in the accident according to TEPCO:

The total dose (external and internal)

More than 250 mSv : 9 cases (max 678 mSv)

from 200 to 250 mSv : 8 cases

[source] TEPCO

Even the maximum dose received by personnel does not effect the life and human health, but for the public the consequences of radiation accidents seem to be very dangerous.

The same can be applied to region around nuclear power plant. The predicted dose that can be obtained by permanent residents in those territories, do not represent any threat to human health. There are a lot of areas on Earth with higher level of natural radiation.
But the decision to return people to these areas will not be accepted because of the overvalued risk.

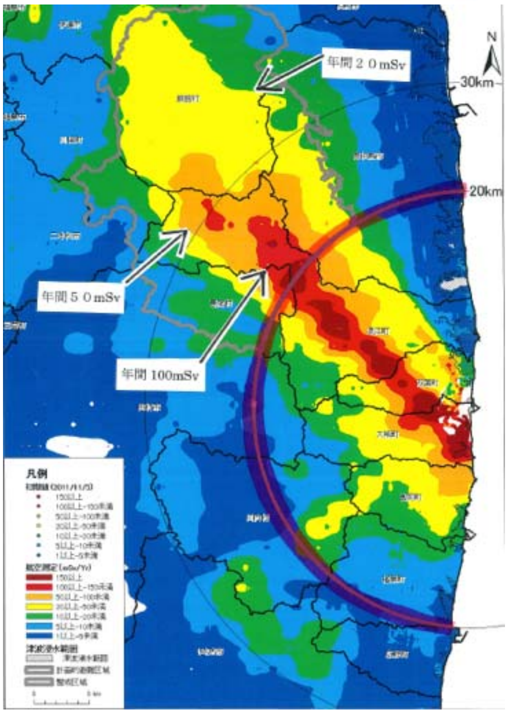
Status of areas near NPP

Announcement of the Headquarters regarding the activities, preventing the impact of the accident at the NPP (26.12.2011):

1. It is planned to lift the ban for the residence in the territories with the exposure less than 20 mSv/a, which means in the green and blue zones in radius of 20 km.

2. To prolong the ban to the residence in the territories with the exposure 20 – 50 mSv/a, which means in the yellow zone, however the ban should be lifted after the deactivation procedures.

3. To mark the territories with the exposure more than 50 mSv/a, as “zones, not available for return”, for a period of 5 years (brown and red zones).



Predictable annual dosage (to the November 5th 2011)

[Source] http://www.meti.go.jp/earthquake/nuclear/pdf/111226_01a.pdf

The influence of the Fukushima accident to the World Nuclear Energy

Production of nuclear electricity is significantly reduced:

During 2010 in the World NPPs produced - 2630 billion kWh

During Jan-Nov 2011 produced - 1 867,3 billion kWh **(- 5,7% to 2010)**

Several countries declared a gradual closure of nuclear power: Germany, Switzerland.

Several countries have frozen the construction of new NPPs: Bulgaria.

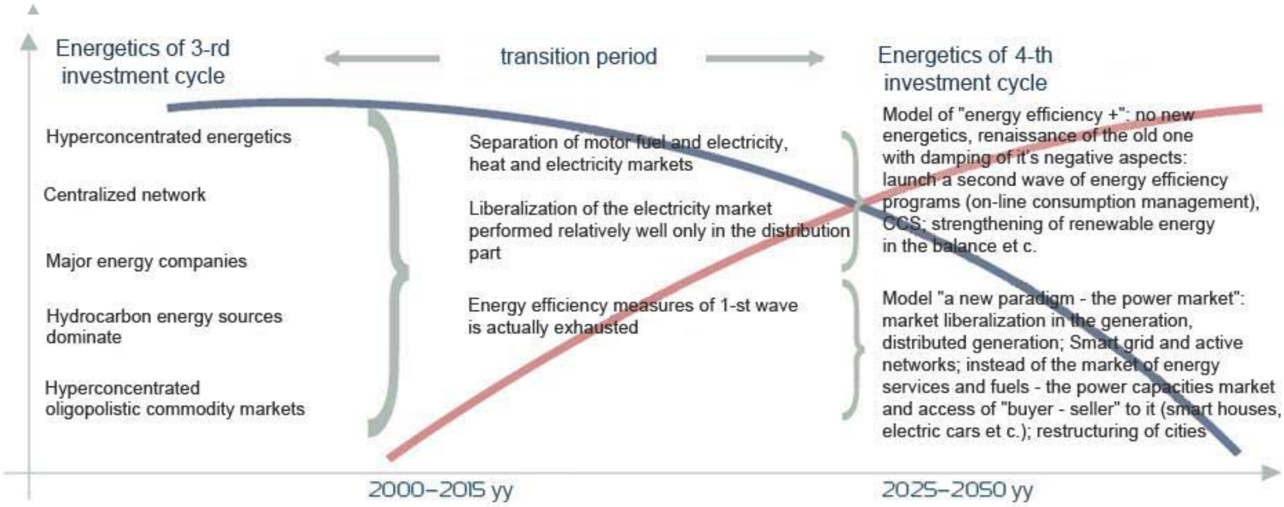
ALL countries with nuclear power expressed the need for tighter regulations on plant safety.

