



## **NERS 2022**

### **EDF EPR1200 TECHNOLOGY: THE EUROPEAN SOLUTION FOR THE CZECH REPUBLIC**

**Sarah Illouz – Offer Director for Dukovany 5  
EDF New nuclear development**

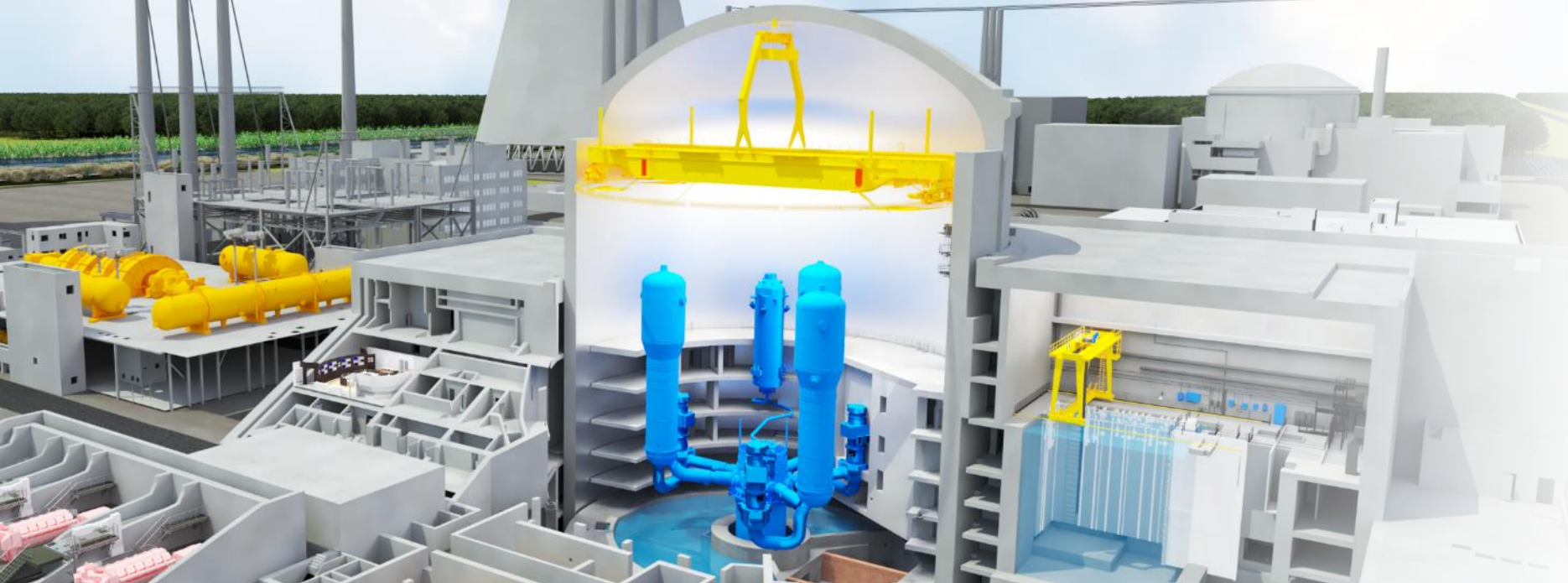
**June 14<sup>th</sup>, 2022**



## **NERS 2022 | AGENDA**

- **EDF: A EUROPEAN UTILITY AND VENDOR COMMITTED TO DELIVERING A EUROPEAN FLEET**
- **A NUCLEAR AMBITION SUPPORTED BY THE FRENCH GOVERNMENT**
- **EPR1200 TECHNOLOGY**
- **EDF VALUE PROPOSITION FOR THE CZECH REPUBLIC NUCLEAR PROGRAM**
- **WORKFORCE DEVELOPMENT**
- **CONCLUSION**





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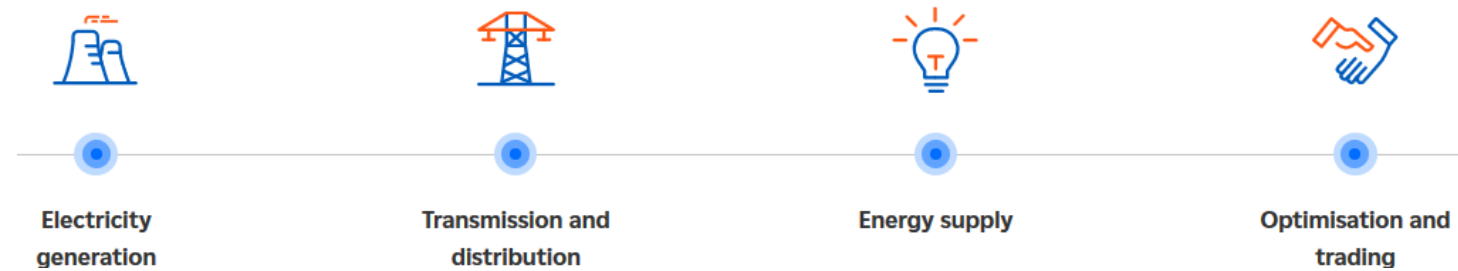
Prague  
June 14th, 2022

# EDF EUROPEAN UTILITY AND VENDOR COMMITTED TO DELIVERING A EUROPEAN FLEET

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# EDF – A EUROPEAN UTILITY AND VENDOR COMMITTED TO SUPPORTING NET-ZERO TARGETS

- Its business covers all electricity-related activities



- Key Figures in 2020



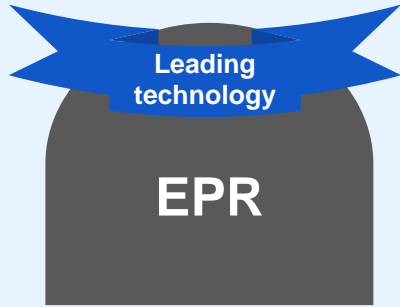
## Our Company Purpose



Build a net zero energy future with electricity and innovative solutions and services, to help save the planet and drive wellbeing and economic development



# A COMPREHENSIVE PORTFOLIO OF GEN III+ TECHNOLOGIES TO MEET OUR CLIENTS' NEEDS



- ✓ Most powerful reactor in the world
- ✓ The leading reference for very high energy demand
- ✓ High maneuverability



1200 MWe

- ✓ EPR adaptation to 1200 MWe
- ✓ Adapted to various site and grid conditions
- ✓ High maneuverability



340 MWe

- ✓ 300-400 MWe coal-fired plants replacement
- ✓ Adaptable to various environments
- ✓ Other low-carbon use: hydrogen, heat & electricity cogeneration, district heating, water desalinization
- ✓ High maneuverability



