International Ministerial Conference on
Nuclear Power in the 21st Century
Saint Petersburg, Russian Federation

CONTINUOUS IMPROVEMENT OF NPP PERFORMANCE AND SAFETY

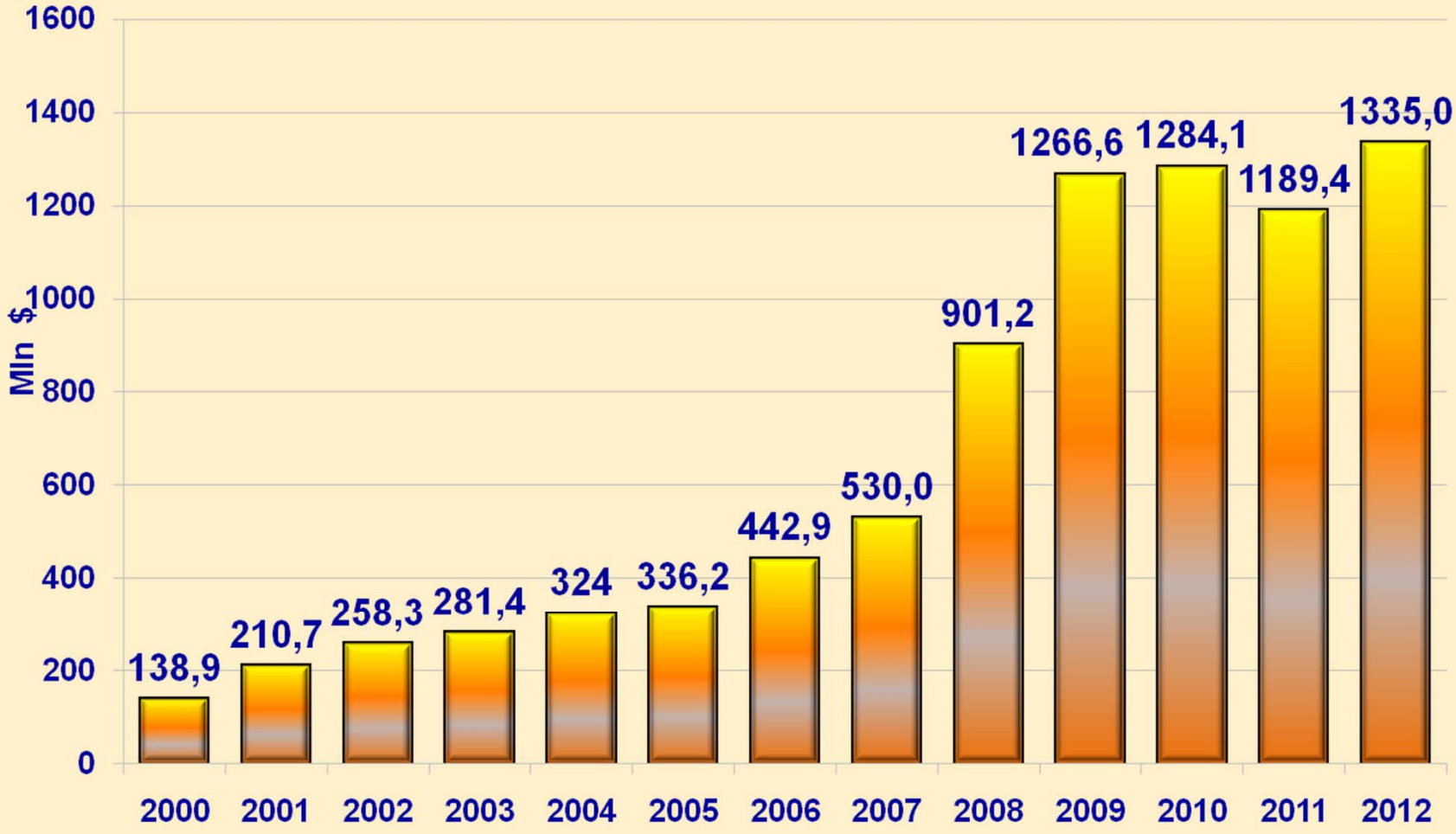
Prof. Vladimir G. Asmolov
Russian Federation

Panel Session 2: Nuclear Safety and Reliability through International Cooperation, 28 June 2013

