

***EXPOPOWER 2018,  
23 April 2018, Poznan, Poland***



Hitachi-GE Nuclear Energy, Ltd. Property

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**On time and on budget nuclear construction in Poland  
with the Advanced Boiling Water Reactor technology**  
***W budżecie i na czas. Konstrukcja elektrowni jądrowej  
na przykładzie technologii ABWR***

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Hitachi-GE Nuclear Energy, Ltd.

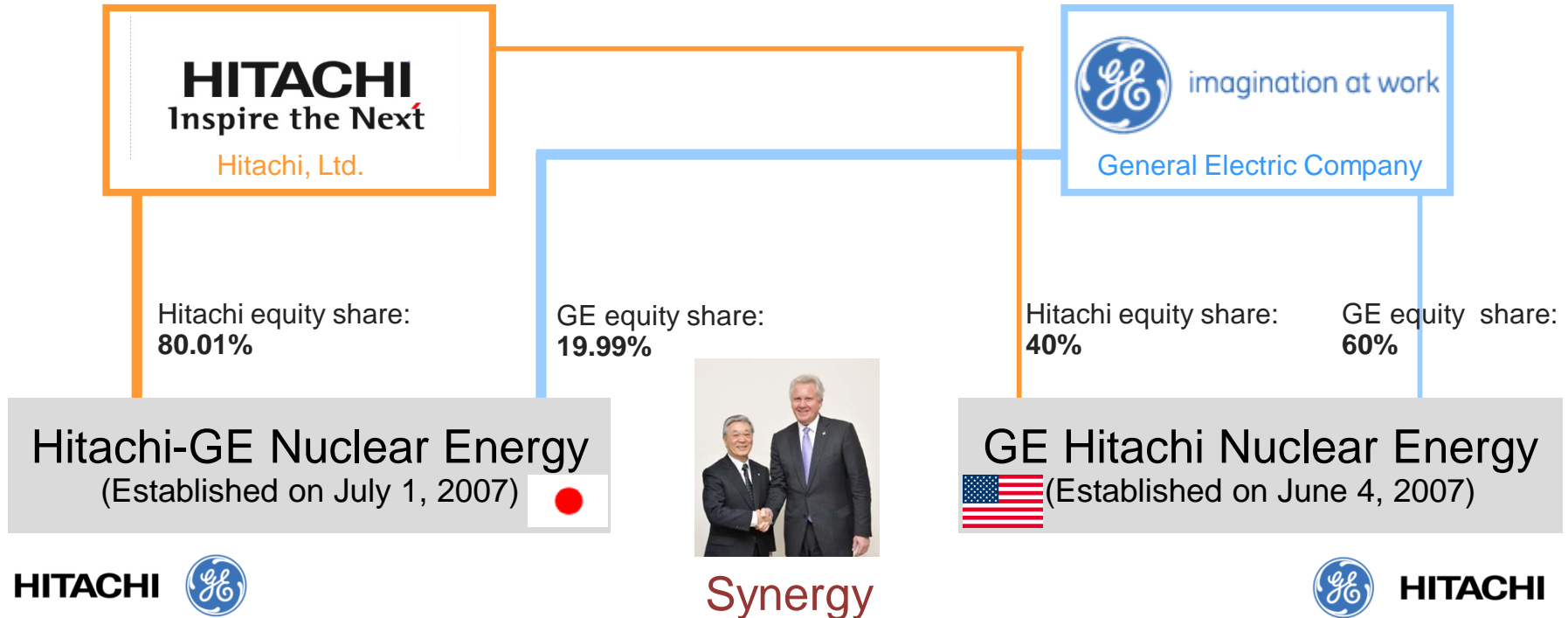
David Powell

GE-Hitachi Nuclear Energy

- 1. Hitachi's nuclear business profile**
- 2. ABWR technology: Proven construction; Proven operation**
- 3. Hitachi's U.K. nuclear project: Building success for Poland**
- 4. New nuclear construction: Opportunity for Polish suppliers participation**
- 5. Summary**



# 1. Hitachi's nuclear business profile



- GE-Hitachi alliance based on nuclear business collaboration for 50 years
- Committed to develop and promote latest BWR technologies and services



Company Name: Hitachi-GE Nuclear Energy, Ltd.

