



NERS 2019

ENERGY MIX AND DECARBONISATION

Patrick ZAK - EDF

New Nuclear Projects and Engineering
Pre-Development and Marketing Director

Hiroshi SASAKI – MHI

Deputy Director, Nuclear Energy Systems Division

Prague, 06 November 2019





CONTENT

- 1.** EDF & MHI partnership
- 2.** French PPE
- 3.** EDF company and contribution to PPE
- 4.** Japanese Strategic Energy Plan
- 5.** MHI company and contribution to SEP





CONTENT

- 1.** EDF & MHI partnership
- 2.** French PPE
- 3.** EDF company and contribution to PPE
- 4.** Japanese Strategic Energy Plan
- 5.** MHI company and contribution to SEP



OFFER OF MIDDLE AND LARGE SIZE REACTORS BY EDF AND MHI

■ Unique experience of two major nuclear vendors: EDF & MHI

- EDF experience in construction and services operation of the French fleet (58 reactors)
- MHI experience in construction of all the PWR Japanese reactors (24 reactors)
- Numerous references in equipment supply and services in international market
- EDF and MHI collaboration on development of middle size reactor



■ Possible combination of different reactors

- | | |
|---------|------------------------|
| □ EPR | 1700 MWe class reactor |
| □ ATMEA | 1200 MWe class reactor |





CONTENT

1. EDF & MHI partnership
2. French PPE
3. EDF company and contribution to PPE
4. Japanese Strategic Energy Plan
5. MHI company and contribution to SEP



WHY A MID TERM ENERGY STRATEGY PLAN (PPE) ?



- PPE shapes France's energy policy, to **tackle climate change** through decarbonization while guarantying affordability and security of supply.
- It will prepare the whole energy sector (including electricity), defining an ambition for 2050, planning up to 2035 and
- It will be reviewed every 5 years.



One **overriding** objective: achieve carbon neutrality in France in 2050



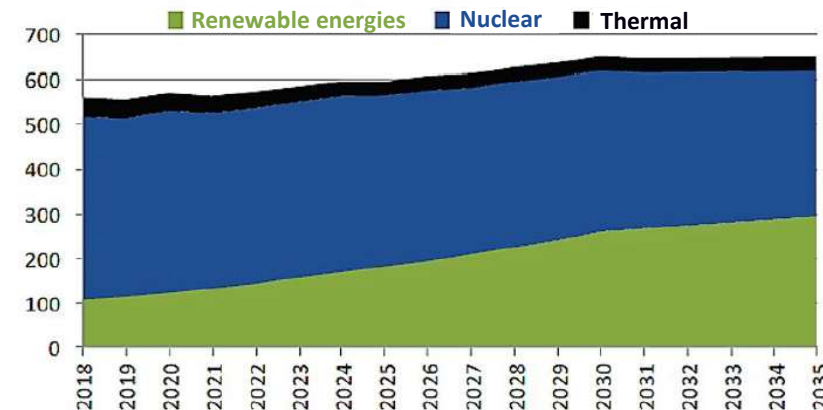
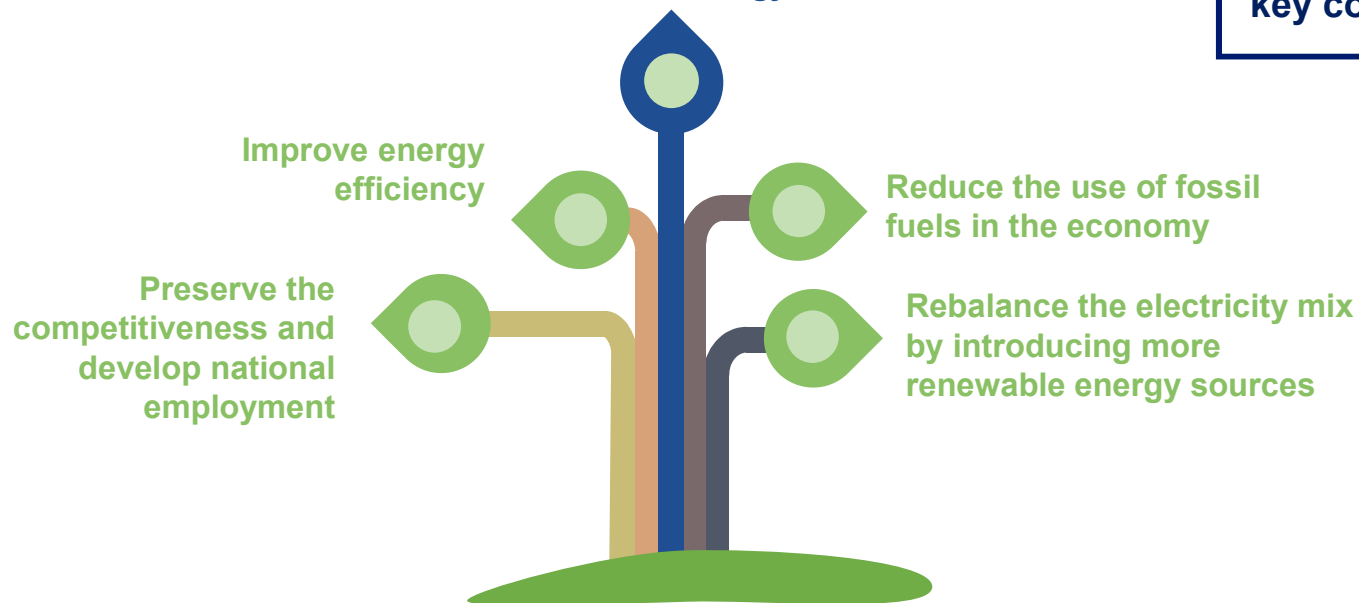
A state energy planning for next decades

HOW IS IT ORGANIZED ?