Basic effort areas of Operating Organizations to improve NPP performance and safety

- **Increase of safety and reliability of power units :**
  - Elimination of safety deficiencies and non-conformances to standards and rules
  - Implementation of international NPP operating experience (incidents and good practices) analysis results
- **Increase of the electricity generation efficiency:**
  - Maintenance campaign optimization
  - Thermal power increasing
  - Efficiency coefficient increasing
- **Power unit operating life extension**

Rosenergoatom expenditures for NPP upgrading

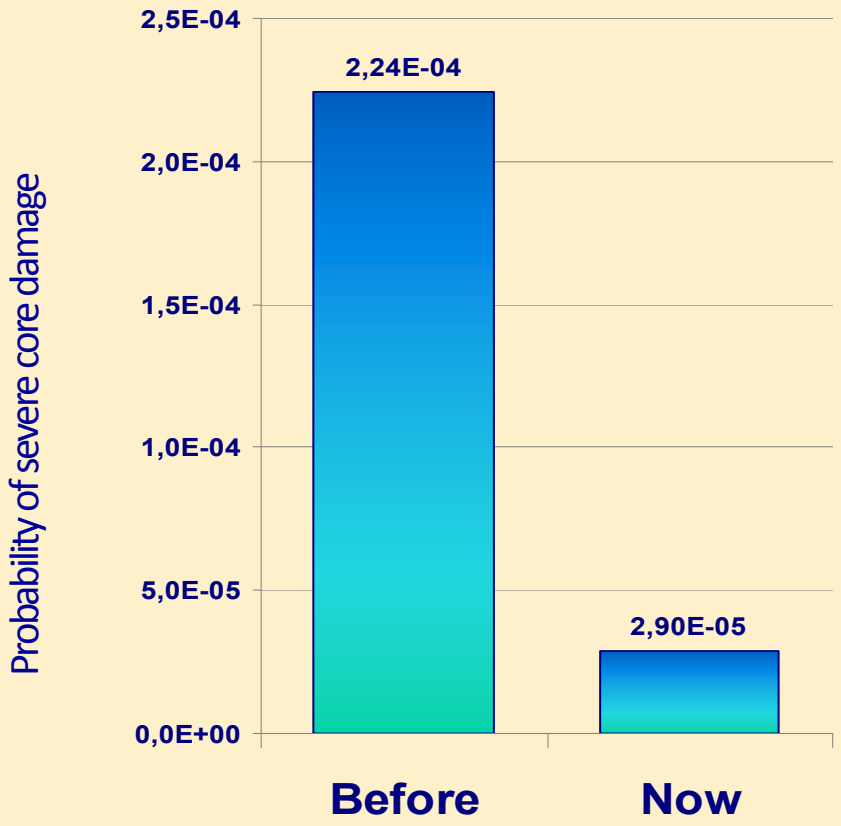


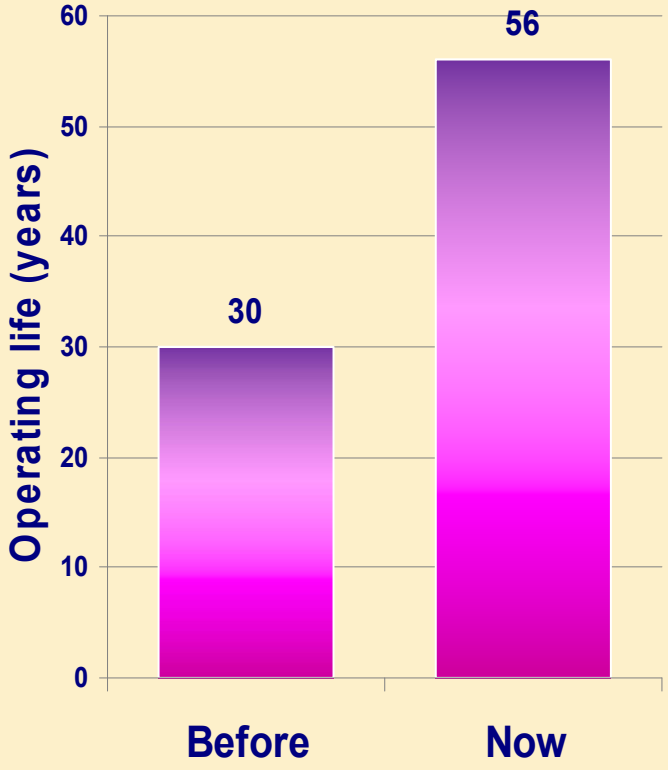
Example of target-oriented modernization for operating life extension