Designs sharing the Core EPR Technology

Fully integrated SMR design

→ EPR1200 and NUWARD™ best suited for the Czech nuclear program as part of the competitive processes in place

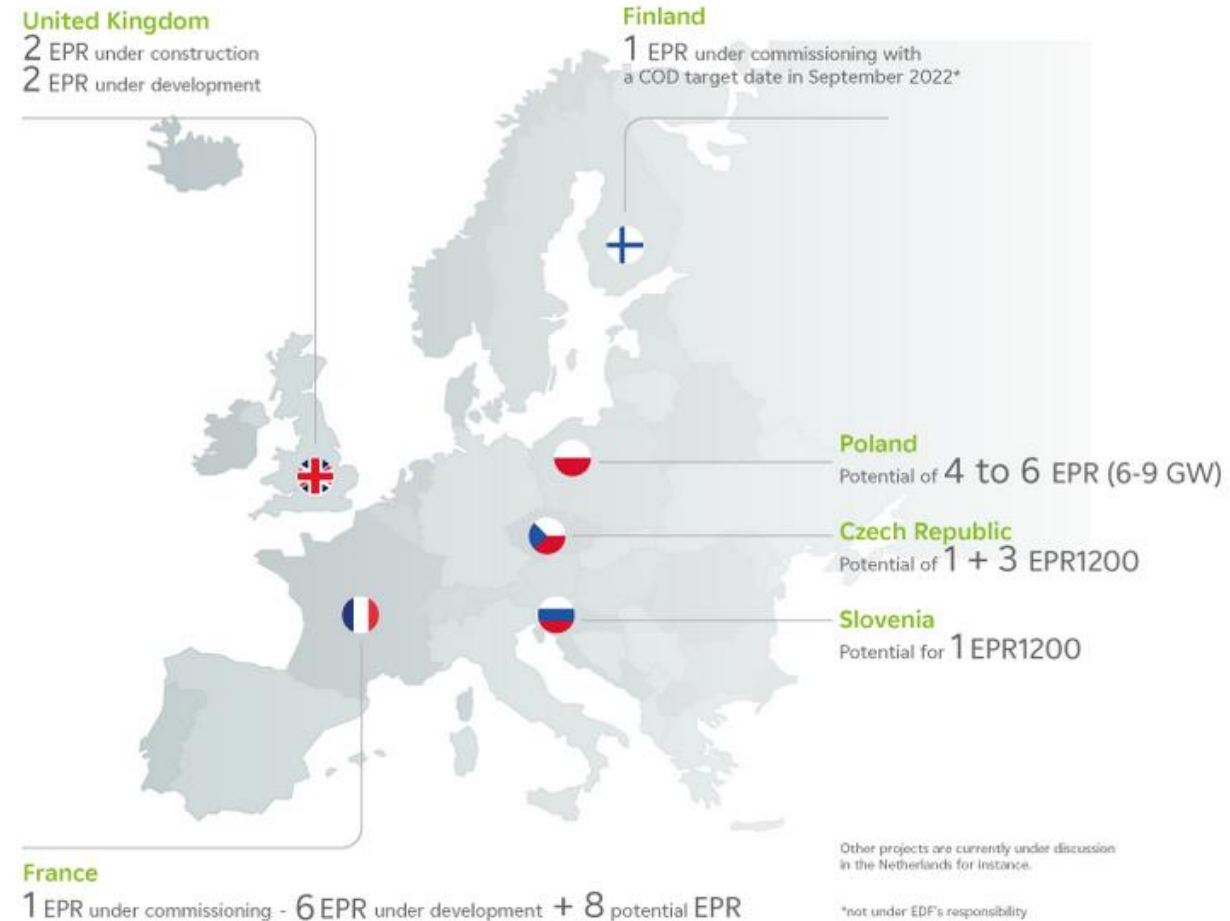
# SHOWING THE WAY IN BUILDING AN EPR EUROPEAN FLEET

## THE EPR-BASED TECHNOLOGY “FLEET EFFECT”

- **Derisked technology**, licensed and under construction in 3 European countries, meeting the EUR (European Utility Requirements).
- **Increased competitiveness** with outstanding operating performance and unbeatable flexibility.
- **Mutualisation** of operation and maintenance, training and sharing of expertise and **Spare parts optimisation** with European manufacturing.
- **A qualified supply chain at EU level** resulting in cost reduction & industry development.

## SYNERGIES BETWEEN EPR PROJECTS

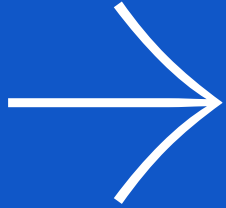
- A strong commitment from EDF to deliver a series of **6 EPR units** (+8 in option) in order to renew the French fleet.
- The French programme shares a high degree of similarity with the other European Nuclear Power Programmes, allowing **many cross-projects synergies**.
- The Czech Republic will benefit from **economies of scale** and faster learnings, securing the **project delivery**.
- Czech economy will be bolstered by other EPR projects in Europe and worldwide.



➔ The EPR-technology fleet approach can deliver long-run competitive, dispatchable and reliable energy to Europe.