In order to guarantee security of supply and competitive prices, nuclear energy will remain a key contributor to France's national electricity

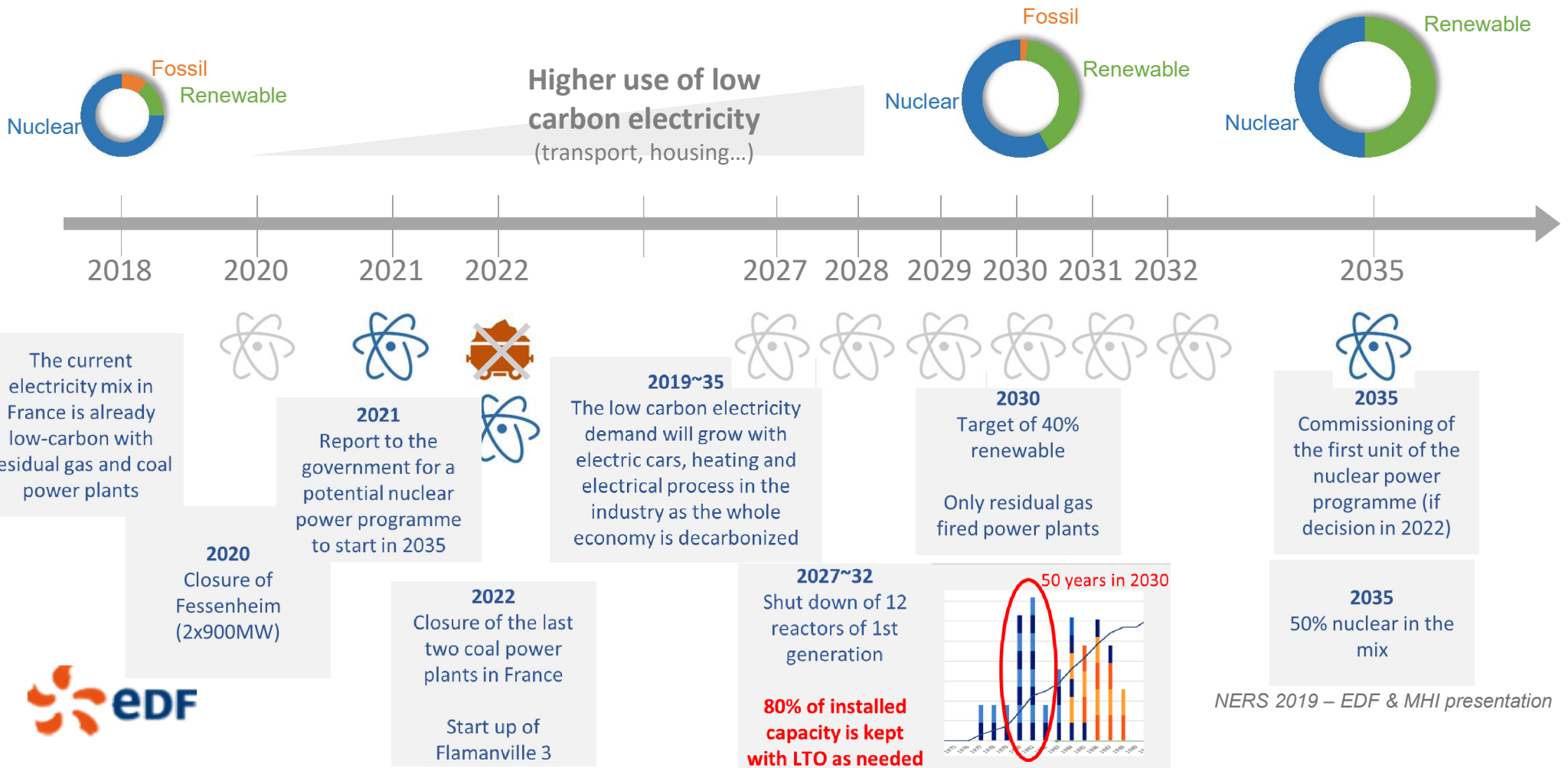
Putting carbon-free electricity at the core of this energy transition



Electricity generation in France (TWh)

France has the capacity, the skills, and the competences needed to lead this energy transition

