

Status of Nuclear Power in Japan

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Osaka University
Akira Yamaguchi
yamaguchi@see.eng.osaka-u.ac.jp

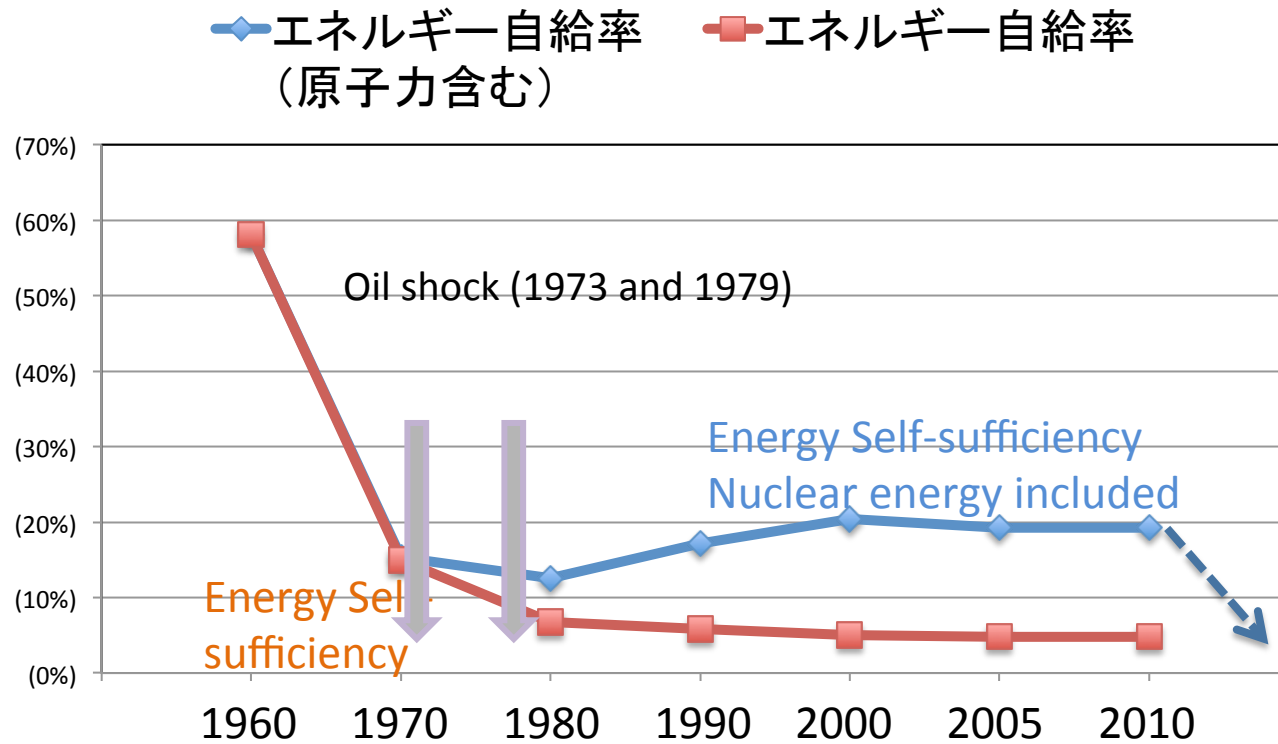
National Security in Energy (3E+S)

- Energy security
 - Stable energy supply to every member of country
- Economic growth and stability
 - Energy supply for home and industry with reasonable price
- Environmental concern
 - Global warming and environmental pollution
- Safety
 - Notion of safety - Nuclear risk?
 - Energy risk, economical risk, global warming risk, geopolitical risk, etc.
- Other concerns
 - Geopolitical situation (spatial perspective)
 - Uneven distribution of resources, Defense of Middle East sea lanes
 - Sustainability (long term perspective)
 - Fuel reprocessing and FBR cycle