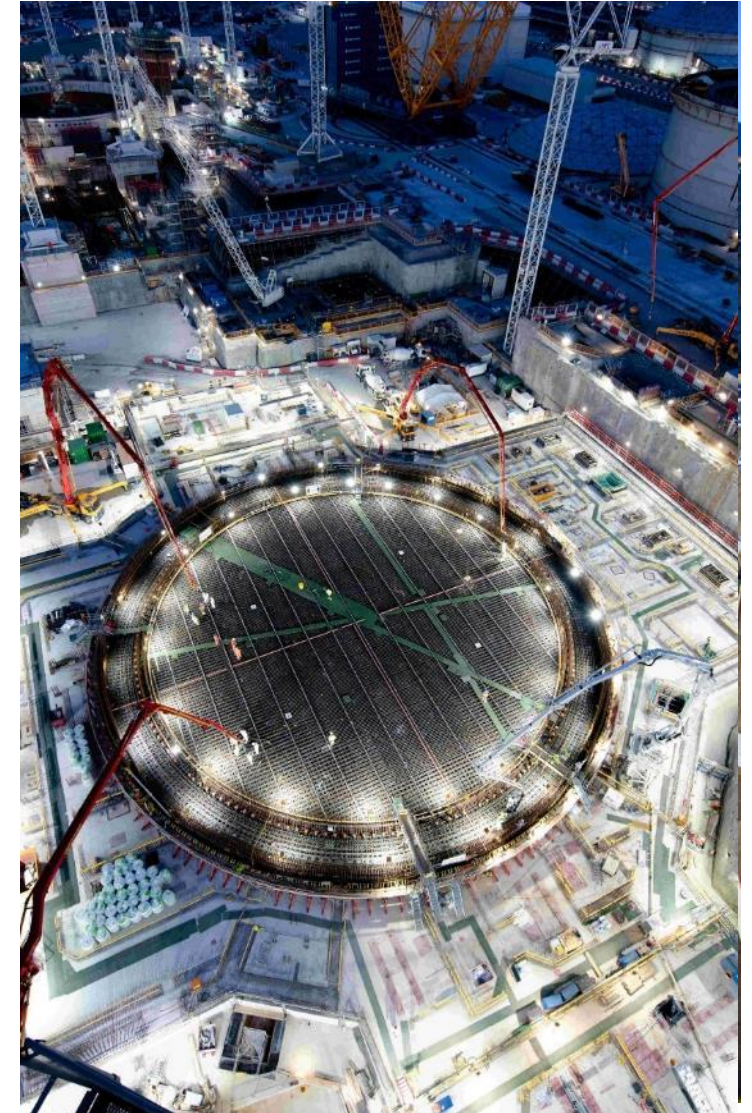


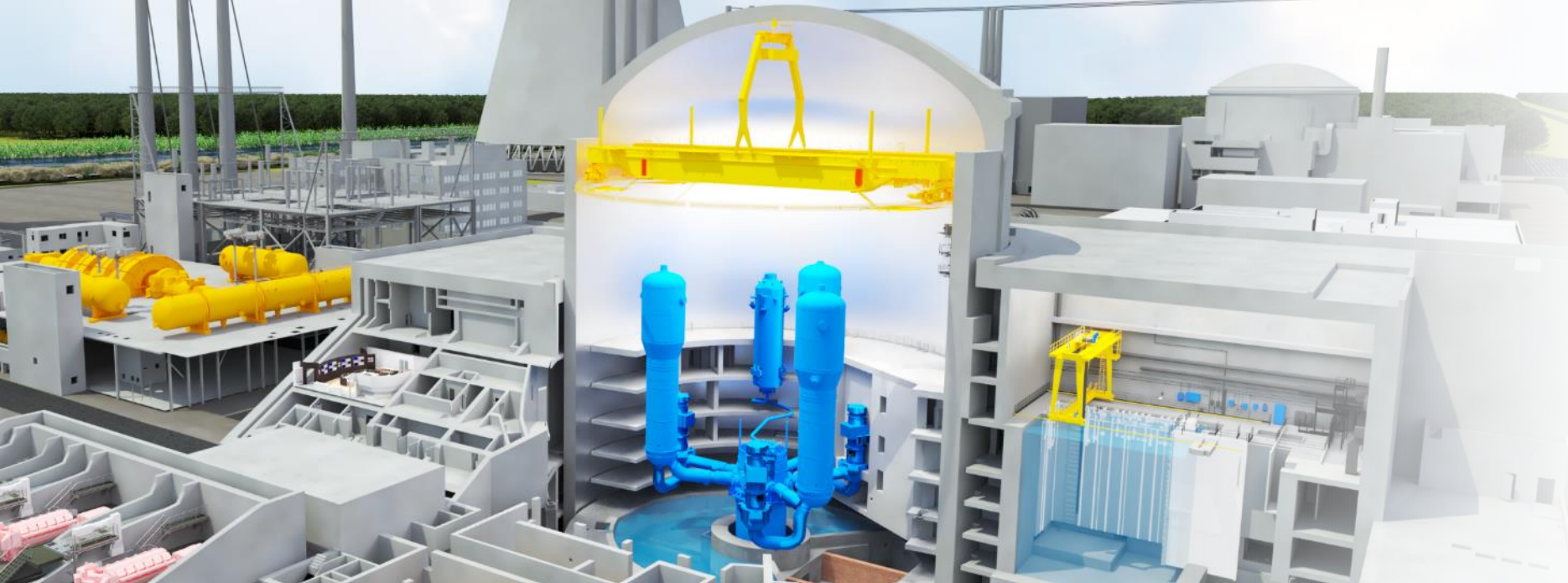
# EDF'S COMMITMENT TO DUKOVANY 5 OFFER



#EDF is strongly committed to support #CEZ nuclear program for #Dukovany5 with a fully integrated offer:

- ① A state-of-the art reactor technology #EPR1200, guaranteeing the highest performance, standards of safety, cybersecurity and operational performance
- ② Long-term support during the entire lifespan of the plant, through sharing of experience and lessons learned during engineering, construction, commissioning and O&M phases
- ③ A secured involvement of the #Czech nuclear industry, notably through appropriate transfer of knowledge and competences.





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# A NUCLEAR AMBITION SUPPORTED BY THE FRENCH GOVERNMENT

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# A FRENCH NUCLEAR INDUSTRY FULLY SUPPORTED BY THE FRENCH GOVERNMENT, WHICH SETS CLEAR AMBITIONS

October 12th 2021

Réinventer  
le nucléaire



Launch of France's €30 billion five-year investment plan

By 2030 France must be a leader in carbon-free power production with one SMR in operation and nuclear plants used to produce clean hydrogen through electrolysis. Part of the plan will see €1 billion (USD 1.1 billion) invested in building a SMR.

→ France will build **6 new EPR 2 nuclear reactors**, an optimised version of the EPR technology, "by 2028, with the first reactor to be commissioned by 2035". **8 more reactors are being considered, bringing the total to 14.**

→ "This new programme could lead to the commissioning of **25 GW of new nuclear capacity** by 2050".

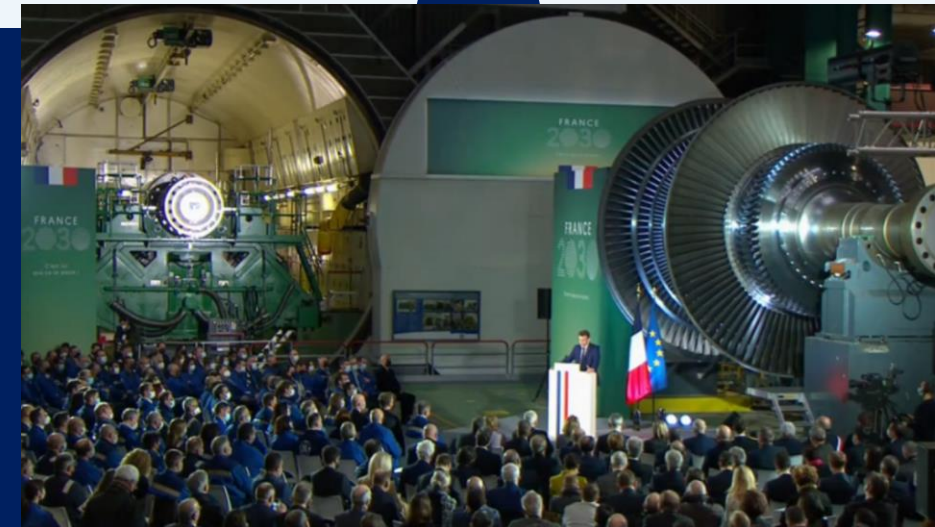
November 9th 2021



Televised address to the Nation for the construction launch of new nuclear reactors in France