THE ENERGY PLANNING ROADMAP



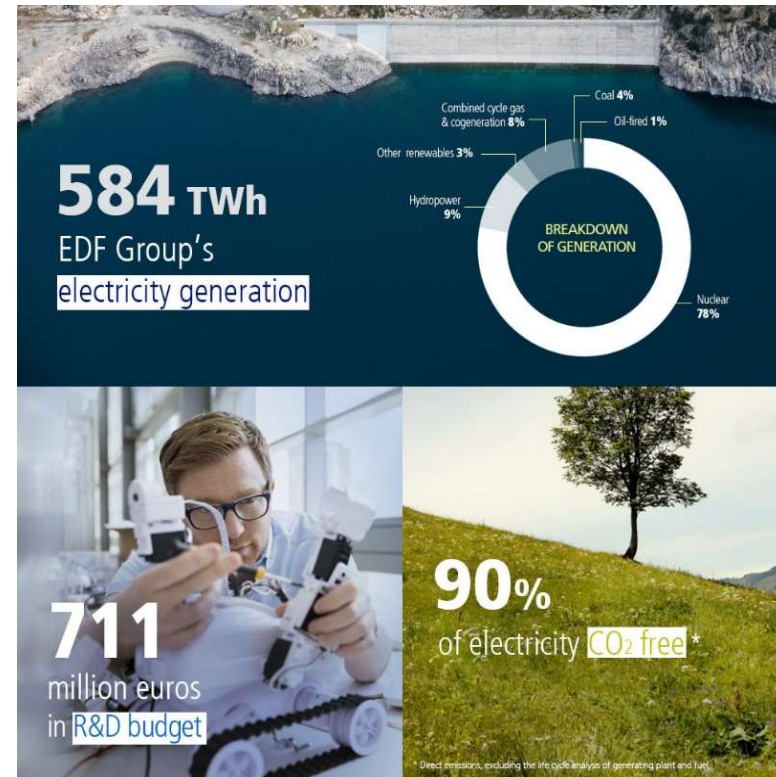


CONTENT

1. EDF & MHI partnership
2. French PPE
3. EDF company and contribution to PPE
4. Japanese Strategic Energy Plan
5. MHI company and contribution to SEP



EDF GROUP: KEY FIGURES 2018



World #1 electricity company

Leader in low carbon power generation

Covers all electricity related activities



EDF'S CURRENT STRATEGY IS IN LINE WITH THE ENERGY PLANNING UPDATE

CAP 2030



3 PRIORITIES

CUSTOMER FOCUS

To create new competitive decentralised solutions, new personalised energy services and smart grids

LOW CARBON GENERATION

To rebalance the energy generation mix by speeding up the development of renewables and guaranteeing the safety and efficiency of the existing and new nuclear fleets

INTERNATIONAL DEVELOPMENT

To penetrate new international markets by developing our low carbon solutions in emerging economies, whilst consolidating our positions in Europe

**EDF, a highly efficient and socially responsible electricity company,
championing low carbon growth**

EDF COMBINES IN ITS STRATEGY ALL THE OPTIONS FOR A LOW CARBON FUTURE



EDF is engaged in the energy transition and promotes the complementarity of nuclear and renewables energies in tomorrow's energy mix

EDF'S NUCLEAR STRATEGY OVERVIEW TO MEET PPE OBJECTIVE

Operate safely the current fleet

Current fleet operating in accordance with highest international safety standards



Reactors life extension

Extend the lifespan of the existing French nuclear fleet beyond 40 years

Decommissioning and waste management

Demonstrate that decommissioning can be done safely in an industrial manner



Nuclear New Build in France

Capitalize on previous years expansion abroad and get the best of our key learning lessons



OPERATING SAFELY THE CURRENT FLEET

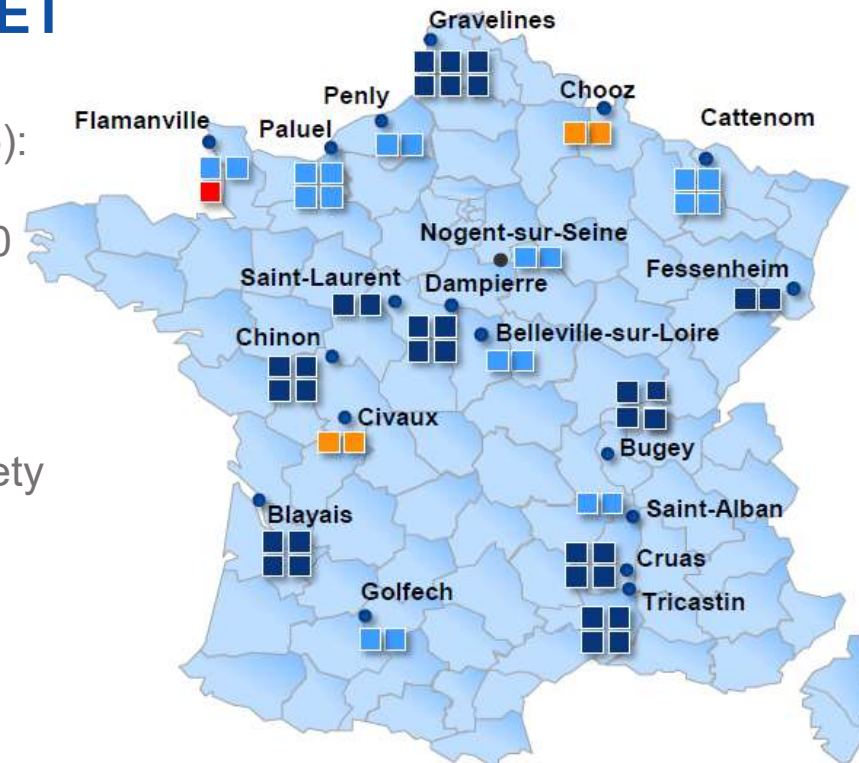
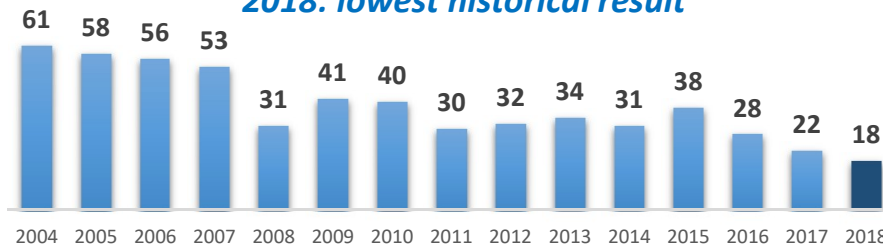
Current fleet is operated in accordance with safety standards (2015):