Founded: July 1, 2007

## ● *New Plant Build*

- 2 ABWRs under construction
- Global business development



Shimane 3



Ohma 1

## ● *Maintenance Service*

- Outage services for 20 operating units
- Plant modification, life extension, etc.



Water Jet Peening



Shroud Replacement

## ● *Fuel Cycle*

- Monju / Rokkasho Commissioning
- Interim Storage Casks



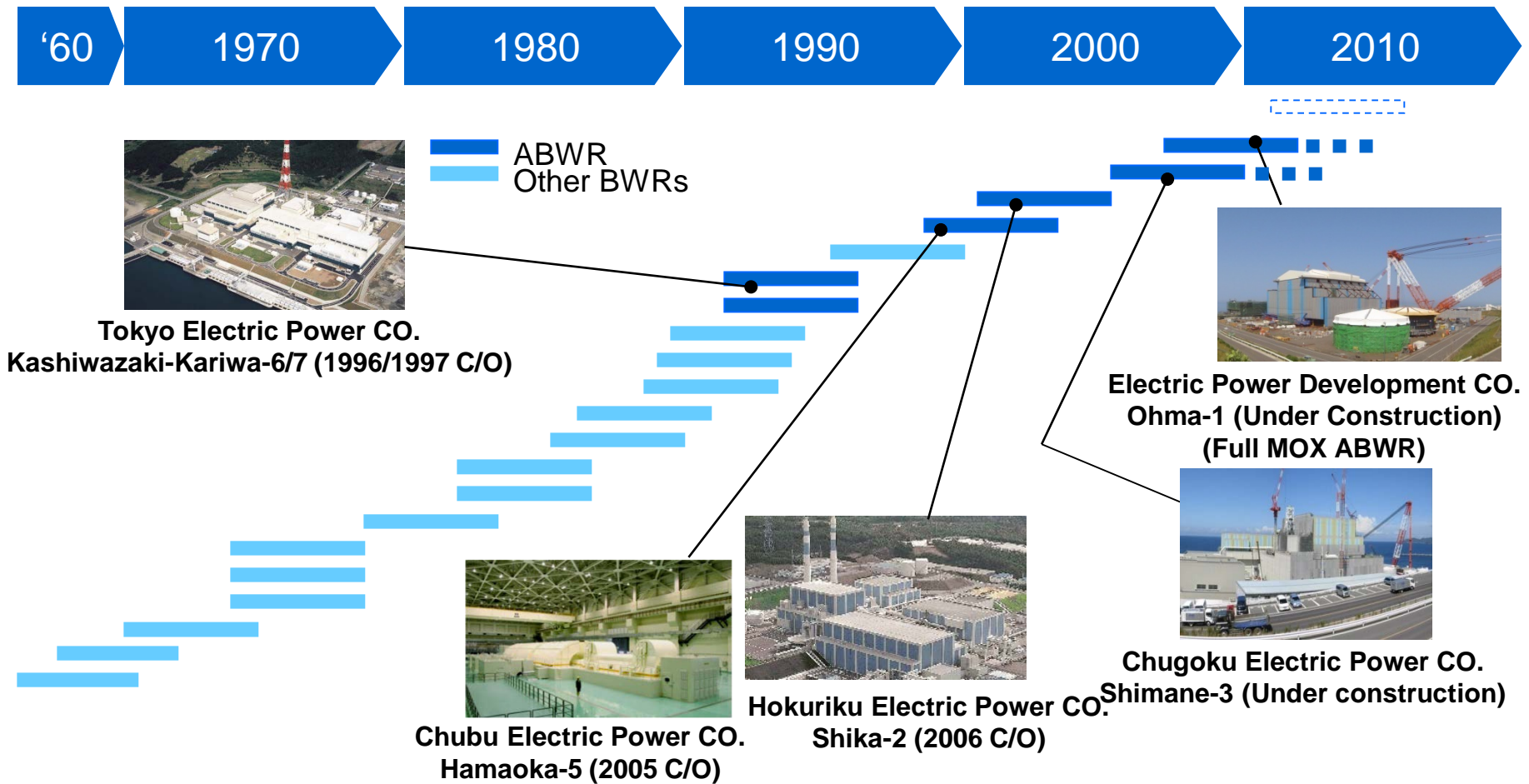
Monju NPS (Prototype FBR)