IMPLICATIONS: tougher standards will increase the cost of nuclear energy production, and reduce of the industry will further increase the cost of generation (the cost of the fuel cycle, radioactive waste managing will not reduced).

Nuclear energy may become uncompetitive

Changing the energy model

The world is just beginning to design a "new paradigm" of energy.
The existing energy system will run at least 40-50 years



- carbon-free balance
- effective consumers
- Distributed generation by renewable energy
- Producers - Consumers
- Efficient major generators
- Large power transmission lines and units
- Large generation – peak (PSPP)
- Smart networks

Competitiveness of NPPs is declining against a background of alternative energy growing

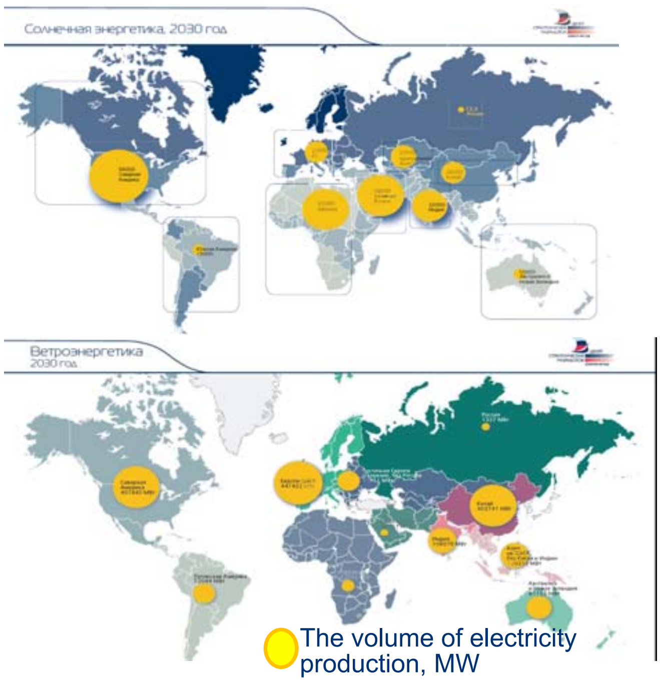
Portion of Renewable Energy (RE) in the world balance - 8,6%

The global volume of installed capacity – 1140 GW.

The growth rate – 3,2% (in Europe – 5,8%).
In 1995, RE accounted for 1-2% of total production, in 2020 planned portion in the energy development programs is 20-25%.

In some countries it is already a reality:

Country	RE portion,%	Type
Iceland	25	Geothermal
Denmark	20,6	Wind
Spain	17,7	Solar



Expansion increases the competitiveness of RE

The main challenge for the nuclear industry – increasing of competitiveness

Competitiveness of nuclear power is declining against a background of growing competitiveness of alternative energy.

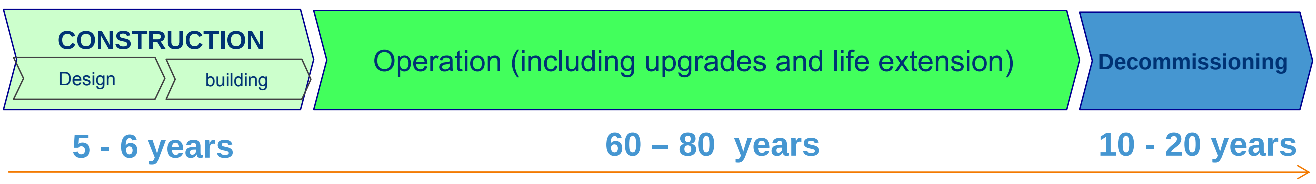
The new model of energy (intelligent networks, distributed small generation) will need a large base generation.
This basic generation should be carbon-free.
This is the place of Nuclear Energy.

But to take this place Atomic Energy can only by improving of competitiveness and simultaneously performing new, more stringent safety standards.