Novovoronezh NPP power unit 5 (VVER-1000/V-179) (2008 – September 2011)

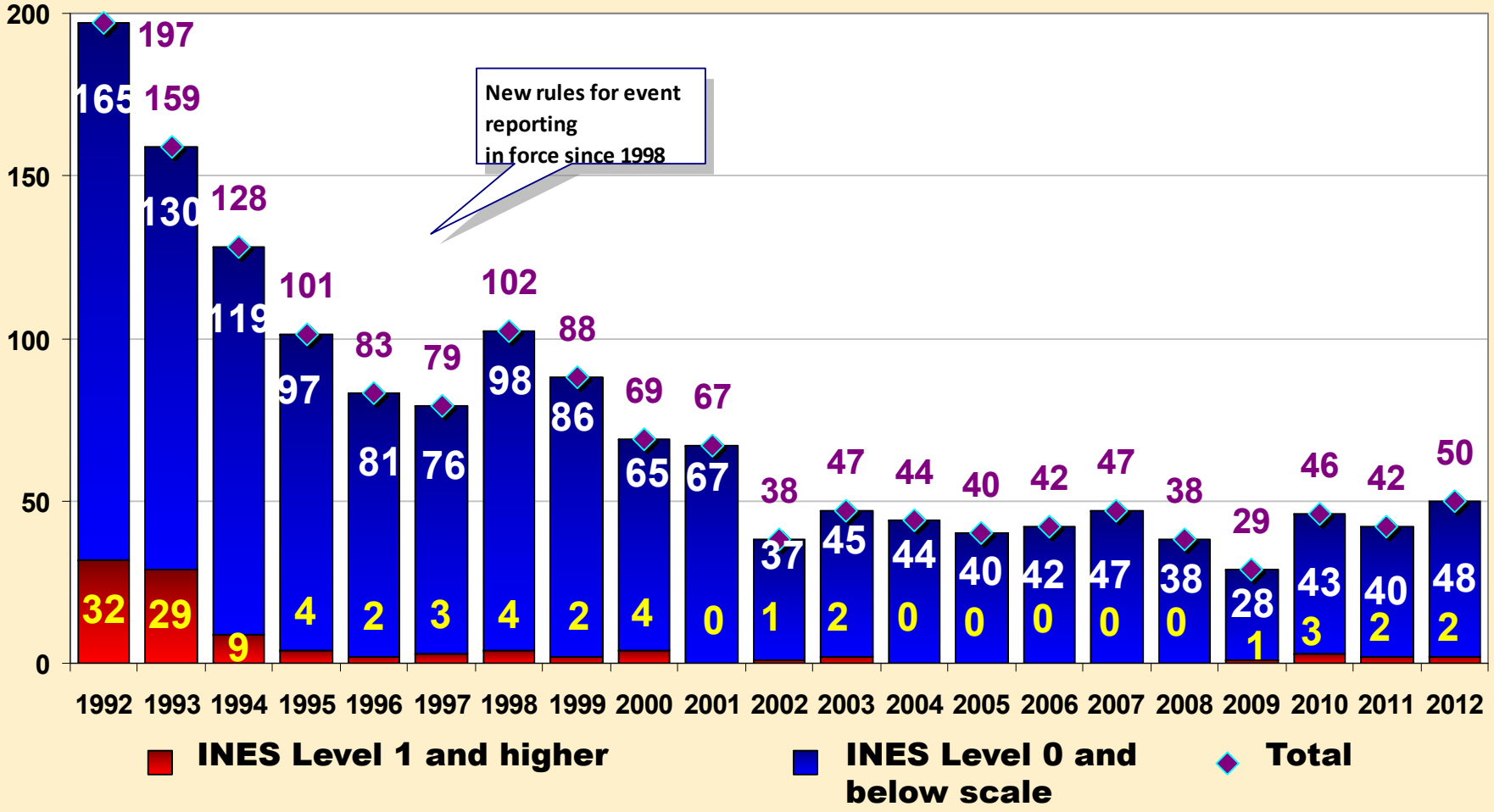
- Emergency power supply system upgrading
- Introduction of a double-set reactor control & protection system
- Implementation of an additional system for emergency feedwater supply to steam generators
- Implementation of hydrogen explosion safety system
- Implementation of gaseous fire suppression systems in the Unit control & protection system premises.
- Turbine generator excitation system replacement by digital ones
- Generator breakers replacement by SF6-gas ones.