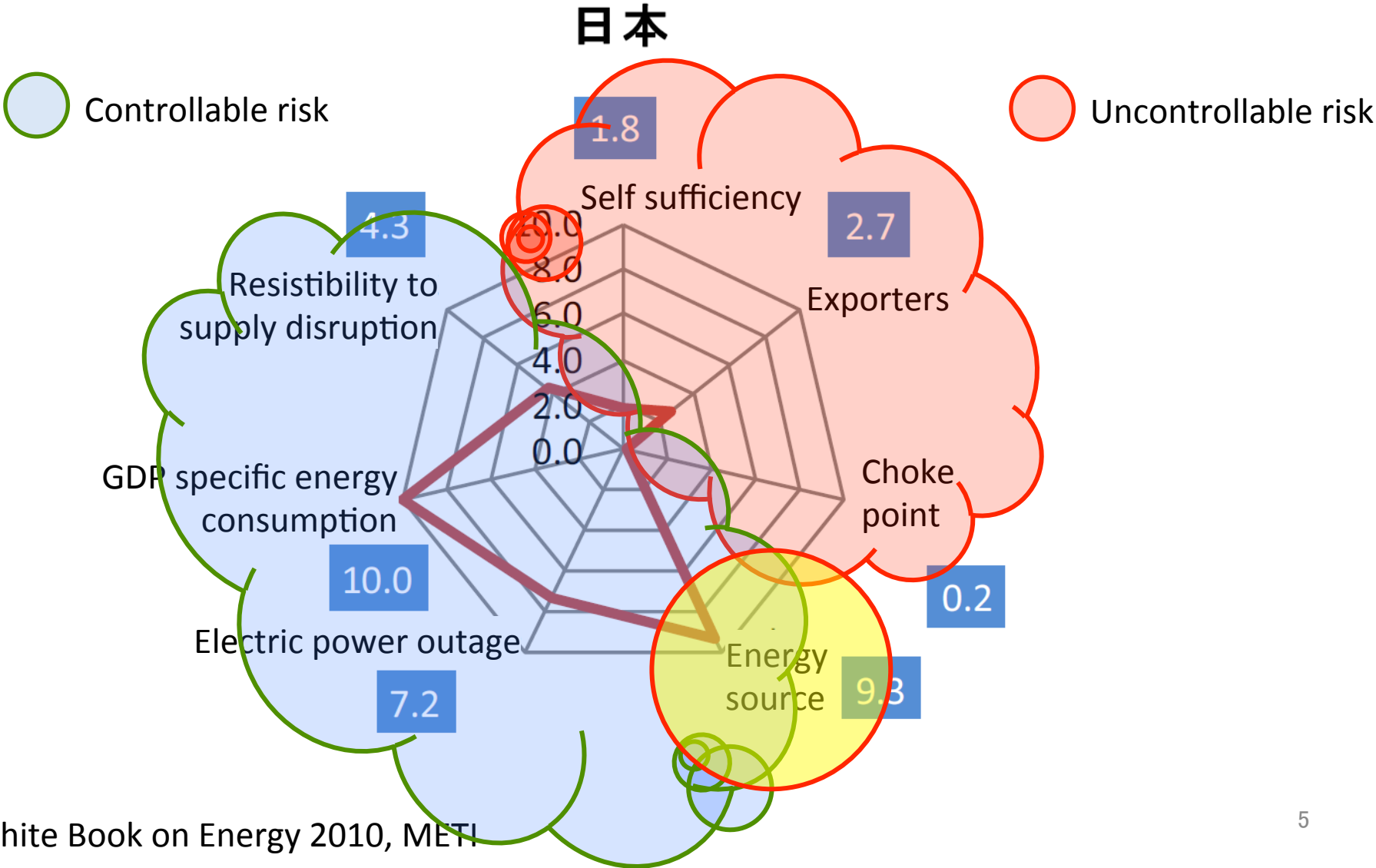
Oil Shock (1973 and 1979)