Rokkasho Reprocessing Plant



- More than 20 BWR units ... continuous construction experience
- All of our proven and advanced technology is consolidated in ABWR





## **2. ABWR technology:**

**Proven construction; Proven operation**



## New nuclear construction challenges

- Historically over schedule and cost overrun
- Significant delays and rework due to many factors

## HGNE's approach

- Comprehensive, detailed, well coordinated, *project development phase* prior to construction start
  - Integrated engineering, design and construction management processes and tools
  - Project specific detailed design that is well advanced prior to construction
  - Integrated project specific supply chain, logistics and scheduling
  - Project specific IT solution implemented
- Project development phases are typically several years in duration

## HGNE's results

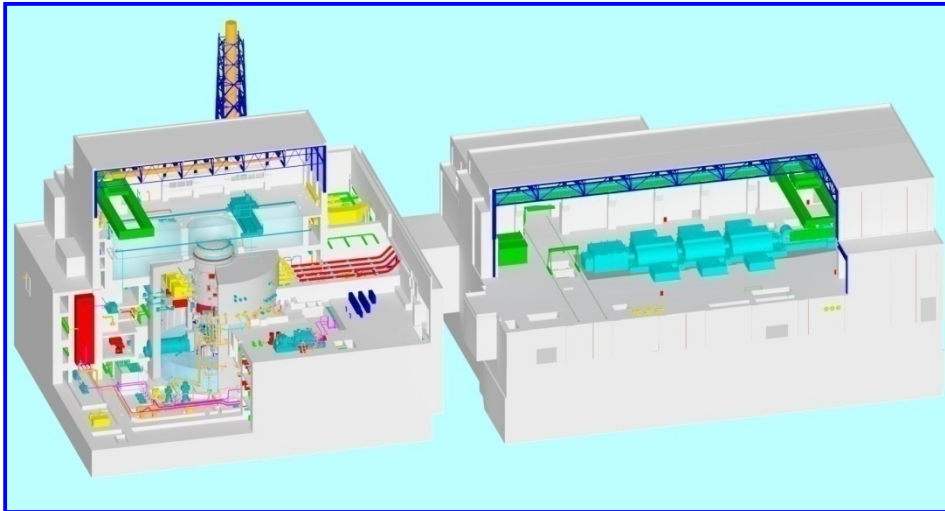
- On time construction
- Executed within budget





## *Most experienced Generation III+ reactor in the world ... advanced, proven and operating*

- Safe, reliable and cost competitive
- Simplified systems with high operability
- Short & credible construction
- Design certified by the US NRC, 1997
- First license approved in 1991; 5 ABWRs in Japan