- **An independent safety organization** with appropriated staff: 10 to 20 safety engineers on each site and about 40 corporate
- **Highly controlled industry:** 473¹ scheduled or unannounced inspections on site by the regulatory body
- **Weak signal detection based approach:** 90%¹ of reported safety events are level 0
- Strong **investment in the initial and continuous training** of nuclear staff : 3 million hours¹ that to say 10% of payroll

¹ figure for 2015

Cumulated number of reactor trips

2018: lowest historical result



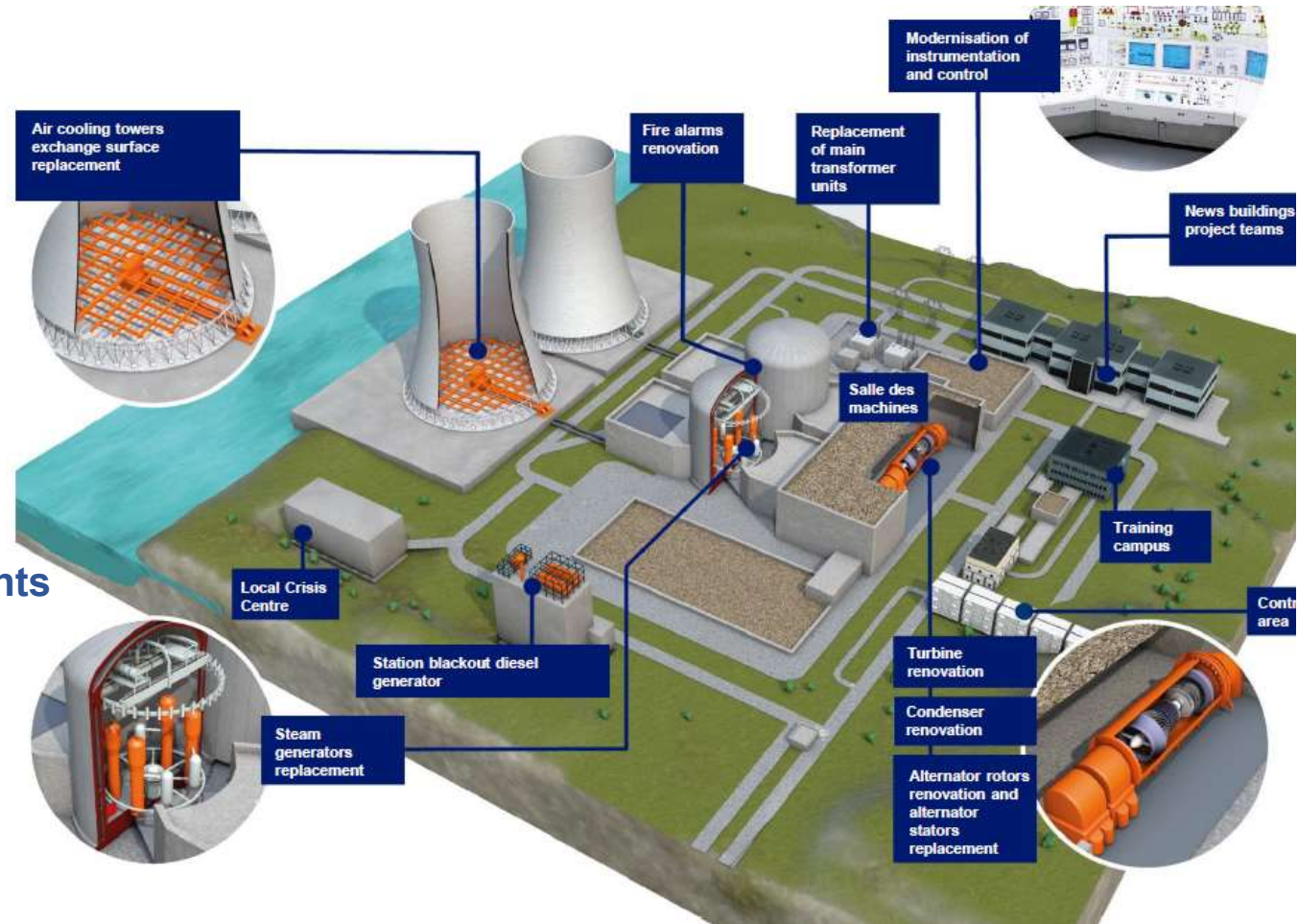
■ 900MW ■ 1,300W ■ 1,450MW ■ EPR

1887 cumulated reactor.year experience



REACTORS LIFE EXTENSION

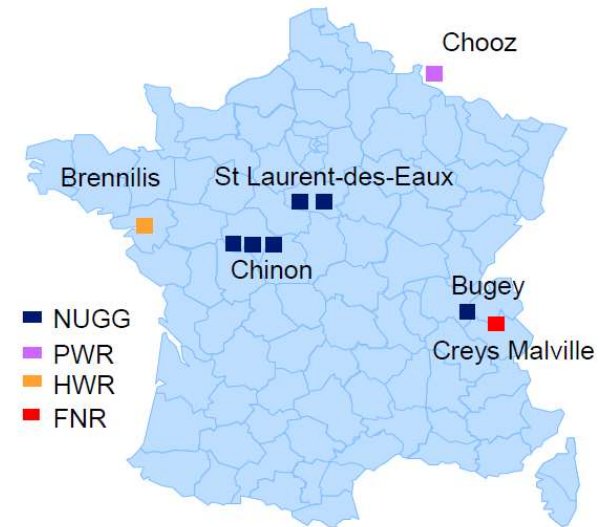
- **27 reactors** have already been extended beyond 30 years for an additional 10 years
- Lifetime extension conducting **heavy maintenance** on:
 - Steam generators;
 - Nuclear Island components;
 - Conventional Island components;
 - Turbo alternator unit
 - Heat Sink
- More general topics to **make the plants more secure**:
 - Post Fukushima modifications
 - Fire Risk Management,
 - Physical protection,
 - Fleet Performance
 - Environmental Chemistry





DECOMMISSIONING AND WASTE MANAGEMENT

- Drawing on experience:
 - **9 French reactors already under decommissioning** with 4 different technologies **including one PWR**
 - **800 EDF experts** on decommissioning and waste management process
- EDF has set up a project to decommission **two 900 MW PWR in 2020**.
- This project will be expanded to include the **decommissioning of 12 additional reactors** by 2035, all the same technology. Economical, social and security of supply issues are all taken into account and are considered in the planning
- Successful decommissioning and waste management make a strong case in the decision on the new programme





NUCLEAR NEW BUILD IN FRANCE ACCORDING TO PPE

Regarding the future of the nuclear fleet in France, and following the PPE statements:

- the EPR must be part of the technological package for tomorrow