Novovoronezh NPP Unit 5 (VVER-1000/V-179)

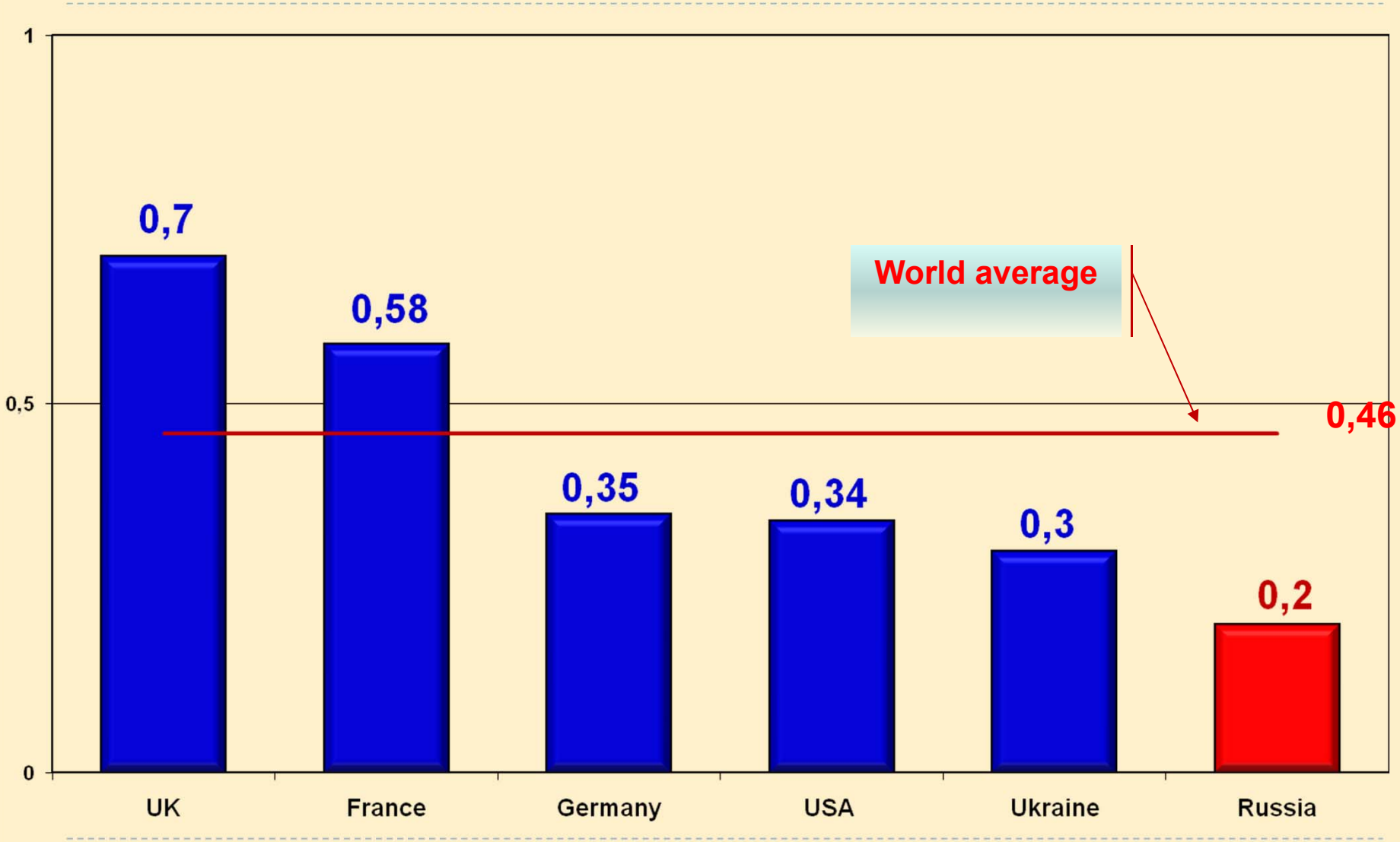