Japanese Energy Self-sufficiency

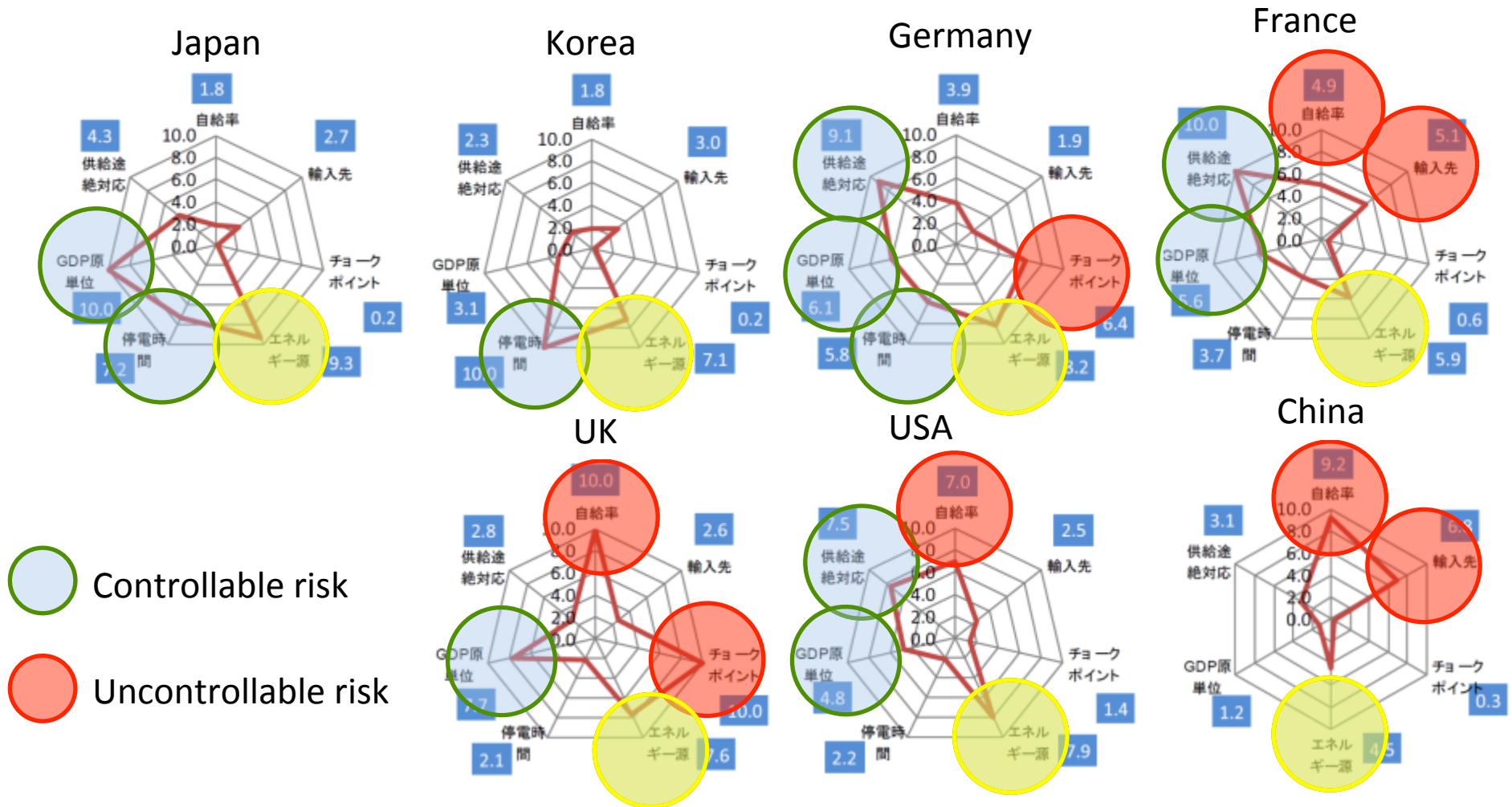


Energy Performance Index in Japan

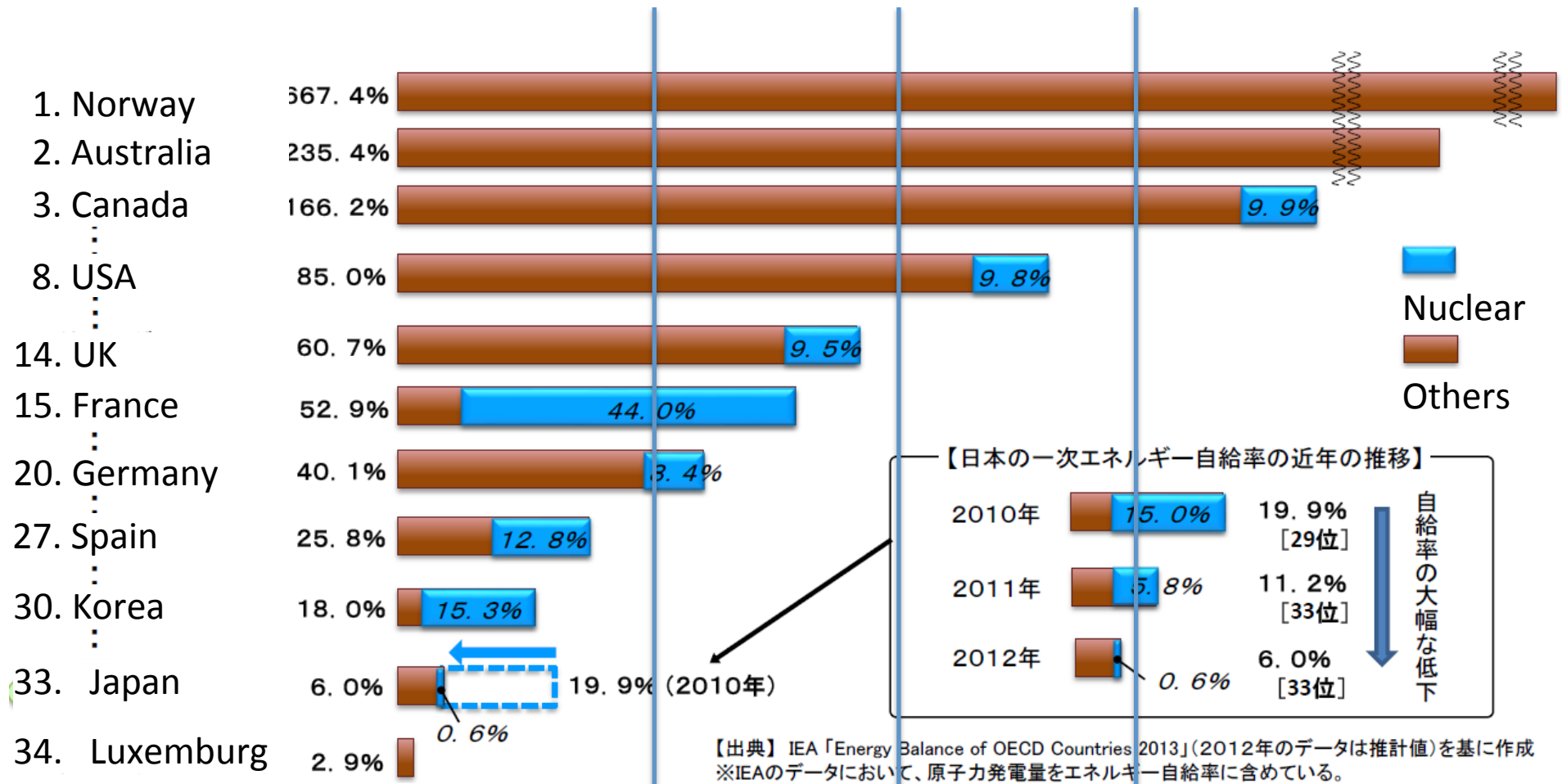


Energy Performance Index

Circled if Score > 5