If we do not solve this problem, we’ll get a reduction in commissioning of new NPPs and a gradual decrease of the Atomic Energy portion - Nuclear Renaissance will end before it started!

NPP Lifecycle Management - the key to security and competitiveness

The life cycle of an object is over 100 years



During the NPP life cycle there are changes of:
- NPP Itself (aging, replacement of equipment),
- our knowledge of the external and internal threats to the object (terrorism, clarification of seismic and tsunami hazards),
- staff training system (Fukushima showed that the staff is one of the major risk factors),
- requirements for the object safety (standards tightening).

The object and its system environment are changing and it is necessary to have an adequate life-cycle management system

NPP Lifecycle Management - the key to security and competitiveness

CONSTRUCTION: Design → building → OPERATION (including UPGRADES and LIFE EXTENSION) → Decommissioning

Ensure the NPP safety is possible only in the lifecycle management logic - when at different stages of plant life we re-evaluate its safety and conduct the necessary technical and organizational measures.

It is necessary to assess the state of NPP adequately to the level of security threats:
- Is there enough level of reserve power supply protection system against flooding, taking into account the maximum possible height of the tsunami**?**,
- Is it acceptable – not to have the hydrogen removal systems in the Unit outside the containment**?**,

It is necessary to teach the staff and prepare regulations adequately to the level of threats :
- Open the hatches in the roof of the Unit during the etching of the containment pressure into the reactor building: this should be in the regulations and properly trained personnel should manage to do this even without regulation.

The information model of the object - a tool to improve competitiveness and security

CONSTRUCTION: design → building → Operation (including upgrades and life extension) → Decommissioning

5 - 6 years | 60 – 80 years | 10 - 20 years

The value of information for the engineering company | The value of information for energy company | The value of information for the decommissioning company

NPP information model, **including the safety case,** should be created at the design stage and transmitted to all subsequent stages of the life cycle with filling and changing during the entire NPP life cycle

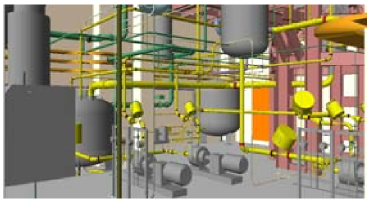
To meet the new situation ATOMIC ENERGY needs a full digitalization of lifecycle management for all nuclear power plants

Reducing the cost and timing of construction - a necessary condition for competitiveness

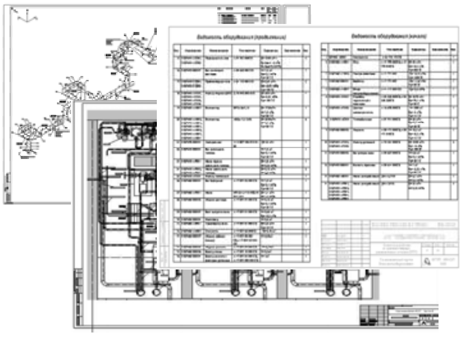
CONSTRUCTION: design → building | Operation | Decommissioning

The use of 6D-modeling and Lean construction during the design and building of NPP

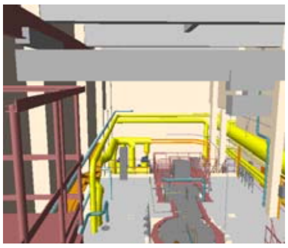
Price depends on the NPP design (WHAT we are building), and the organization of the construction process (HOW we are building). LastPlanner (a special case of Toyota Production System) - method of managing seven key streams on site: people, information, equipment, materials, previous work, secure external environment and a safe space.



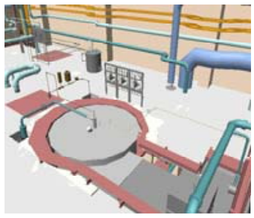
The movement inside building



Working documentation



The motion of the object (crane)



1 *Collision check*

The global nuclear fuel cycle - new basis of security and nonproliferation

Matters of the nuclear fuel cycle become crucial for the nuclear power development in the world.