“ To guarantee France's energy independence and achieve our objectives, in particular carbon neutrality in 2050, we will for the first time in decades relaunch the construction of nuclear reactors in our country. ”

February 11th 2022



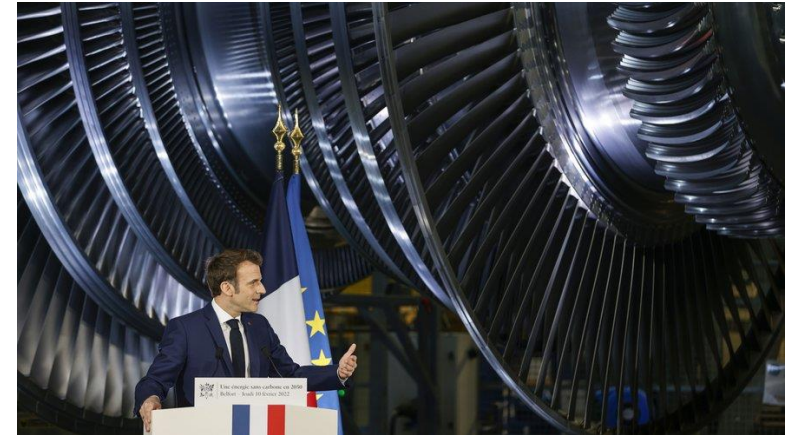
Macron presents France's long-term "nuclear-heavy" energy plan in Belfort

→ "The state will assume its responsibilities in **securing EDF's finances** and its short- and medium-term financing capacity".

→ The French government will grant €500 million of financial support for the development of NUWARD™ SMR technology under the *France 2030* plan.

# CONSTRUCTION OF NEW EPR2 REACTORS IN FRANCE WILL BENEFIT EDF'S PARTNER COUNTRIES AND THEIR SUPPLY CHAINS

- **EPR2 is the optimised design of EPR reactor selected for the renewal of the French fleet**
  - It will replicate the best features of the EPR design and will incorporate improvements drawn from the operating experience of current EPR projects (Flamanville 3, Taishan and Hinkley Point C)
- **Construction of 6 units**
  - To benefit from the series and fleet effects
  - To give visibility to the supply chain and implement the Excell plan, aiming at developing the safety culture and maintaining the highest quality levels
  - To benefit from operation and maintenance synergies
- **EPR2 program in France will support the strengthening of the nuclear industry in France and in Europe**





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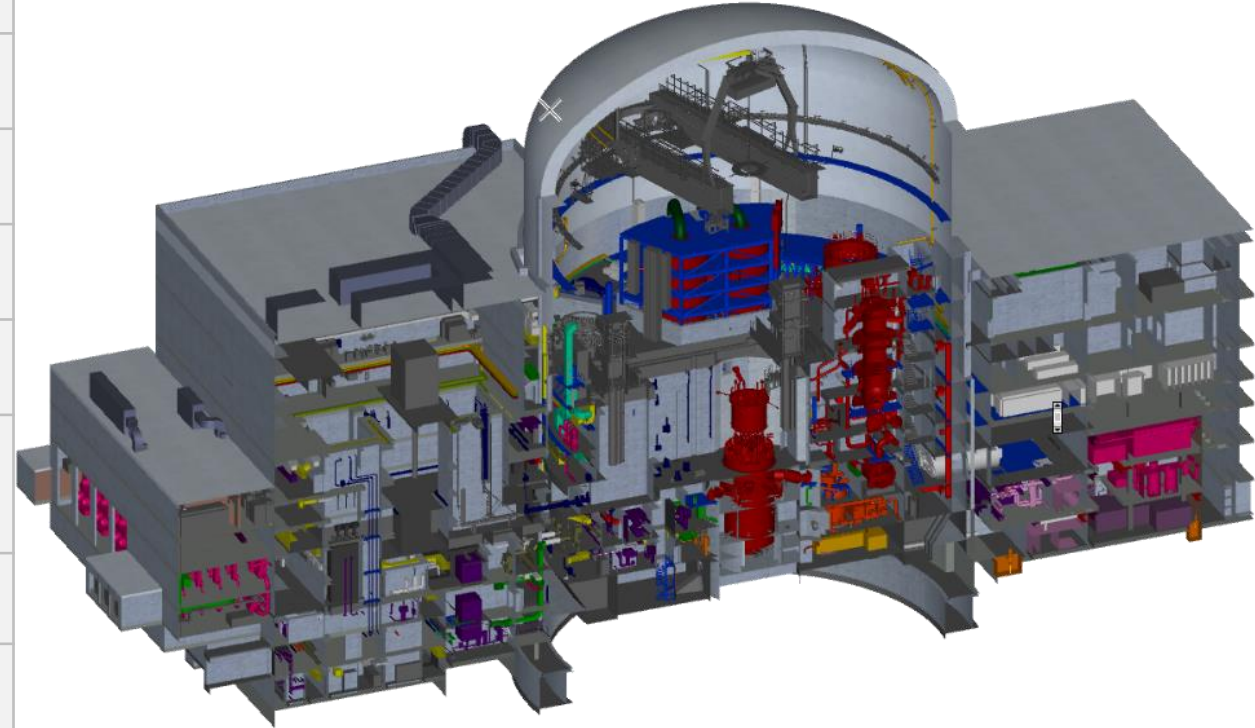
## EPR1200 TECHNOLOGY

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# EPR1200 MAIN FEATURES

Core power	3300 MWth
Electrical output (net)	1150-1200 MWe
Operation cycle	18 months
Availability factor	> 90%
Design plant life	60 years
I&C	Fully digital
Fuel assemblies	177 fuel assemblies 14ft
Spent fuel storage capacity	More than 10 years
Grid connection	Compliant with EU Requirements for Generators