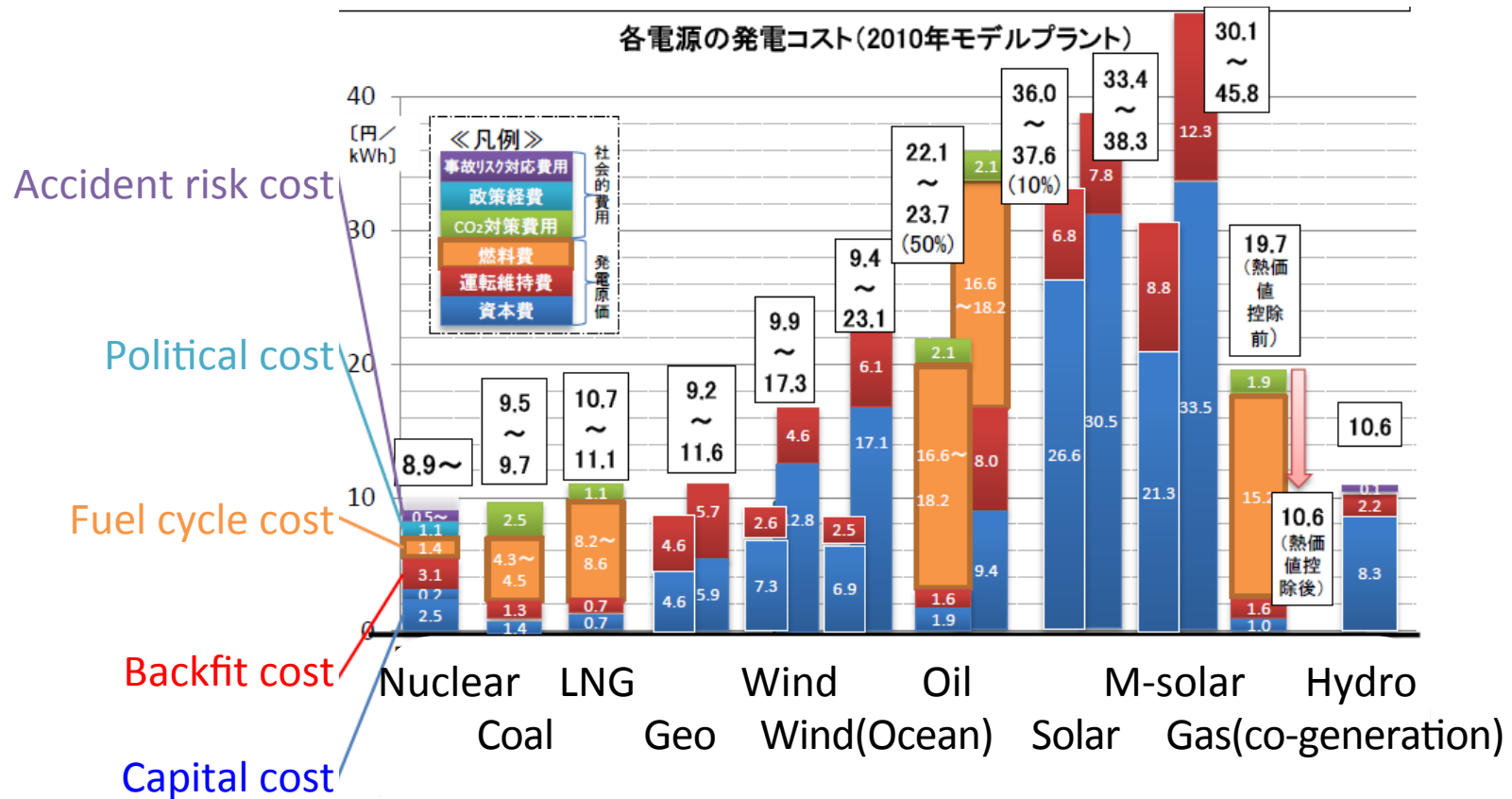
Energy Security: Self-sufficiency of Primary Energy in OECD Countries



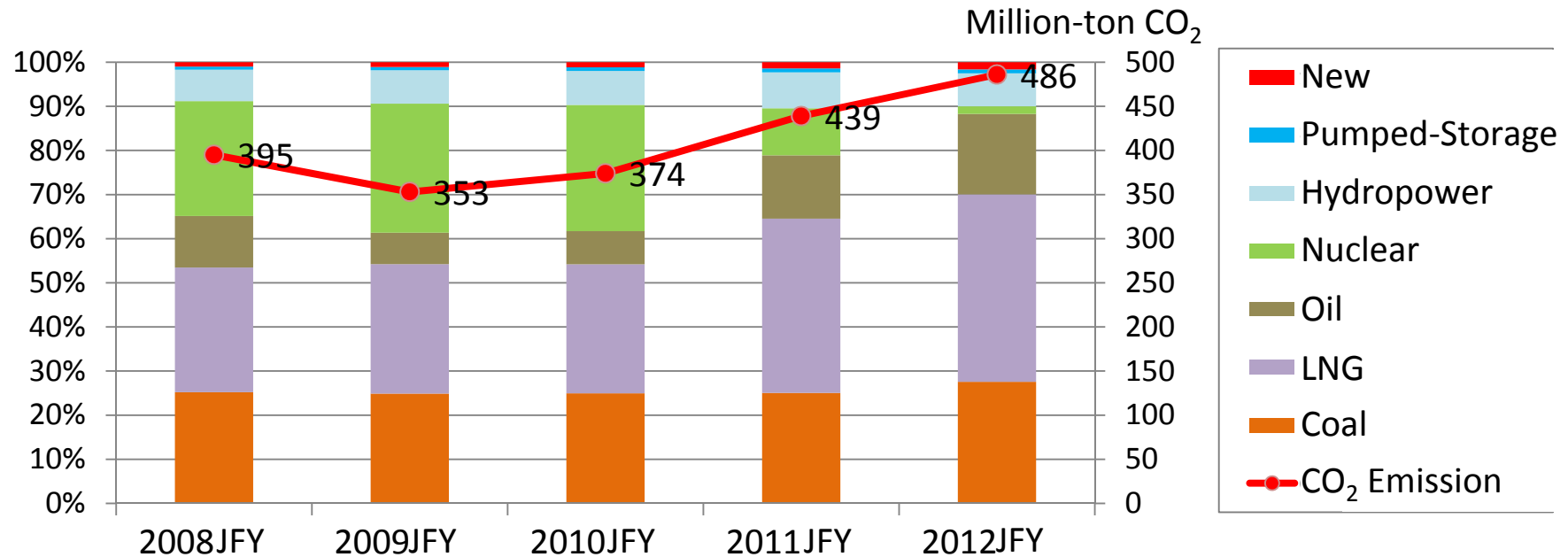
Cost Estimate Committee (Dec. 2011)