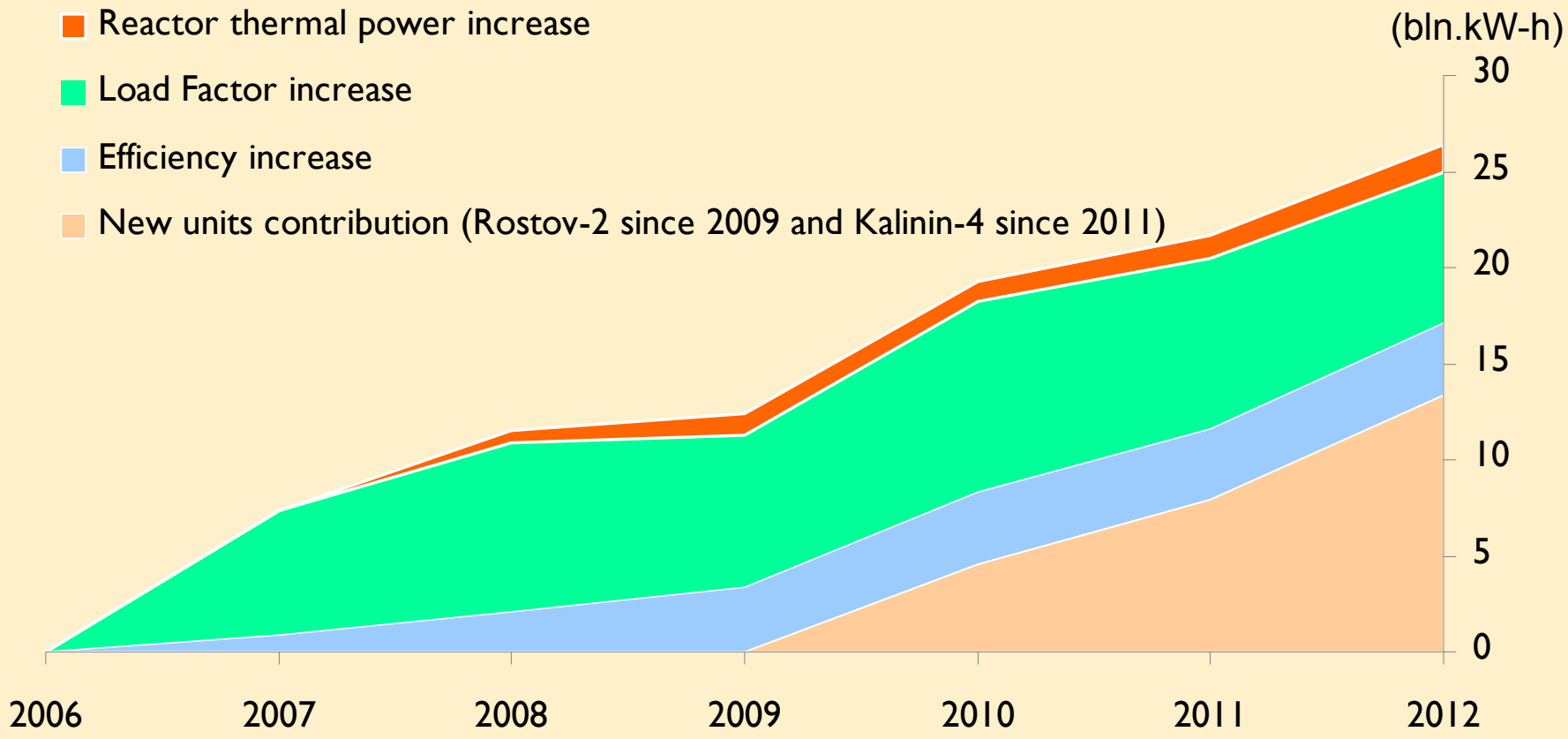
Historical trend of Russian nuclear operating events reportable to the Regulator