# EPR1200 REACTOR IS BASED UPON THE FULLY PROVEN EPR TECHNOLOGY

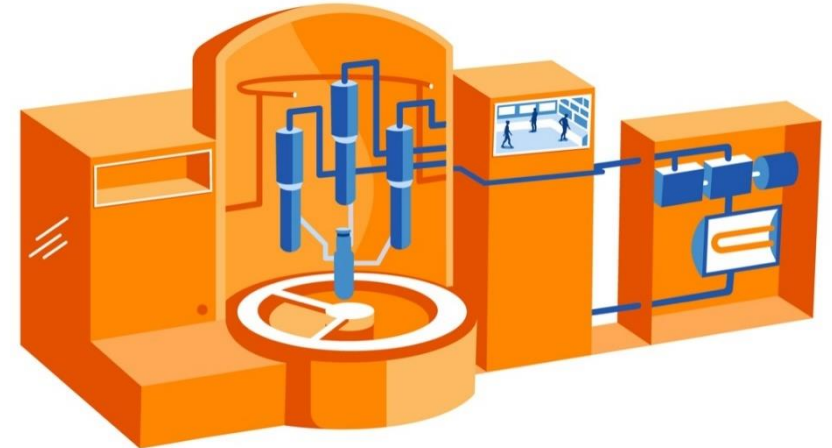
## EPR TECHNOLOGY AT A GLANCE

- + **Highest** standards in terms of **safety**, reliability, efficiency, productivity, operational performance and environmental impact
- + **Core EPR technology** technical features basis of all EPR configurations
- + Full **digital design**

- ✓ Licensed by 4 recognized Safety Authorities including 3 in Europe  
France – Finland – China – United Kingdom
- ✓ Fully compliant with the European Utility Requirements (EUR)
- ✓ Strong resistance confirmed by the European Post-Fukushima stress tests

## EPR1200 REACTOR

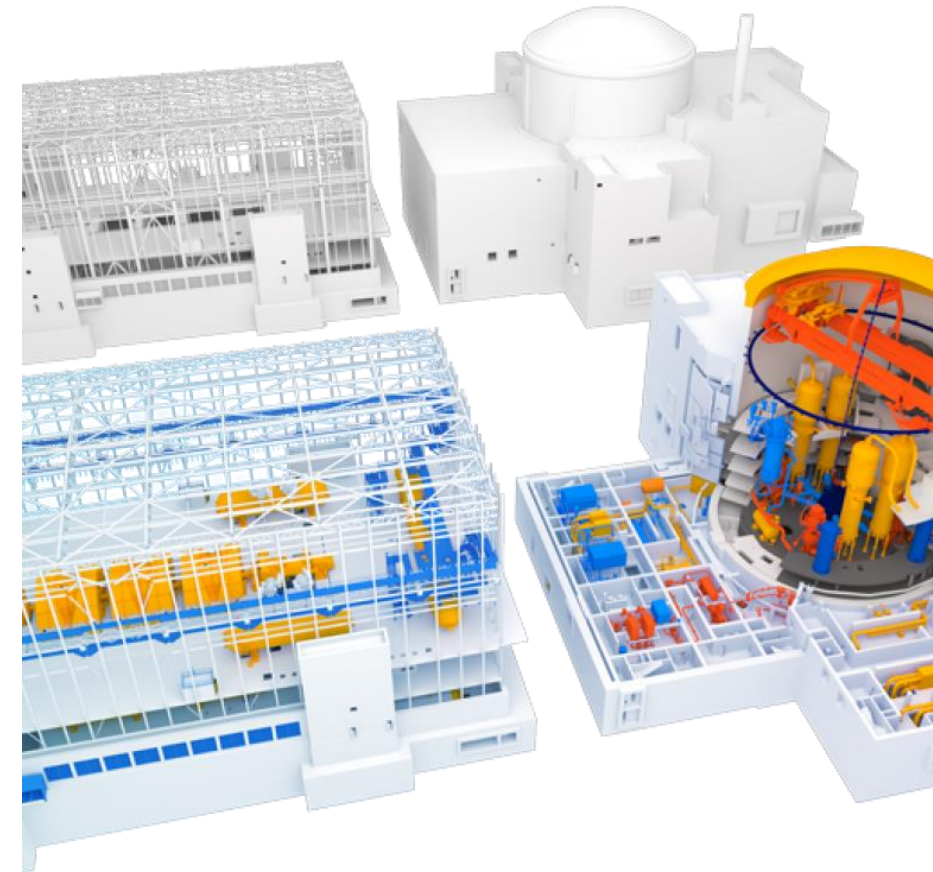
- ⚡ Net electrical power output **1200 MWe**
- 💡 **9 TWh** low carbon electricity generation per year, avoiding **6,6 millions** t eq CO<sub>2</sub> emissions  
Enhanced grid base-load and load-following
- 📈 maneuverability: **80% variation in 30 minutes**



The mid-size adaptation of the EPR Technology

# EPR1200 – A MID-SIZE ADAPTATION INTEGRATING THE BEST OF EPR LESSONS LEARNED AND OPTIMIZATIONS

- The EPR1200 is designed for export markets and aims to be licensed in other countries, with a strong emphasis on Europe.
  - EPR1200 has the same safety referential of EPR and EPR2 which is following the new texts published after Fukushima accident by AIEA (World), WENRA (Europe) and ASN (France)
  - EPR1200 takes into account EPR2 design optimizations as well as construction and operation feedback from all current EPR projects (FLA3, TSN, HPC)
- All major design options derived from EPR2 have been reviewed and accepted by the French Nuclear Regulator
  - “The ASN considers that the principle of a **single thick-walled containment** is acceptable, with regard to the functions of the containment and projection against external hazards of natural or human origin.”
  - “The ASN considers that the principle of a **three-train architecture of the main safety systems** should meet the safety objectives defined in the ASN guide of July 18, 2017.”



The updated standard design options ensure safety and security standards of the same level as its reference design, the Flamanville 3 EPR.



# CORE EPR TECHNOLOGY

## SAFETY PRINCIPLES

- Defence-in-depth
- Safety Design
- Diversification and Redundancy
- Severe Accident Management
- Combination of active and passive systems

## REACTOR SYSTEMS DESIGN

- Core design
- Safeguard systems architecture
- Support Systems architectures
- Heat Removal Systems
- Emergency Feedwater Systems
- Steam and Power Conversion System
- Severe accident mitigation devices



## STANDARD EPR COMPONENTS & CATALOGUE

- Reactor Pressure Vessel
- Core instrumentation
- Steam Generators
- Pressurizer
- Primary Pumps