Every cost included

- Nuclear: 8.9JPY/kWh, 0.1JPY/kWh/1TJPY for 1F clearing cost



CO₂ Emission and Electricity Energy Mix



【出所】資源エネルギー庁「電源開発の概要」、「電力供給計画」をもとに作成

CO₂ Emission Coefficient

Coal	LNG	Oil	Nuclear	Renewable
0.82	0.40	0.66	0	0

(単位: kg-CO₂/kWh、発電端) 【出所】電中研資料より

Influence of NPP Outage

- Dependence on Fossil Fuel import increase
 - 88% of total power generation (in 2013)
 - Higher than the first oil shock (76%)
- Dependence on Middle East
 - Oil (83%), LNG (30%)
- Renewable energy introduction (2.2%) costs \$6.5B
- Additional fuel import costs \$36B
- Electricity cost increased by 20%
- CO₂ Emission increased by 9%
 - 110M-ton (9% of annual emission in 2010)

Nuclear Regulatory Authority

- The newly established NRA is now responsible to promote effective and efficient safety regulation, with a full recognition of international safety standards, maintaining an able team with right skill, experience, knowledge and behavior
- NRA's mission*
 - To protect the general public and the environment through rigorous and reliable regulations of nuclear activities.
- The five principles of good regulation*
 - Independent Decision Making
 - Effective Actions
 - Open and Transparent Organization
 - Improvement and Commitment
 - Emergency Response
- Thereby NRA enhances confidence and trust of the public

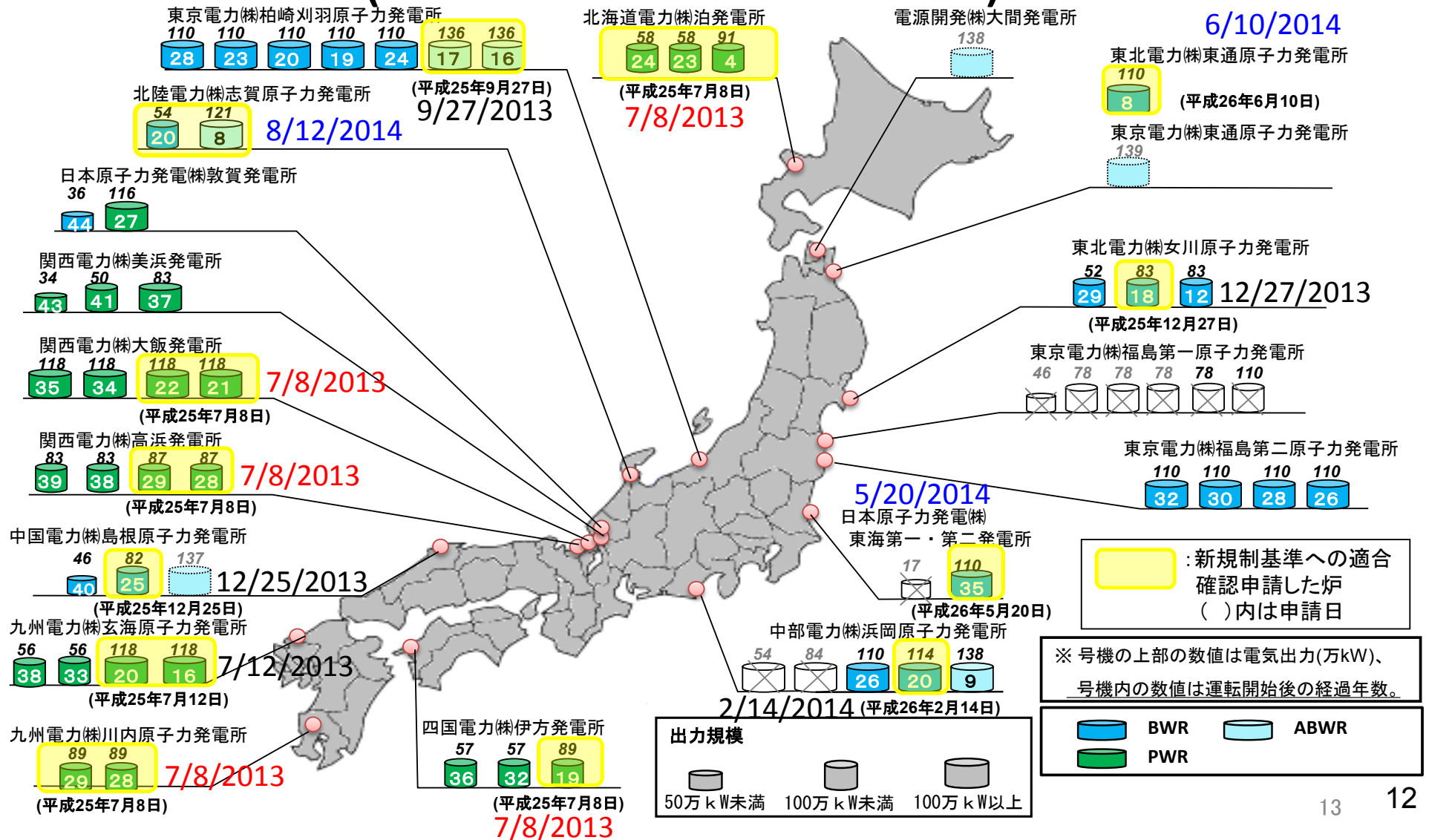
* https://www.nsr.go.jp/english/e_nra/idea.html