- capitalize on the previous EPR projects to ensure a smooth implementation
- the French State asks EDF to work on a New Build programme based on EPR technology enabling a decision commitment in 2021
- this new programme would maintain the supply chain and guaranty that nuclear remains a **key contributor to the French energy supply**



Demonstration of these conditions would enable a decision commitment in mid 2021

TAKE-AWAY KEY MESSAGES

1

This is not the first time that France does an energy transition and EDF has always successfully met the goals set by the country

2

France aims at low-carbon economy in 2050. For this purpose, it will rely on **fully decarbonized electricity**, which shall be competitive and guarantee its security of supply

3

French energy planning includes a larger share of renewable energy sources as these are maturing. **The share of nuclear will remain high** at 50% in 2035 as a good complement to intermittent energy ensuring system stability

4

In order to preserve this large share of nuclear, EDF will **pursue its life extension programme** for a large portion of its fleet while managing responsibly the plants that reach their end of life

5

The government requested EDF to propose **a fleet renewal plan based on EPR technology** by 2021 so that a potential decision can be taken.



CONTENT

1. EDF & MHI partnership
2. French PPE
3. EDF company and contribution to PPE
4. Japanese Strategic Energy Plan
5. MHI company and contribution to SEP



JAPANESE STRATEGIC ENERGY PLAN

Overview

- The 5th Strategic Energy Plan is the basis for the orientation of Japan's new energy policy towards 2030 and further towards 2050, considering the changes in energy environments inside and outside Japan.
- Following the 3E+S principle to realise a stable energy supply:
(3E+S: Safety, Energy security, Economic efficiency, Environment,)



Towards 2030

- To reduce emission of greenhouse gases by 26%
- To achieve energy mix target
 - ✓ Currently halfway to the target
 - ✓ Deliberate promotion
 - ✓ Realistic initiatives
 - ✓ Intensify and enhance measures