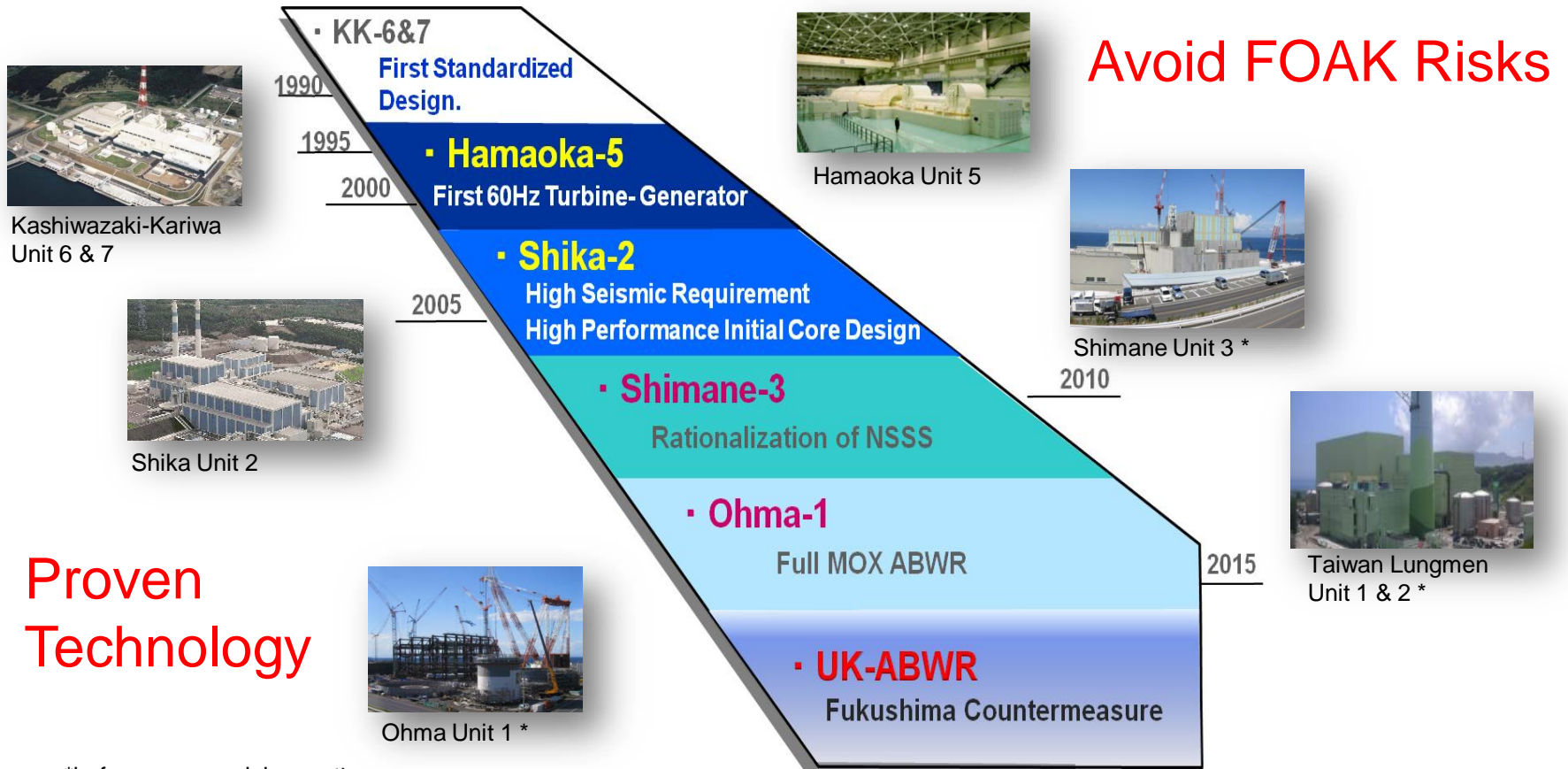
1350 MWe class



World's 1<sup>st</sup> & 2<sup>nd</sup> ABWRs: Kashiwazaki-Kariwa 6&7  
(Operation start : 1996 & 1997)

ABWR technology is always evolving

- Incorporating customer requirements, site conditions and
- Improvements based on plant operating experience and technological advancements



\*before commercial operation



F/C – First safety concrete  
F/L – Fuel load

## Construction durations (months)

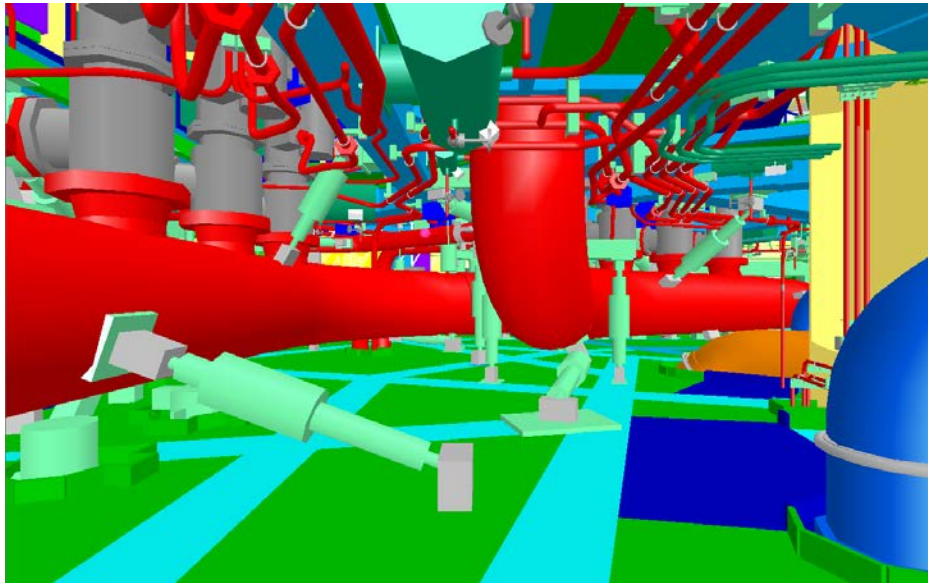
Plant	F/C –F/L		Start up	Total		Plant status
	P *1	A *2	A *2	P *1	A *2	
Kashiwazaki-Kariwa-6	37	37	11	48	48	Operation (1996-)
Kashiwazaki-Kariwa-7	38	38	10	48	48	Operation (1997-)
Hamaoka-5	43*3	43 *3	11	54	54	Operation (2005-)
Shika-2	42	42	11	53	53	Operation (2006-)
Shimane-3	41	-	-	51	-	Under Construction
Ohma-1	42	-	-	53	-	Under Construction