Timeline, 2011-Present

- Mar 11, 2011 Fukushima Daiichi Accident
- Mar 23, 2011 Emergency back-fit requirement by NISA
- Jul 6, 2011 Order of Stress Test for restart
- Mar 2012 Ohi-3/4 Stress test report approved by NISA and NSC
- Jul 2012 Ohi-3/4 restart
- Sep. 2012 NRA established and no more use of the stress test
- Jul 8, 2013 New Regulation Standards endorsed
- Sep. 2013 Ohi-3/4 Shutdown for periodical maintenance
- Sep. 10, 2014 Sendai 1 & 2 Permission for Change in Reactor Installation
 - The applied design and safety features of Sendai NPS Units 1 and 2 were deemed to meet the NRA's new regulatory requirements
 - This is a regulatory step to grant permission for the basic design
 - NRA will review the detailed design and construction and Operational Safety Programs

Current Status of Application

20 units (12PWRs and 8 BWRs) in 13 Sites



Strategic Energy Plan, April 2014

- Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure, on the major premise of ensuring of its safety, because of the perspectives:
 - Superiority in stability of energy supply and efficiency
 - Low and stable operational cost, and
 - Free from GHG emissions during operation.

Policy Direction - Restart

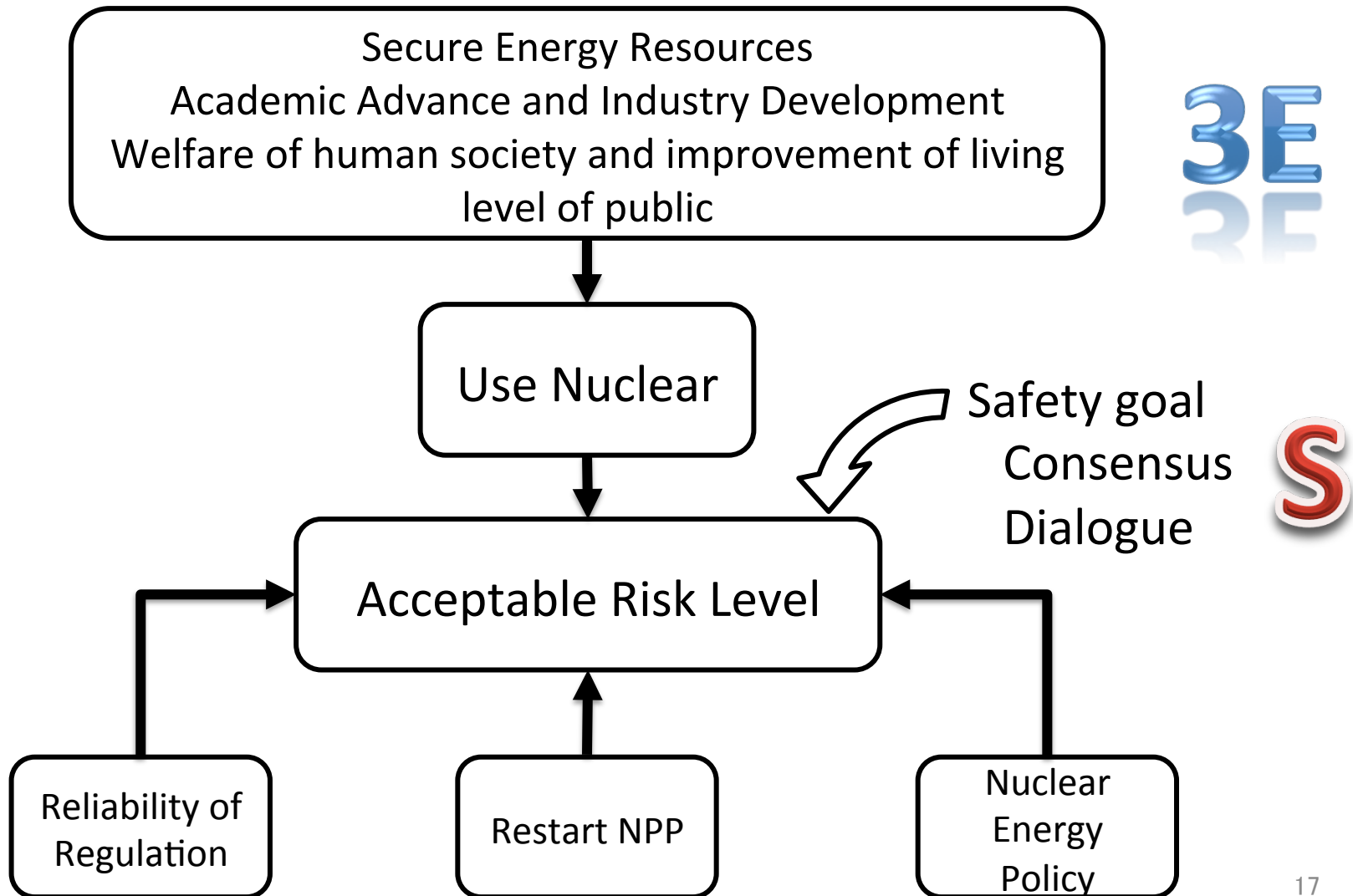
- On the premise that safety comes before everything else and that every possible effort is made to resolve the people's concerns, judgment as to **whether nuclear power plants meet the new regulatory requirements will be left to the Nuclear Regulation Authority (NRA)** and in case that the NRA confirms the conformity of nuclear power plants with the new regulatory requirements, which are of the most stringent level in the world, GOJ will follow NRA's judgment and will proceed with **the restart of the nuclear power plants**. In that case, GOJ will make best efforts to obtain the understanding and cooperation of the host municipalities and other relevant parties.