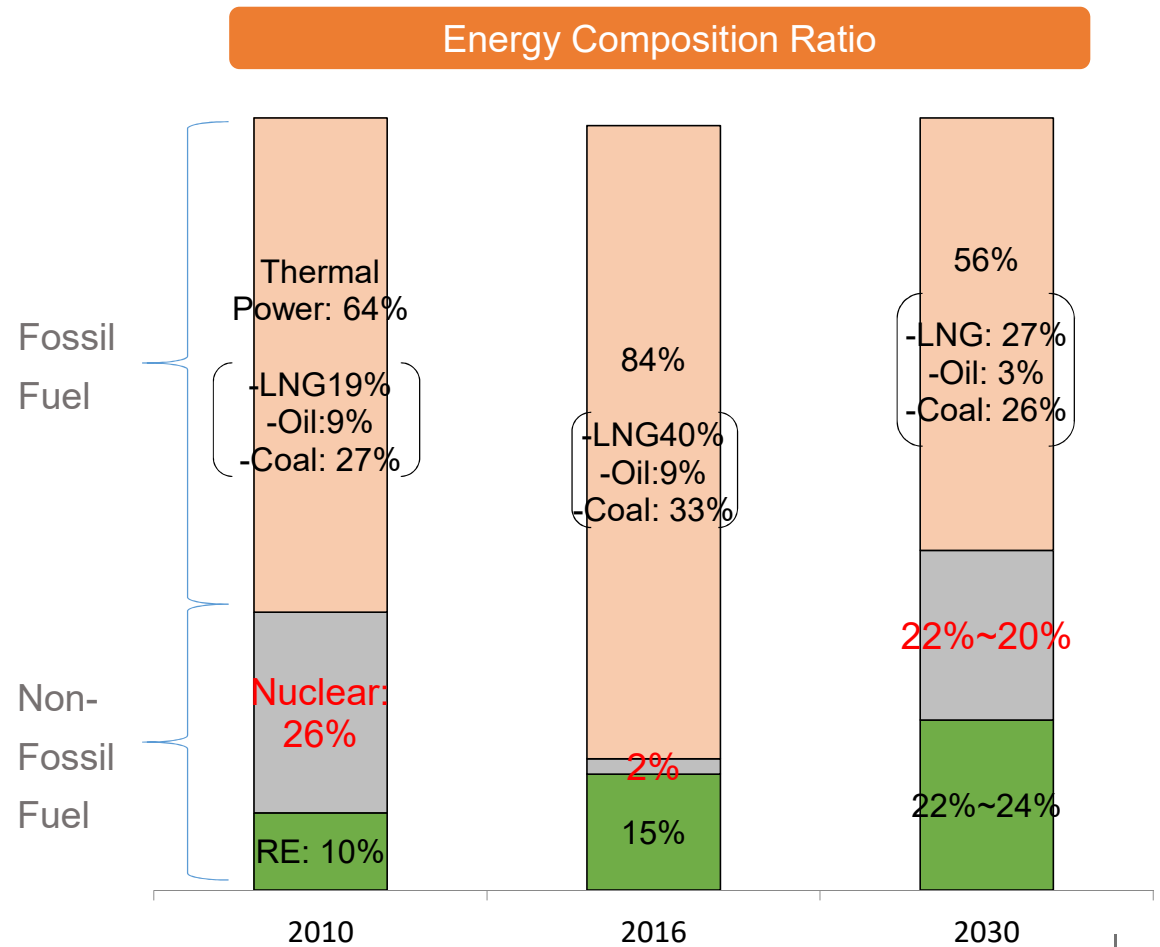
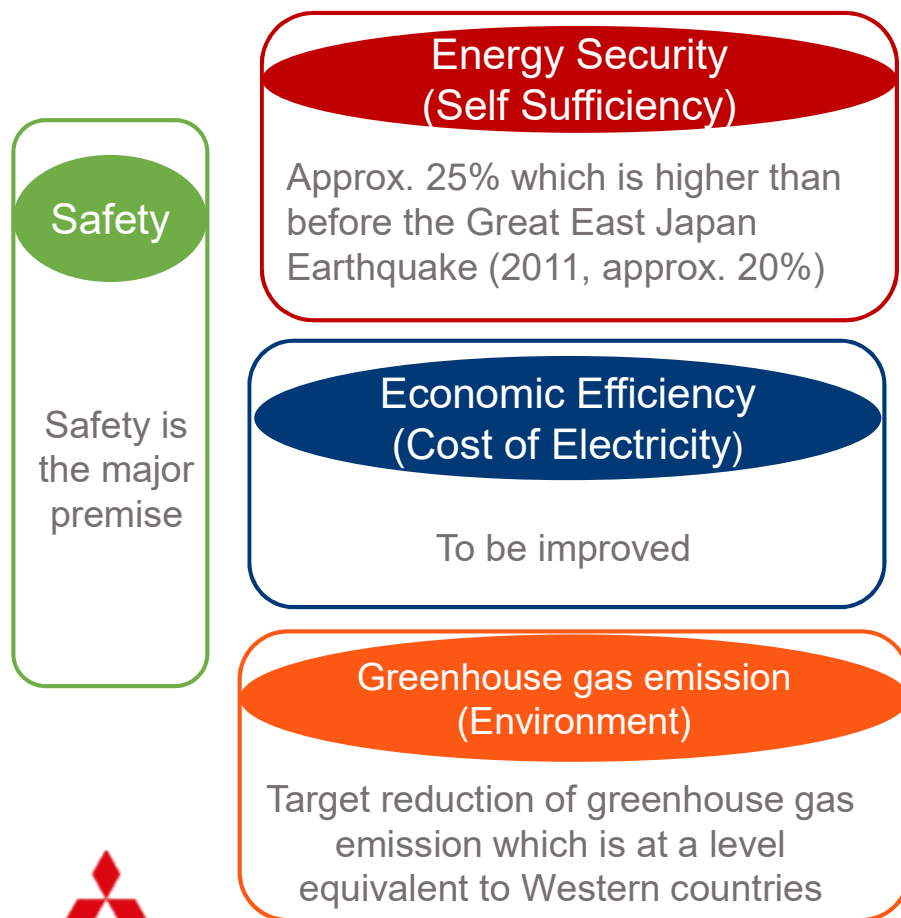