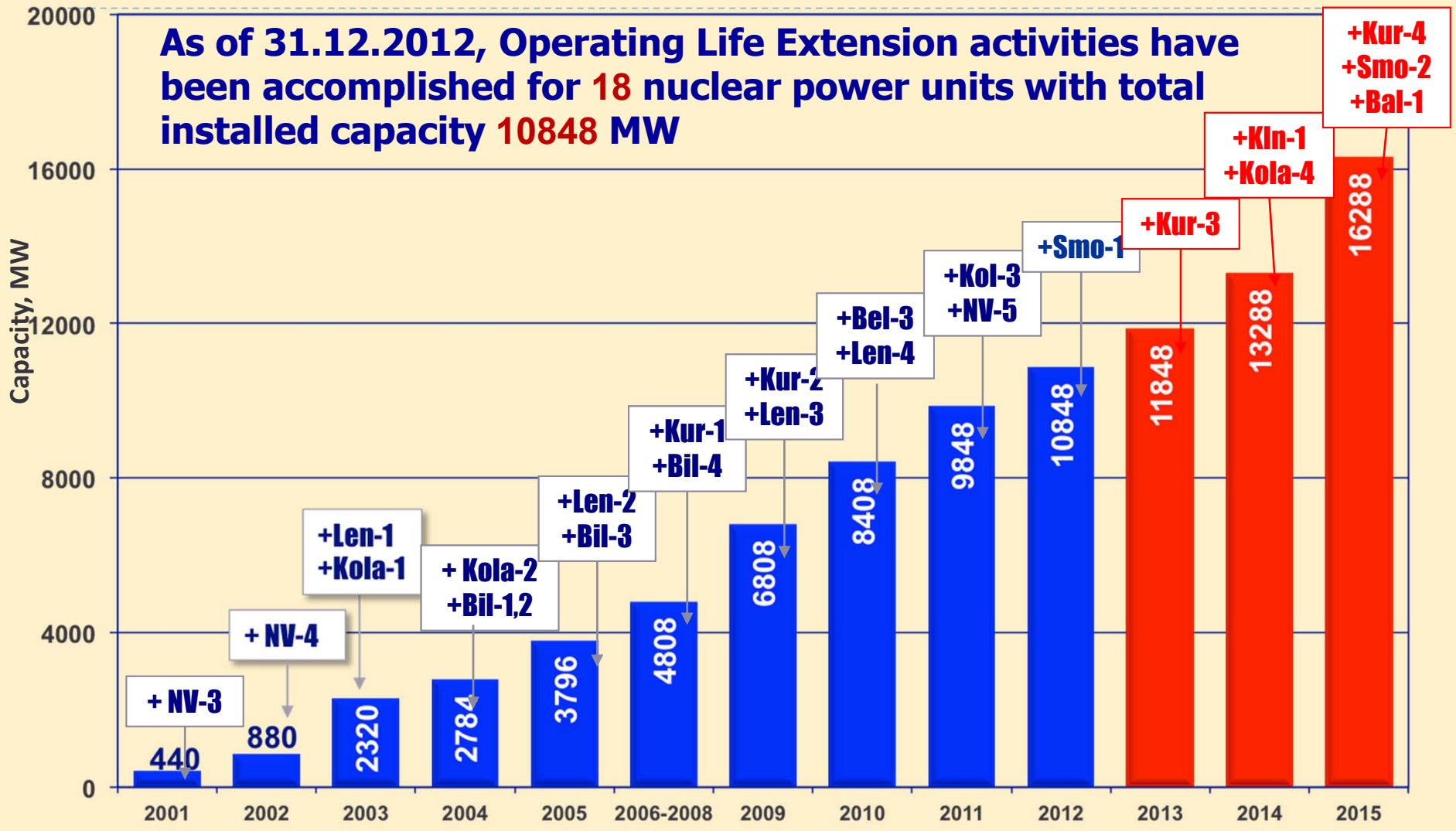
Unplanned reactor scrams at NPPs of leading nuclear countries in 2012 (as per WANO method)