Policy Direction – Energy Best Mix

- Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as improving the efficiency of thermal power generation, etc. Under this policy, GOJ will **carefully examine a volume of electricity to be secured by nuclear** power generation, taking Japan's energy constraints into consideration, from the viewpoint of stable energy supply, cost reduction, global warming and maintaining nuclear technologies and human resources.

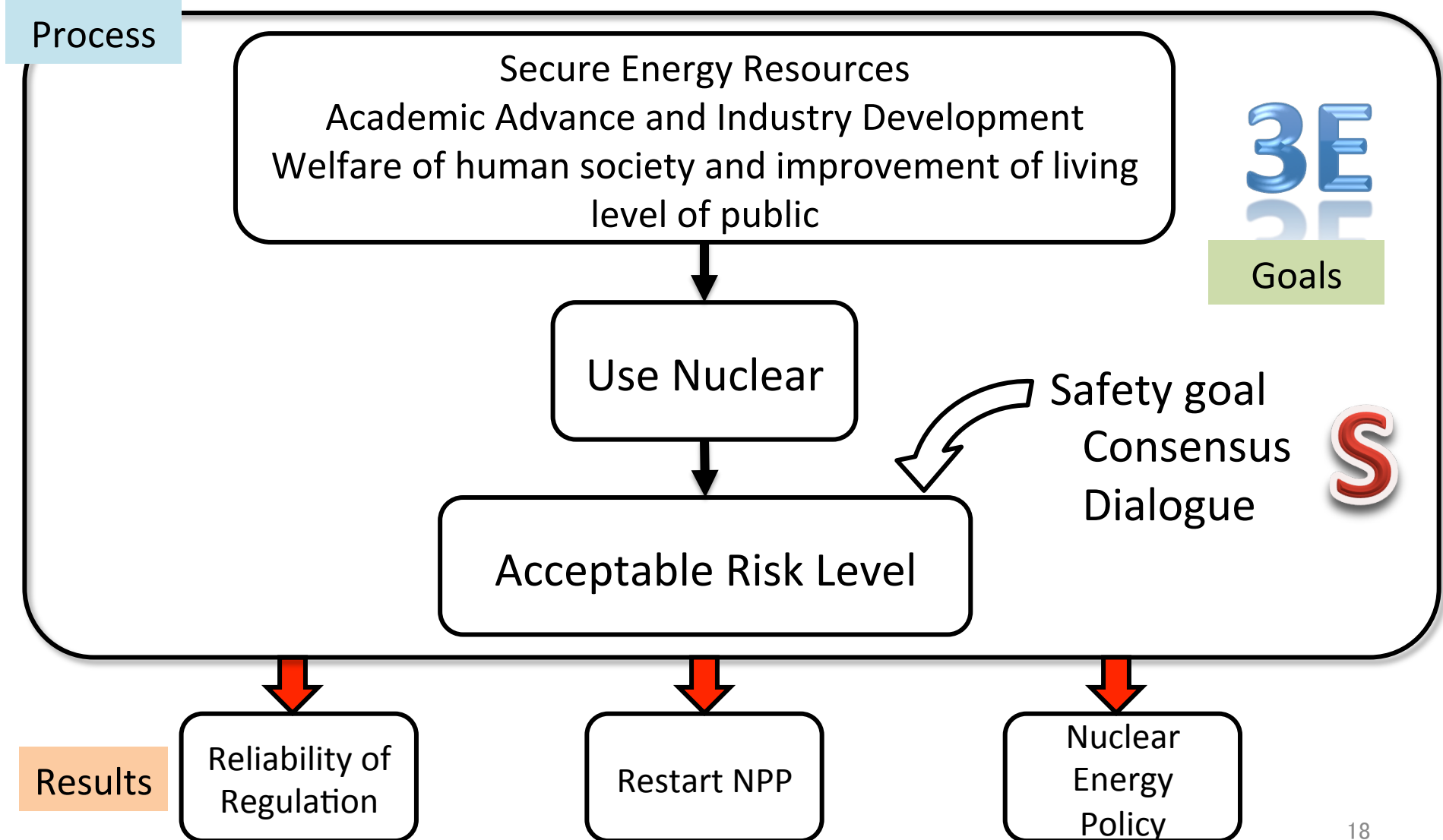
Deadlock: Goal and Process

Atomic Energy Act (June 2013) and Strategic Energy Plan (April 2014)