\*1: Planned months, \*2: Actual months, \*3: Including suspended time

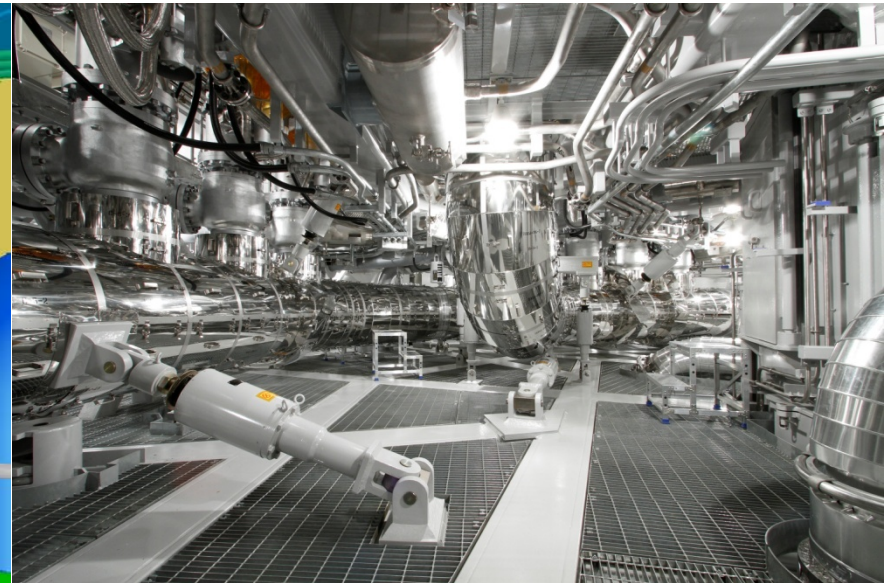


## Project Development Phase work product

- Integrated data management through total plant life (3D plant CAE)
- Integrated plant construction methodologies and management
- Advanced site specific design engineering before starting construction ... less rework

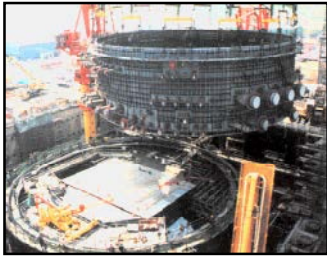


3D design output of reactor area



Actual installation work of reactor area

Construction and component installation are performed as designed and planned during the “Development Phase”



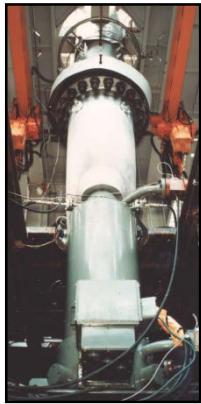
Reinforced concrete Containment Vessel (RCCV)