A reasonable response to this challenge:

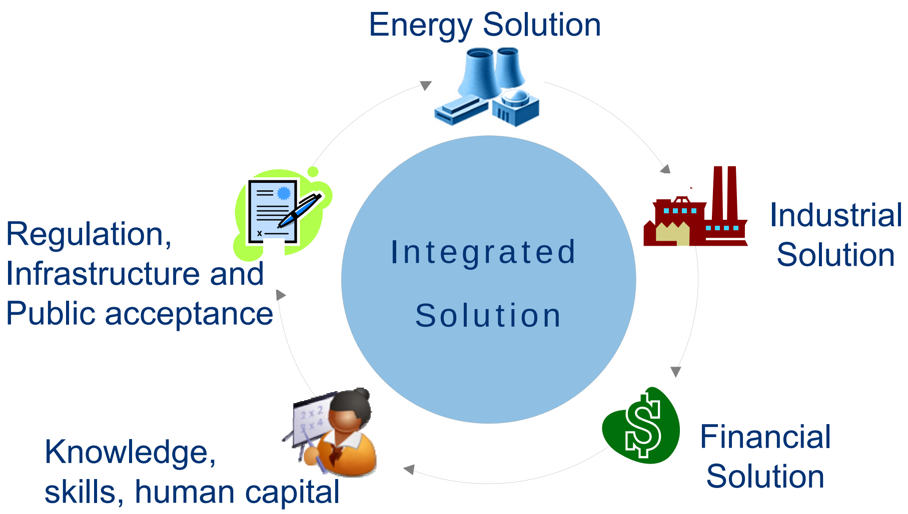
1. Create an international network of long-term storage centers of spent nuclear fuel. It should be several such centers. Each vendor should have one national center. Centres should be under the supervision of the IAEA. In the future, these centers should not only deal with storing of spent nuclear fuel, but its reprocessing and secondary fuel fabrication.

2. At the same time there is a need to create several centers of fuel enrichment under international control.

3. Energy companies are leasing the fuel at economically reasonable price (not tied to the value of electric energy), completely getting rid of the responsibility for the storage and disposal.

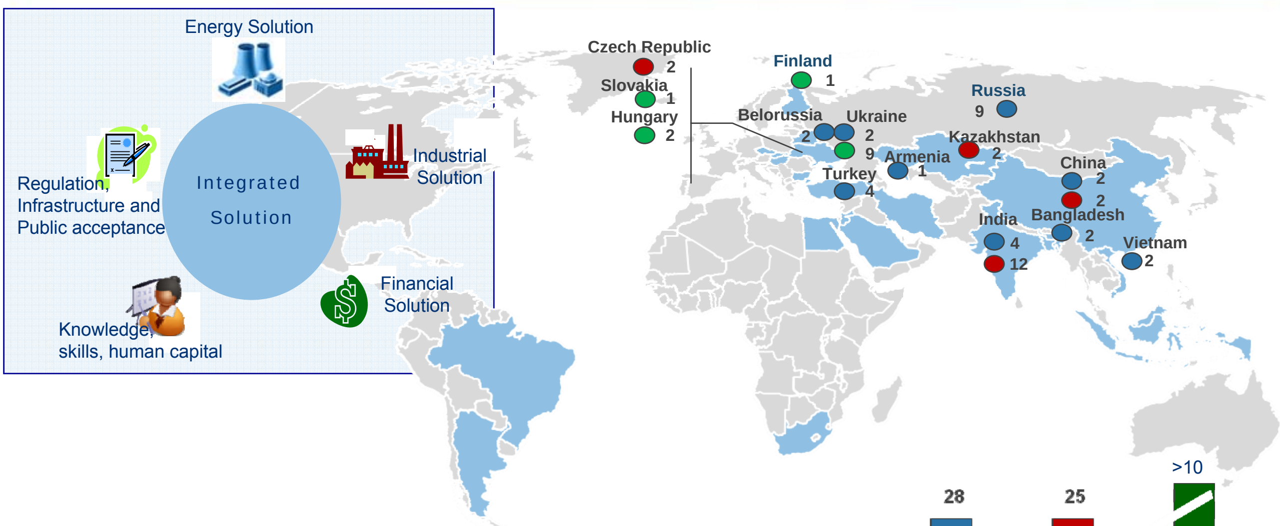
Fukushima necessary lesson

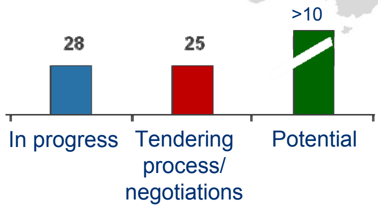
How to ensure the safety of nuclear power plants in new countries? In such countries, constructing their first NPP, there is a need to supply not only the power units, but also comprehensive services for the creation of standards and security infrastructure.



Failure to follow this principle will endanger the entire global nuclear industry!