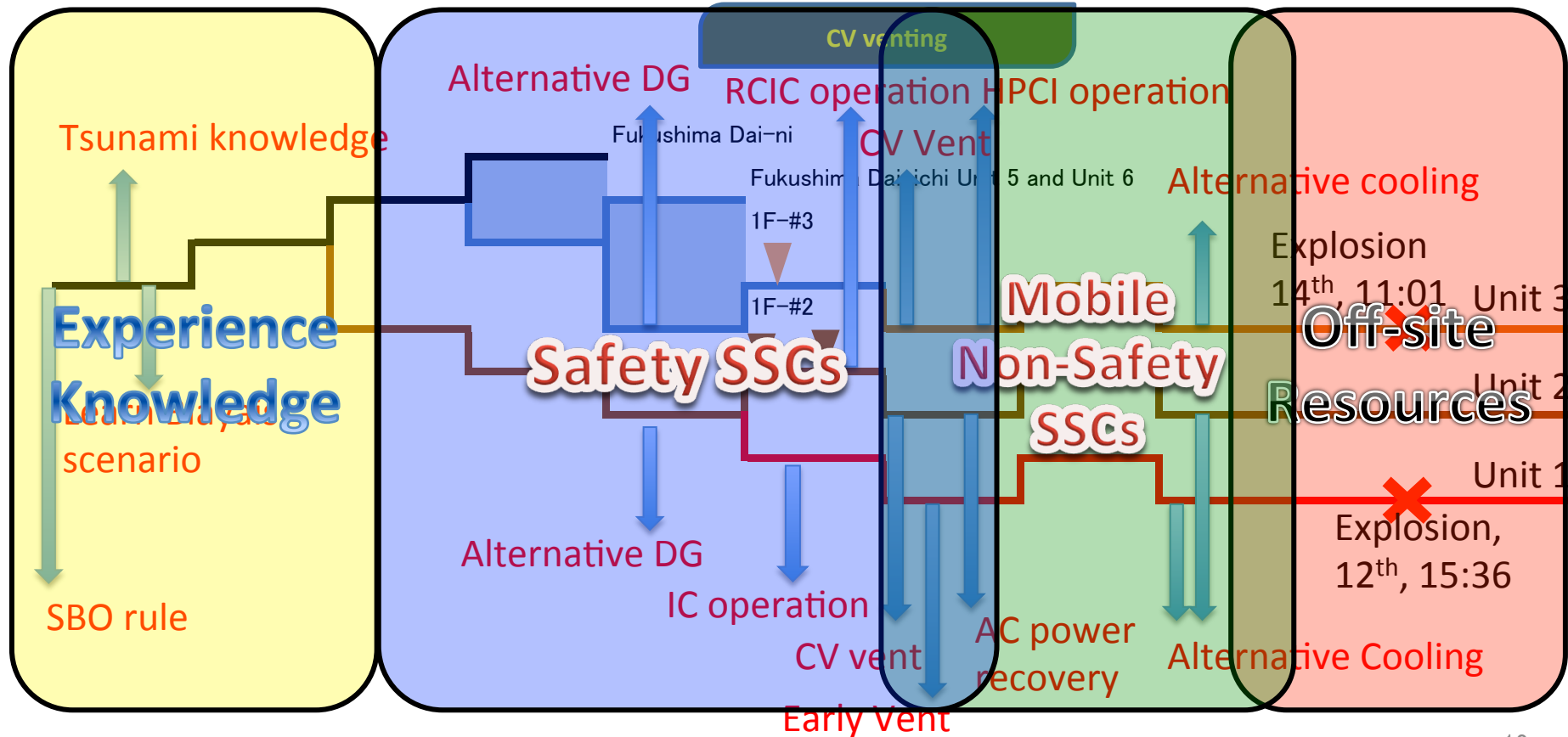
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Fukushima Dai-ichi Accident Scenario and Chance of Recovery (Avoidance of Large FP Release: Crisis)

	Reactor Scram	DC Power	Off-site Power	Emergency DG	Cooling (High pressure)	AC Power Recovery	Reactor Depressurization	Residual Heat Removal	Recovery of Heat Sink	Cold Shutdown
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Crossroad Exists Everywhere, Every Stage of Scenario

- Knowledge and experience level
 - Operational experience
 - Contemporary research/knowledge
- Safety design level
 - Review and revise of postulated event set and design basis event (Adequacy of current design perspective)
- Accident management level
 - Robust, independent, resilient, credible measures
- Emergency readiness level
 - Risk-reduction or crisis prevention (off-site response)
- Risk-informed defense-in-depth protection

Conclusions

- National Security in Energy and Nuclear Regulation
 - 3E+S is an optimization problem
 - NRA has been established and missions and principles have been defined
- Deadlock after Fukushima Daiichi Accident
 - We need to keep the lessons and recommendations in mind
 - Goal, process and results are in disorder
- Goal: Comes first
 - 3E: Energy Security, Economy and Environment (Goal)
 - S: Safety goal is the final piece of the puzzle
- If we understand “failure-free” does not mean “ensuring safety”,
 - Results such as trust of regulation and NPP restart shall follow