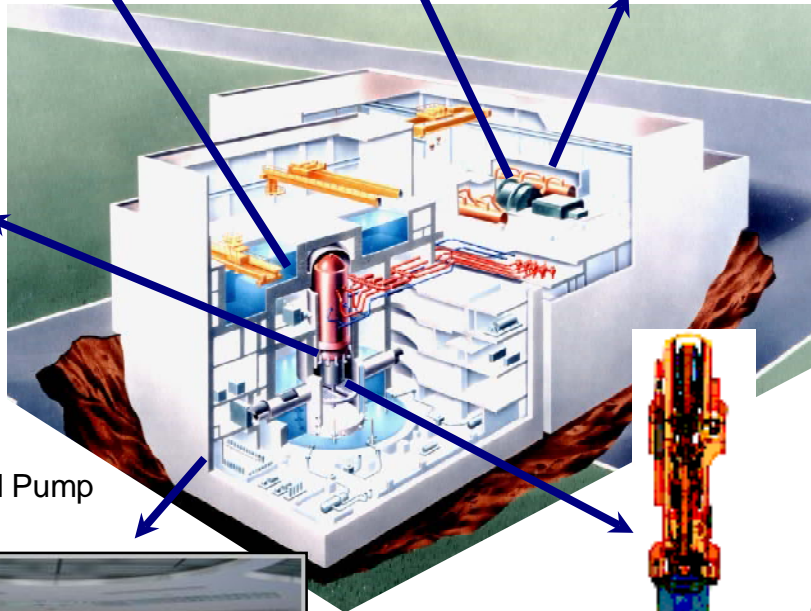
52inch long turbine blade



Moisture Separator Re-heater (MSR)



Reactor Internal Pump (RIP)



Intelligent Man-machine Interface



Fine Motion Control Rod Drive (FMCRD)

## Increased Safety

- Avoidance of large pipe break accident using RIPs
- 3-division ECCS

## Improved Operation

- Precise power control using FMCRDs and RIPs
- Intelligent Man-machine Interface

## Improved Economy

- Improved thermal efficiency using 52 inch or longer turbine blade and MSRs
- Downsizing building volume

## Increased Reliability

- Dual CR drive system (FMCRD)
- Digital Instrument and Control System

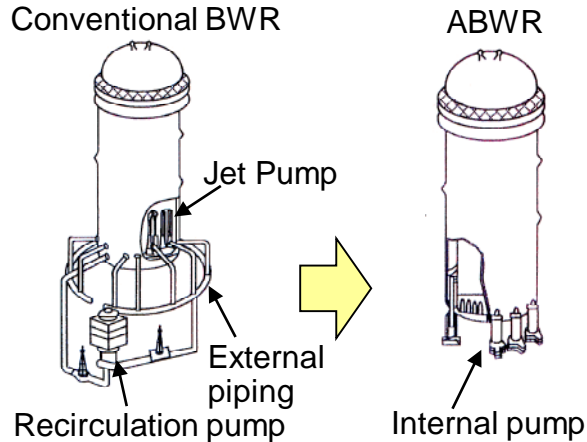


## Anticipated requirements and considerations

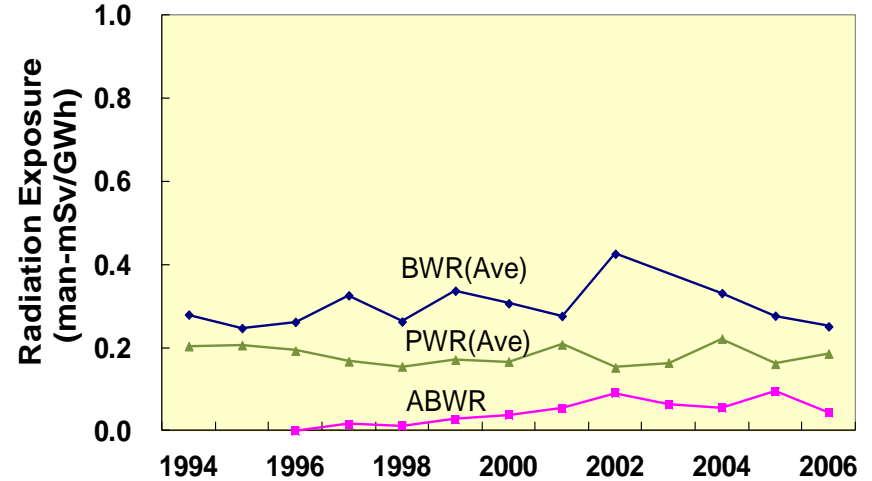
- IAEA based requirements
- WENRA considerations
- EUR considerations
  - ABWR EUR compliance review completed in 2001
  - Largely compliant with EUR guidance
  - Exceptions to EUR have been evaluated
    - US and UK ABWR address aircraft impact requirements
- Defense lines including the backup (fourth) defense line, which was added more recently – addressed in global ABWR projects
- ABWR team prepared to provide an optimized plant based on Polish requirements and regulations