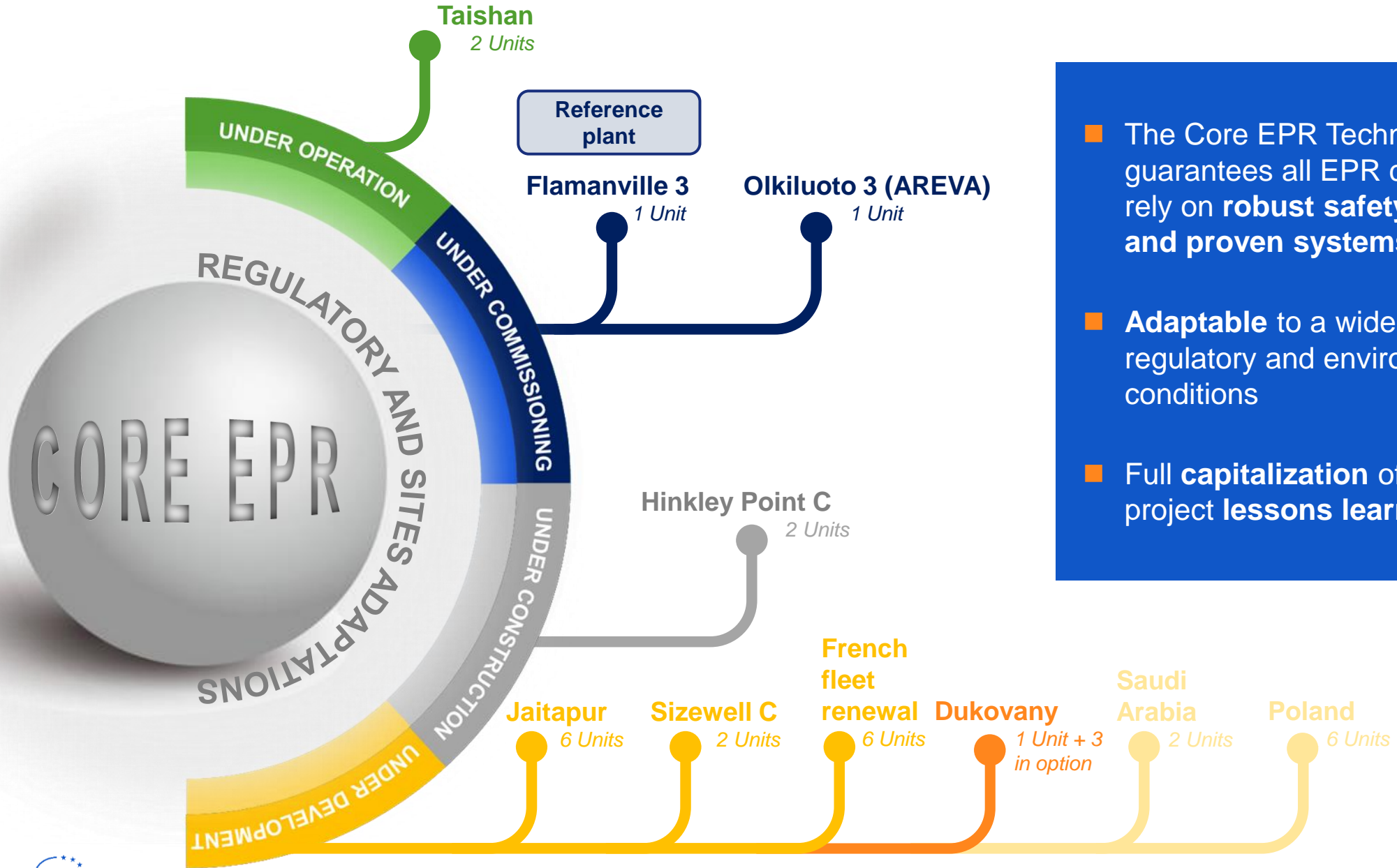
Fully Digital I&C

## CODES AND STANDARDS



→ Core EPR Technology unchanged regardless the EPR configuration and the rated power of the reactor (1650 – 1200)

# THE CORE EPR TECHNOLOGY: THE BASIS OF ALL EPR CONFIGURATIONS



- The Core EPR Technology guarantees all EPR configurations rely on **robust safety features and proven systems**
- **Adaptable** to a wide variety of regulatory and environmental conditions
- Full **capitalization** of previous project **lessons learned**



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# EDF VALUE PROPOSITION FOR THE CZECH REPUBLIC NUCLEAR PROGRAM

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# EDF VALUE PROPOSITION FOR THE CZECH REPUBLIC NUCLEAR PROGRAM

## EPR1200 reactor

Proven technology, mid-size version of the state-of-the-art EPR reactor, guaranteeing the highest performance, standards of safety and cybersecurity

## Fully integrated offer

Outstanding experience in design, engineering, construction, commissioning and operation of NPPs worldwide with EDF's unique expertise of Architect-Engineer

## Cumulative lessons learned

of EPR projects in Europe and in the world, with unparalleled licensing experience in Europe

## Localisation

Tailor-made localization programs to create industrial, social and economic value and co-develop a robust and highly qualified European nuclear supply chain



## Cultural and geographic proximity between EDF and CEZ

As responsible European utilities facing similar challenges in the operation of their nuclear fleets in the European regulatory context

## Long-term partnership approach

During the whole lifespan of the plant and on many others energy topics, notably through the EPR Owners-Operators Group (EPROOG)

## Unrivalled operating experience

Leveraging the learnings of the biggest nuclear fleet operated worldwide

## Training and Skills development

Tailor-made training solutions and skills transfer to current and future generations

# A UNIQUE APPROACH TO LONG-TERM PARTNERSHIP

## EUROPEAN FLEET APPROACH

EDF proposes a European fleet approach, based on the EPR reactors under construction and development in Europe, including notably the French fleet renewal, the UK EPRs, Dukovany 5 and potentially other EPR projects in the near future

## EUROPEAN NUCLEAR SUPPLY CHAIN

Based on Dukovany 5 experience, the opportunity for the Czech Nuclear industry to participate in future EPR projects

## LONG-TERM SUPPORT

A long-term support during the whole lifespan of the plant (60 years), by sharing experience, good practices and lessons learned amongst EPR operators worldwide, as part of the EPR Owners Operators Group (EPROOG). EDF will very much welcome CEZ as part of this worldwide organization

## ENERGY TOPICS

A global partnership with EDF Group on all electricity-related activities and new businesses: SMR; Energy management, Hydrogen generation, Electric mobility, Renewable Energy etc.





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# WORK FORCE DEVELOPMENT

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# EDF'S LOCALISATION APPROACH: A COMMITMENT TO EMBARK THE CZECH NUCLEAR INDUSTRY

For over 40 years, EDF has developed a robust and proven localisation methodology, that maximises economic, social and industrial benefits for local communities

- Sustainable and targeted localisation programme for a high level of local content on all levels of the value chain,
- Advanced human capacity building approach involving student education, staff training, and supplier's qualification,
- Promotion of French-Czech cross industry partnerships for the success of Dukovany 5 and beyond,
- Promoting social engagement and transparent stakeholder management practices.