Towards 2050

- Toward reducing GHGs by 80%
- Challenges towards energy transitions and decarbonization
 - ✓ Possibility and uncertainty
 - ✓ Ambitious multiple track scenario
 - ✓ Pursue every option
 - ✓ Choose priorities by scientific review

3E + S AND ENERGY MIX

NUCLEAR POWER PLAYS AN IMPORTANT ROLE IN 3E+S POLICY



Ref: Prepared by MHI based on the material published by Ministry of Trade and Industry of Japan

POLICY ON NUCLEAR POWER UNDER STRATEGIC ENERGY PLAN

Year 2030 : realization of the energy mix

- Nuclear power : an important base-load power source as a low carbon and quasi-domestic energy source, contributing to the stability of the energy supply-demand structure
- Safety always comes first.
- To restart nuclear power plants which are confirmed by the NRA (Nuclear Regulation Authority) under the new regulatory requirements.
- Dependency on nuclear power to be lowered based on the premise that the targeted energy composition ratio will be met.

Ref: Prepared by MHI based on the material published by Ministry of Trade and Industry of Japan



CONTENT

- 1.** EDF & MHI partnership
- 2.** French PPE
- 3.** EDF company and contribution to PPE
- 4.** Japanese Strategic Energy Plan
- 5.** MHI company and contribution to SEP



MHI COMPANY OVERVIEW

MHI Products and Operation Results in Fiscal Year 2018 (consolidated)

POWER SYSTEMS

- Nuclear Energy Systems
- Thermal Power Systems
- Offshore Wind Power Systems
- Pumps, Marine Machinery, Compressors

INDUSTRY & INFRASTRUCTURE

- Chemical Plants
- Shipbuilding & Ocean Development
- Land Transportation Systems
- Engine, Turbocharger, Material Handling Equipment

AIRCRAFT, DEFENSE & SPACE

- Commercial Aircraft
- Defense Aircraft, Missile Systems, Naval Ships
- Space Systems



Net Sales	4,078.3 billion Yen (€ 34.0 B)
Orders Received	3,853.4 billion Yen (€ 32.1 B)
Number of Employees	80,774