Additional electricity generation by Russian NPPs

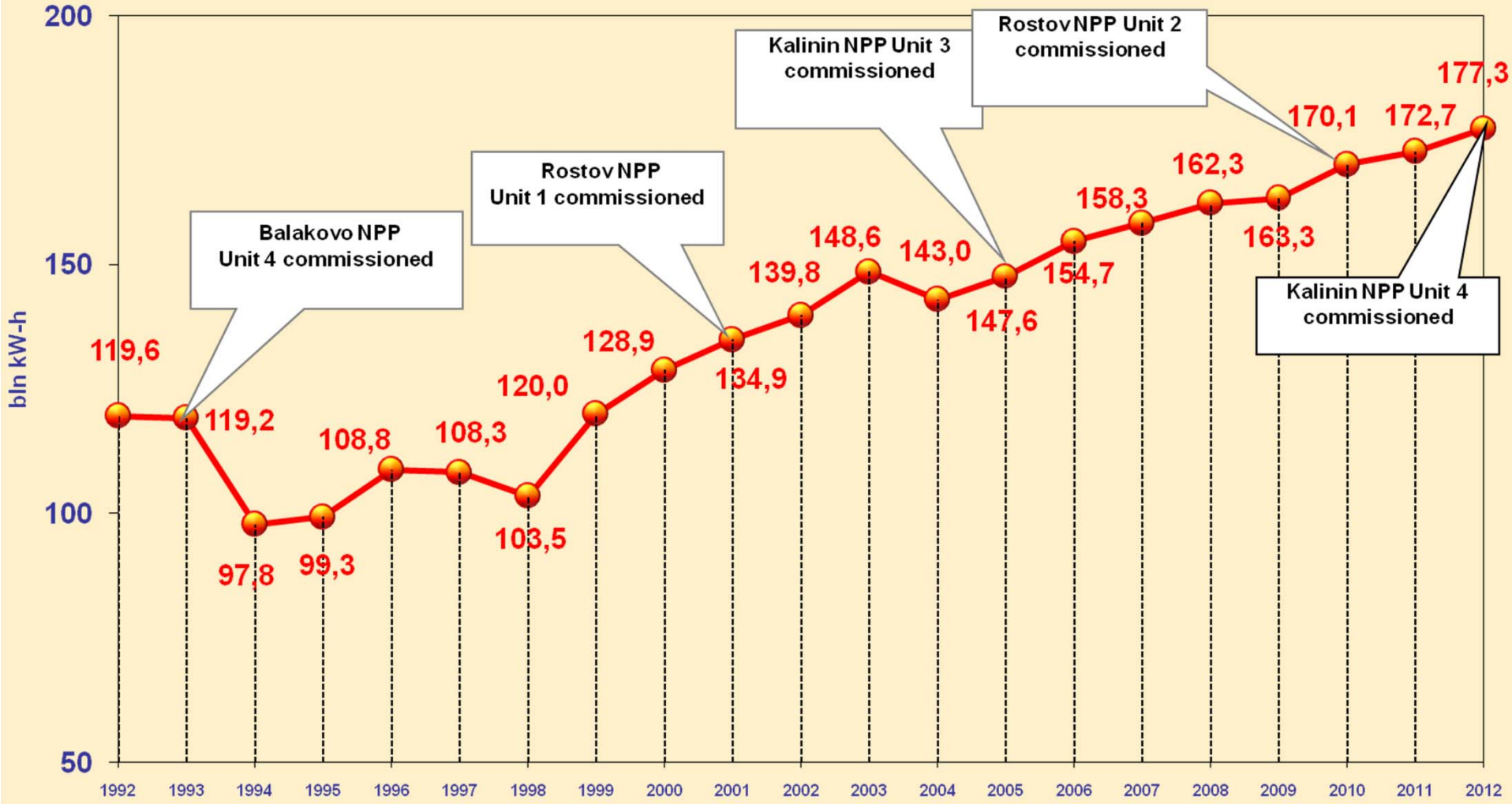


Retention of nuclear generating capacities as result of Operating Life Extension process



Electricity generation by Russian NPPs

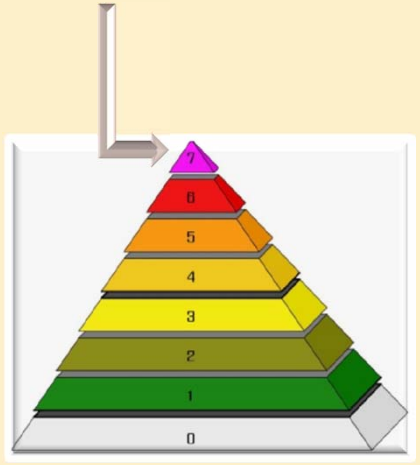
(~ 16,8 % of total electricity generation in Russia)