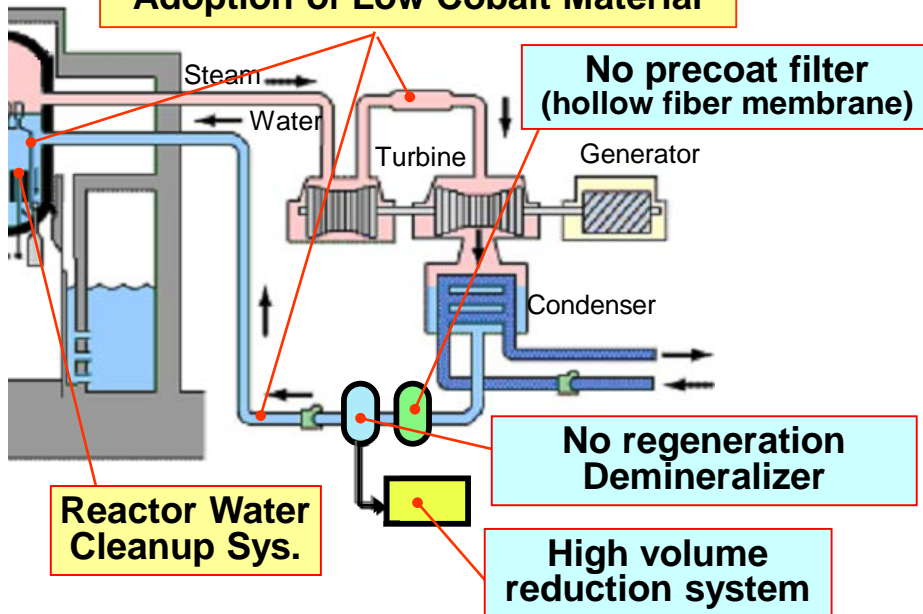
## External piping elimination



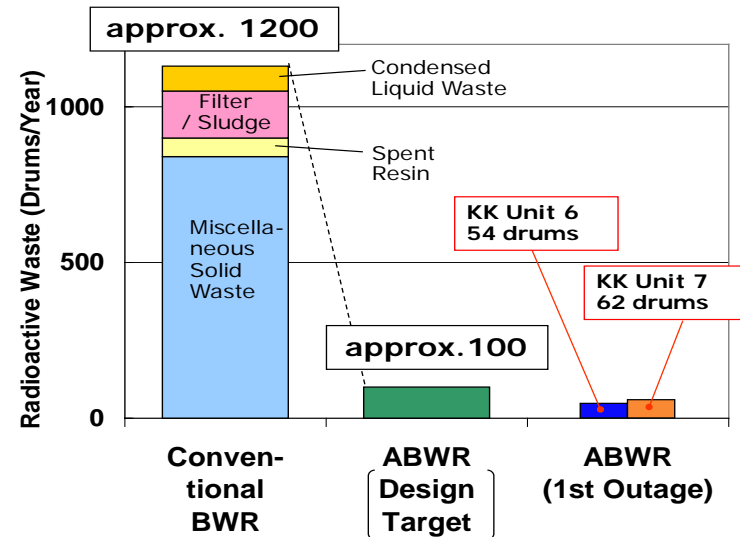
## Less Radiation Exposure



## Adoption of Low Cobalt Material



## Less Radioactive Waste





- *Predictable cost and construction schedule*

Hitachi-GE has the most advanced construction methods in the industry, achieving “On-schedule & On-budget” results

- *Reliable operation*

Design refinements from almost 2 decades of operating experience

- *Continuous improvement*

Feedback from Hitachi-GE maintenance services organization is submitted to the design process to improve manufacturing, modularization, construction and operability

- *Designed for Poland*

Polish ABWR will need to meet local requirements and regulations as well as be optimized for site specific conditions





### **3. Hitachi's U.K. nuclear project: Building success for Poland**

- Deploying Hitachi-GE UK ABWRs
- 5.4GW of new capacity across two sites (Wylfa and Oldbury) – c.10 million homes
- Up to 60% of project value could be spent in UK
- Employment: around 8,500 people at peak construction