Currency exchange rate of 1€=120JPY



Gen III+ PWR

ST rotor

Wind Turbine



LNG Carrier



LRT



Mitsubishi Space Jet



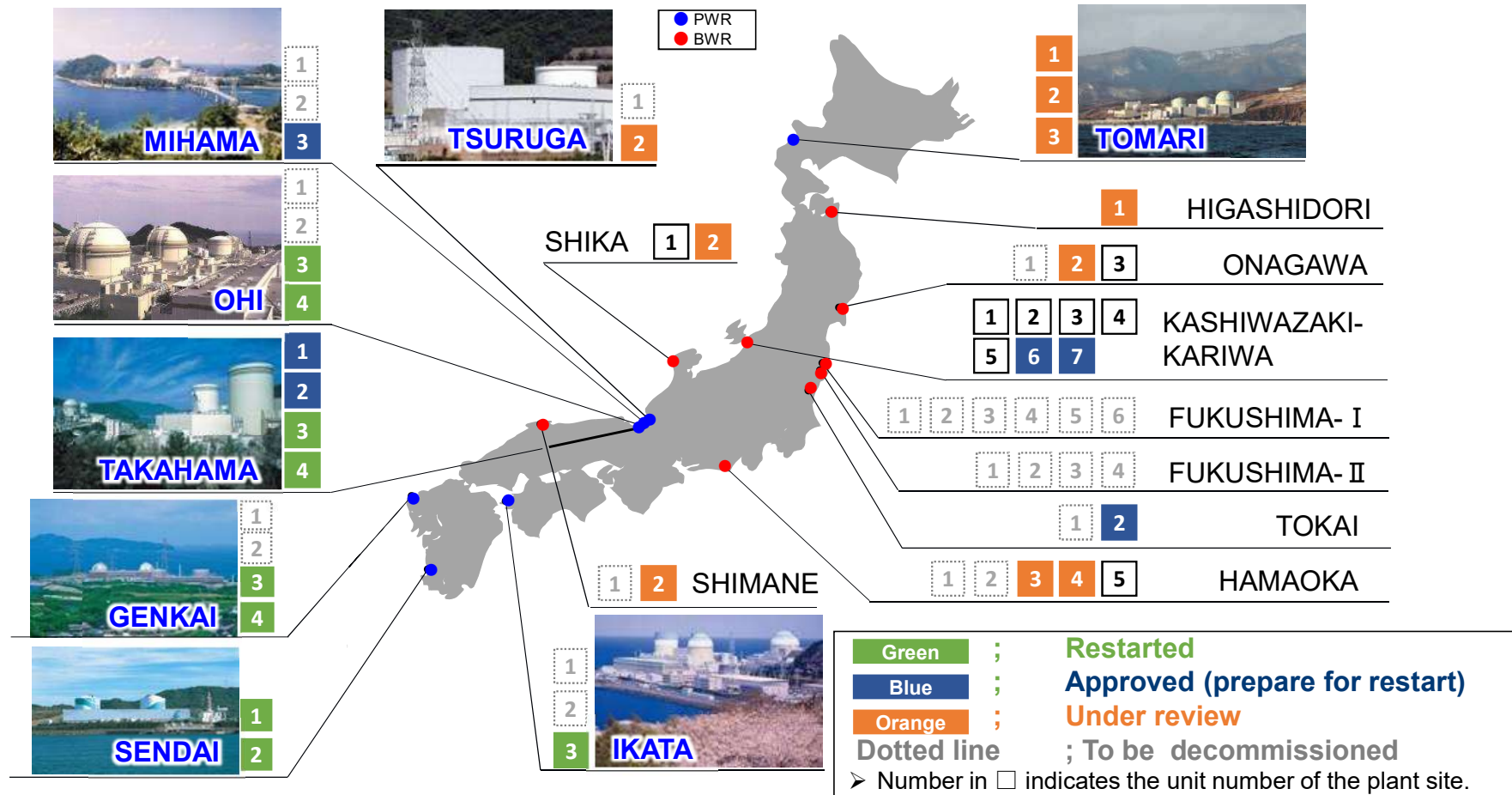
Submarine JINRYU



H-II B

NERS 2019 – EDF & MHI presentation

MHI, THE SOLE PWR PLANT SUPPLIER IN JAPAN, IS CONTRIBUTING TO THE STRATEGIC ENERGY PLAN AND DECARBONISATION THROUGH NPP CONSTRUCTION AND SUPPORT OF NPP RESTARTS

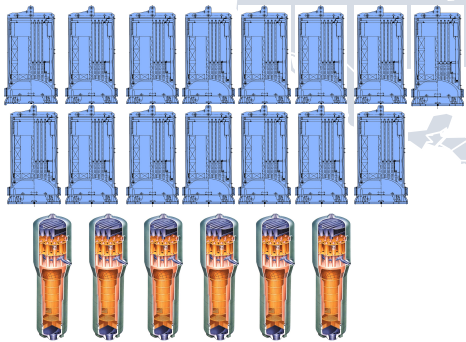


MHI IS ALSO CONTRIBUTING TO WORLD-WIDE DECARBONISATION THROUGH SUPPLYING KEY NUCLEAR COMPONENTS TO OUR GLOBAL CUSTOMERS



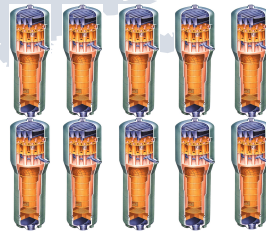
U.S.A

Water Jet Peening for
Wolf Creek/Callaway NPP
(2016/2017)
Reactor Vessel Head×15
Steam Generator×6
Pressurizer×1



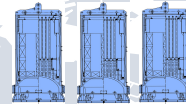
BELGIUM

Steam Generator×10



SWEDEN

Pressurizer Nozzle Spool Piece
Replacement on Ringhals unit 3
(2016)
Reactor Vessel Head×3



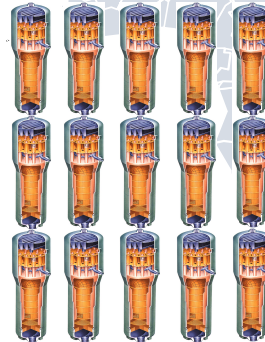
FINLAND

Reactor Vessel×1



FRANCE

Steam Generator×15



SPAIN

Turbine×1



TAIWAN

Turbine×2



SLOVENIA

Turbine×1

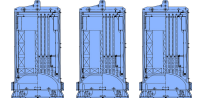


Pakistan
Turbine×1



KOREA

Reactor Vessel Head×3



CHINA

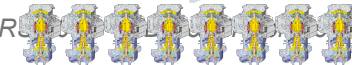
Reactor Vessel×3

Turbine×6

Reactor Coolant Pumps×8



NERC...ation



※ Components : main components only
※ Services : most recent projects only



děkuji