Robust Localisation process

Human Capacity Building

European Cooperation

Access to EPR technology

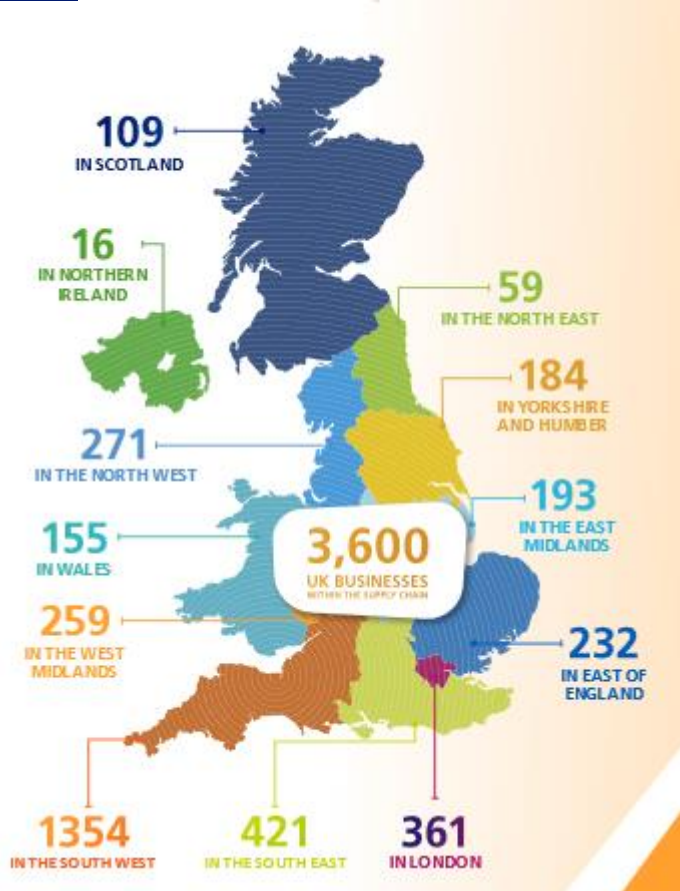
Social and local engagement

Access to EPR projects worldwide

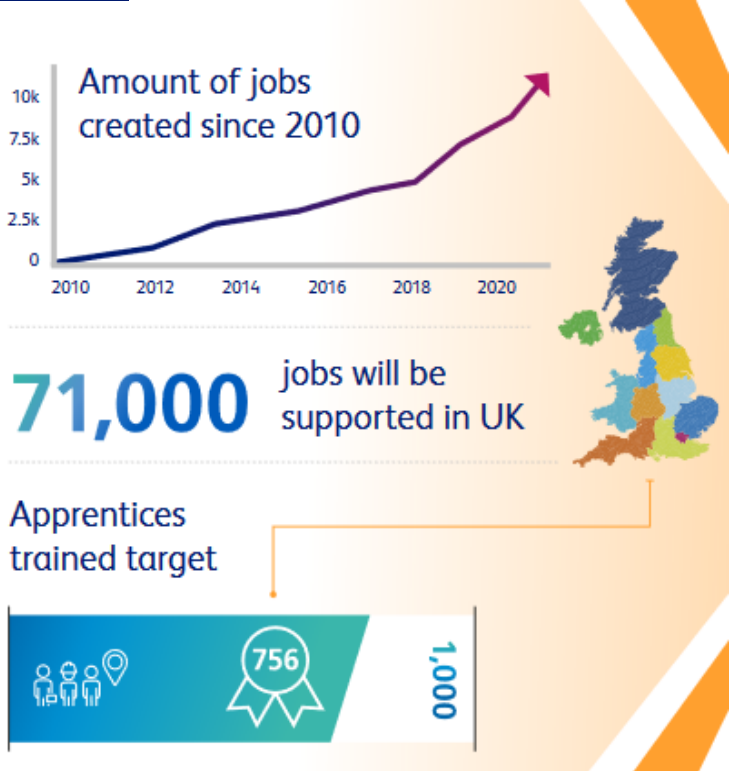


# BENEFITS FOR THE LOCAL AND NATIONAL ECONOMY: THE CASE OF HINKLEY POINT C

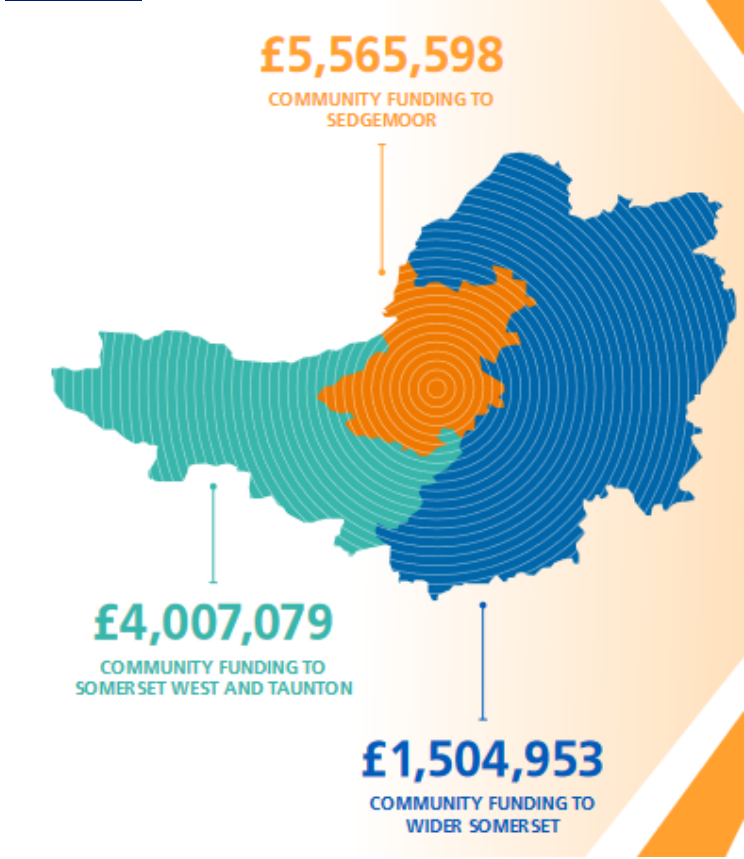
## Supporting British Businesses



## Skills, Jobs and Education



## Supporting local communities



# TAILOR-MADE TRAINING SOLUTIONS AND SKILLS TRANSFER

- In support to the technology offer, EDF also provides a complete education and training offer



- Customized training programs for each profession, notably for the future owner-operator's staff to support the project, the operation as well as the maintenance, required during the entire lifespan of the plant
- This customized training is based on e-learning, off-site classroom training, on the job training, on full scope simulators exercises and will use further training approaches using a systematic approach