- Mr. Duncan Hawthorne has joined Horizon as Chief Executive Officer from May 1, 2016

Visit the website to find out more-> <https://www.horizonnuclearpower.com/>



## Extensive synergies expected

- Design                      Common ABWR technology
- Licensing                    Similar European safety requirements
- Procurement                Common supply chain in EU market
- Manufacturing              Production efficiencies as volume increases
- Staffing                      Continuous and secure recruitment
- Construction                Deploy well-trained skillful workers; leverage construction training programs
- Training                      EU based operator training center
- Operation                    Leverage ABWR fleet operating experience
- Maintenance                Leverage ABWR fleet best practices; potential for common spare parts pool



## **4. New nuclear construction: Opportunity for Polish suppliers participation**



## Smart Grid & Battery Storage

Hitachi is building the biggest in Poland smart grid & battery storage system for wind power plants (Northern Poland)



## Energy Market

In 2012 Hitachi (later MHPSE) and Polimex Mostostal have been awarded project of construction of **European biggest and most effective coal power unit in Koziencice; PLN 6.3 billion project**

# HITACHI

Inspire the Next



## Innovation Leader

Hitachi implemented in Poland first biometric ATMs in Europe (finger vein authorisation)



## Big data, IoT, Storage

Leader in data processing in Poland since 2006



## Logistics & Finance

Comprehensive logistic services, fleet management and financial services



GE entered Polish market in 1992. It currently employs 7,300 people in the industrial sector.

Polish Government and GE signed an agreement on strategic cooperation in the fields of energy and aviation (2017)

GE already invested over **USD ~670** million in Poland

### Annually:

- GE R&D expenditure in Poland is **USD ~100 million**
- GE exports from Poland goods for **USD ~900 million**
- GE buys in Poland goods for **USD ~400 million**
- **Over 5000** qualified suppliers

**Power sector** – very strong GE presence in Poland (Belchatow, Opole, Orlen Włocławek power plants, now selected for Ostroleka)

## 8 Manufacturing plants

(power, aviation, appliances)

## Engineering Design Centre

(Established in 2000 and today ~2000 engineers)



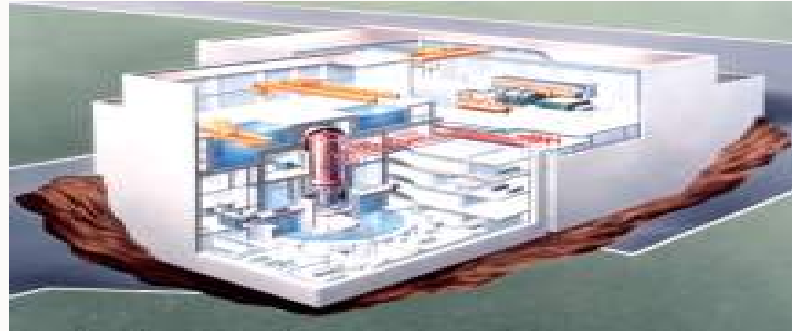
## Reactor Island

- Reactor Pressure Vessel (RPV)
- Steam Dryer
- Pedestal
- Spent Fuel Pool
- Fuel Handling Machine (FHM)
- Reinforced Concrete Containment Vessel (RCCV), etc.

## Turbine Island

- Outer Casing
- Lube Oil System
- Bearing
- Jacking Oil Pump
- Heat Exchanger
- Oil Seal System etc.

## Nuclear Power Plant



✓ **5,000 Workers (Max)**

✓ **5 Years in Construction**

## Civil Construction & Erection

- Reactor / Turbine Buildings
- Control Building & Other Buildings
- Turbine / Generator Foundation etc.

- Mechanical Installation
- Electrical Installation
- Piping Work etc.



## 5. Summary





## ***Why the ABWR is the right choice for Poland***

- Established competitive technology
- Predictable construction cost and schedule
- Synergies with Horizon UK ABWR build
- A long term partner in Poland
- Ability to utilise Hitachi's and GE's local experience
- Project financing assistance
- Opportunities for Polish supply chain

***In Poland...with Poland...for the 21<sup>st</sup> century Poland***



**HITACHI**



Hitachi-GE Nuclear Energy, Ltd. JAPAN  
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<http://www.hitachi-hgne.co.jp/en/index.html>