Updating of NPP safety after Fukushima

Events at Fukushima NPP in Japan

Level 7 according to INES scale



Impact of extreme external natural events and their combinations

New stimulus for NPPs safety review at the global level

General insights from the Fukushima accident

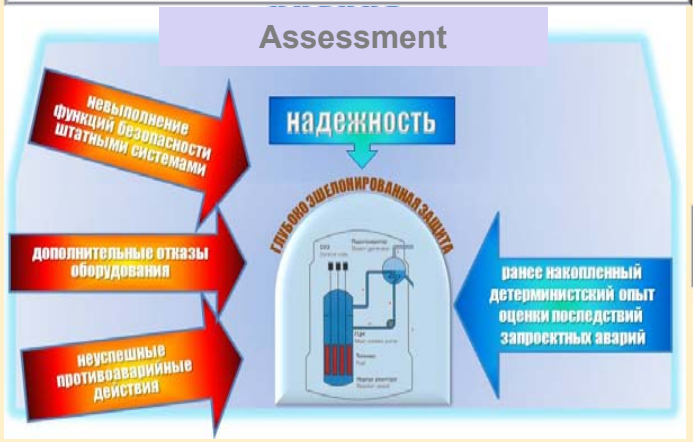
1. **It is now clear that many of the factors contributing to the Fukushima accident have been identified before it:**
   - *poor severe accident management planning structure;*
   - *failure to implement safety improvements as needed;*
   - *inadequate evaluation of possible external impacts;*
   - *weak regulatory system;*
   - *lack of personnel training on Emergency Preparedness.*

2. **The necessary measures to address these shortcomings were not put in place.**

Activities resulting from the analysis of NPP resistance to external impacts

2011

Operative



2012

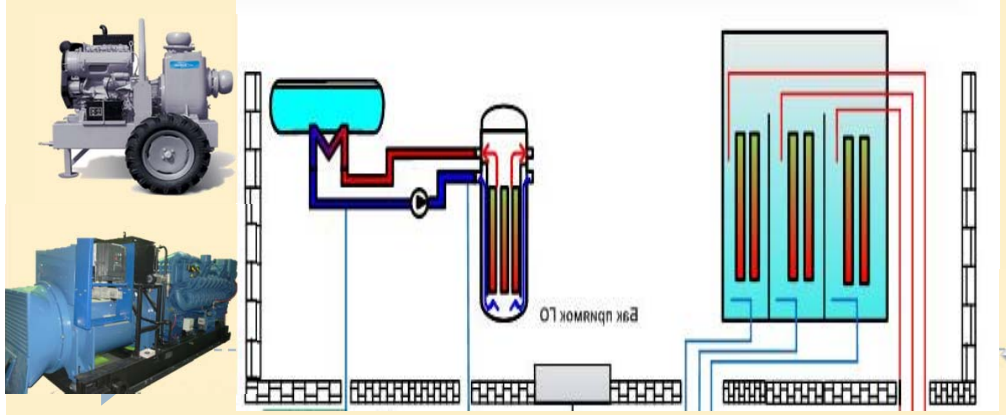
Short-term

2013

Medium-term

2014 – 2016

Long-term



Introduction of mobile emergency equipment at NPPs

Integrated emergency response exercise has been conducted at Kursk NPP with successful demonstration of the new emergency equipment

In 2012, the following items have been supplied to 10 Russian nuclear plants:

31 2-MW mobile diesel generators (6kV; 0.4 kV; 220V DC)

36 0.2-MW mobile diesel generators (0.4 kV)

35 Mobile HP pumps of various capacity and head pressure

80 Motor-driven pumps of various capacity and head pressure

Total: 182 items

WANO-MC Regional Crisis Center for NPPs with VVER reactors (12 member countries)

1. RCC has been put into trial operation

2. 3 exercises have been conducted to organize the information exchange between RCC and Loviisa NPP on responding to a hypothetical accident at NPP

3. RCC took part in the international exercise at Loviisa NPP

The main lessons learned from the Fukushima accident

1. **Fundamental Safety Principles remain appropriate as a sound basis for nuclear safety when properly implemented.**
2. **Implementation of safety principles shall provide for accident prevention and accident mitigation as equal priorities.**
3. **Primary responsibility for safety is imposed on the Operating Organization, and therefore, it shall take immediate measures for the accident management.**
4. **Safety features provided in the nuclear plant design shall allow the Operating Organization to perform accident management actions within a limited period of time.**