Rosatom safe and mature VVER technology is highly welcomed worldwide…





Russian Federation in 2011 commissioned a new unit at the Kalininskaja NPP and continues to build 9 more blocks in Russia

Rosatom NPP construction perspective backlog – more than 60 units

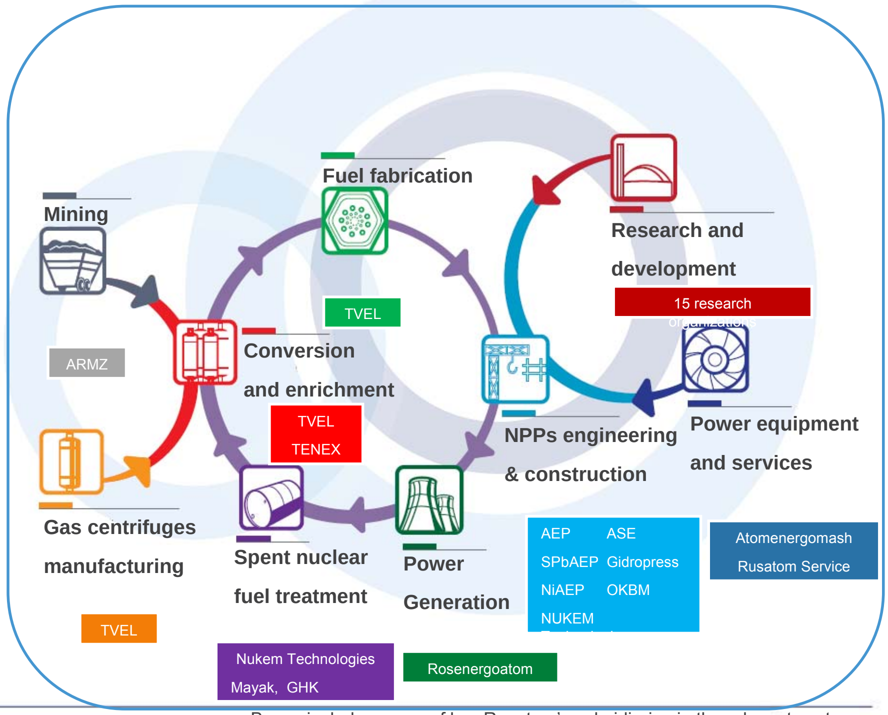
Rosatom offers complete solution from uranium supplies to NPP construction operation and decommissioning

Key Activities of Rosatom*

Guaranteed supply
of complete life-cycle products and services

Flexible capabilities
of NPP supply from components and services to turn-key and BOO projects

Being a state corporation Rosatom is taking advantage of unique industry
access to privilege resources



* Boxes include names of key Rosatom's subsidiaries in the relevant sector

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New technological platform of nuclear energy development

New level of reactor safety with environmental issues solution

Enhancement of reactor safety

Fast neutron reactor based of natural safety principles – radiation release outside containment is impossible

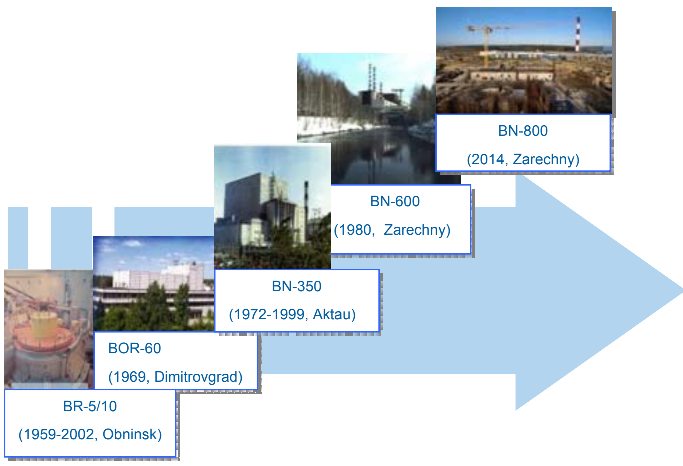
Closed Nuclear Fuel Cycle

Closed NFC – solid solution of resource efficiency usage issue

Spent Nuclear Fuel and Radwaste Management

Recycling of depleting materials – significant decrease of SNF and RW volumes. Full annihilation of several RW types.

Russian designed Sodium Cooled Fast Reactors



Accumulated operational experience – 140 reactor-years

Shifting to massive construction of Generation IV reactors in Russia is a target for 2030

Radiation Technologies – one of the most promising areas of nuclear applications

Rosatom Radiation Technologies Business

Nuclear medicine

- Origination and execution of Investment projects in fields of medical isotopes and equipment
- Medical equipment sales and servicing
- R&D management

Irradiation facilities

- Contract irradiation
- Equipment production, engineering and maintenance
- Production of radiation modified materials

Ecology

- Waste management
- Water treatment

Detection systems

- Security and nondestructive testing solutions

Thank you for your attention!!!