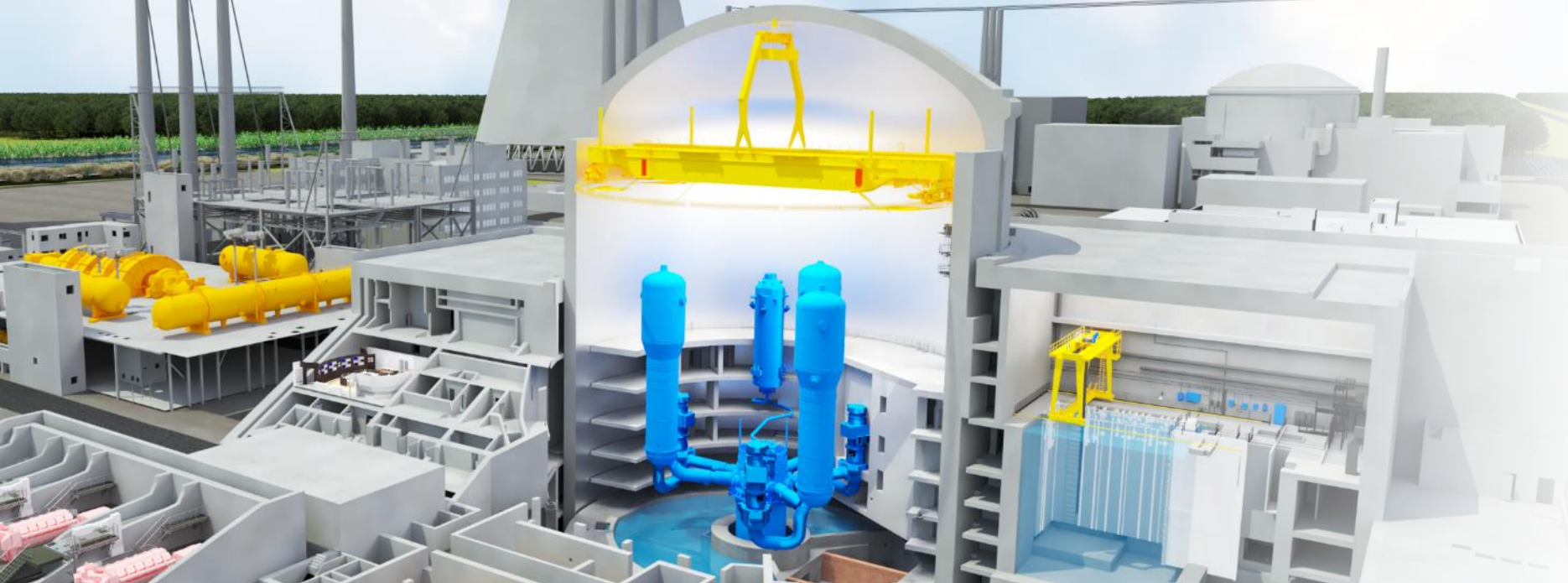
- Supporting advanced nuclear training thanks to
  - ➔ 700 skilled and recognized professional instructors
  - ➔ Several training facilities in France and in the United Kingdom
  - ➔ The cumulated expertise of EDF and its partners in designing tailor-made training and skills development programs



**Paris – Saclay Campus is one of the world's major innovative site dedicated to training:**

- ✓ full-scope EPR simulator
- ✓ training mockup workshops
- ✓ learning factory
- ✓ showroom of innovations





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## CONCLUSION

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# CONCLUSION

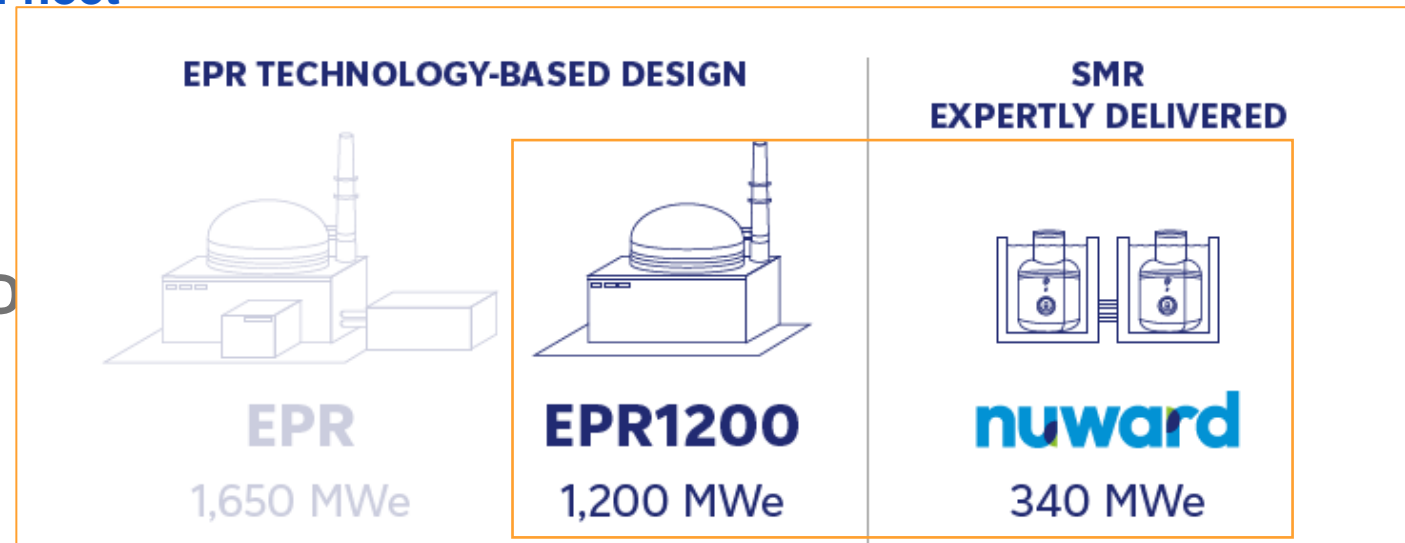
## ■ EDF IS COMMITTED TO

- **Delivering a truly European and competitive offer for the Dukovany 5 Project** and potentially Dukovany 6 and Temelin 3&4, as part of a **wider European EPR fleet**
- **Embarking the Czech nuclear industry** and to rely on its competences and capabilities in the nuclear field
- **Supporting EDU1 and ČEZ in the long run**, contributing to the carbon neutrality of the European energy & climate 2050 strategy as part of **EDF's EPR European fleet**



## ■ EDF PROPOSES TWO TECHNOLOGIES FITTING THE CZECH NUCLEAR PROGRAM NEED

- **EPR1200** (Generation III+)
- **NUWARD** (SMR)





**MERCI**

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**DĚKUJI**