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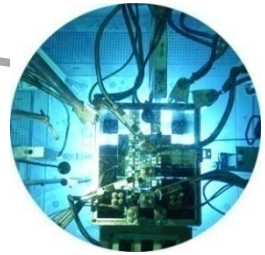

Nuclear Energy in France after Fukushima
Back Ground and Prospects

Christophe Behar
Director of
CEA, Nuclear Energy Division

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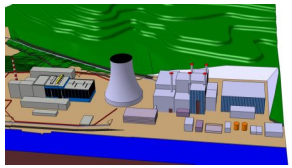
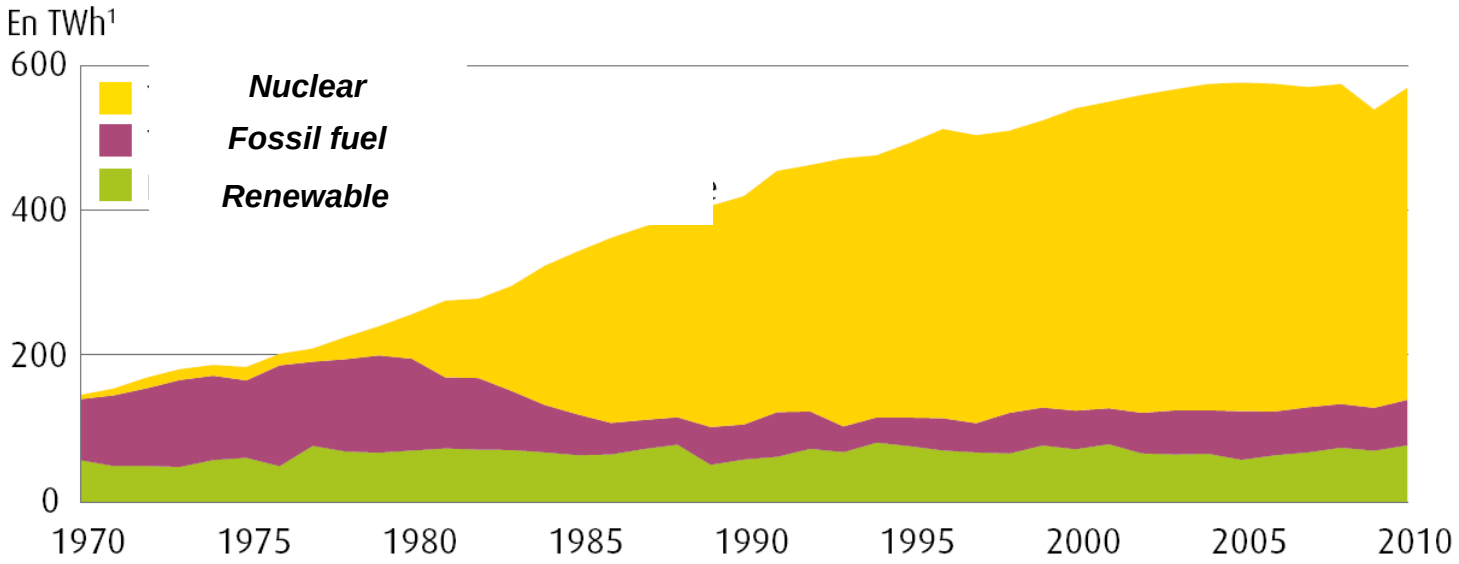


FRENCH ELECTRICITY IN FRANCE



- 58 LWR units
- 63 GWe
- >410 TWh per year
- Closed fuel cycle

This French nuclear energy policy is backed by a regulatory framework

- **2005 ACT about ENERGY POLICY :**
  - national self-sufficiency (security of supply);
  - large access to energy (competitive price);
  - environmental preservation (decrease CO2);
    - nuclear energy, a pillar;
    - R&D for future generation nuclear systems.
- **2006 ACT about TRANSPARENCY & INFORMATION**
  - independent Safety Authority;
  - High Committee for transparency & information ;
- **2006 ACT about NUCLEAR MATERIALS & WASTE**
  - recycle (decrease waste amounts);
  - geological repository for final waste.

And its interest has been re-assessed recently

- **2012 (January): « Cour des Comptes » REPORT about nuclear energy costs:**
  - French electricity cost : 40% lower / other EU countries;
  - no « hidden costs »;
  - uncertainties about decommissioning costs: a low incidence on global costs;
  - the main point : NPPs life-time extension (> 40 y) (if not: huge investments needed).

- **2012 (February): « ENERGIES 2050 » REPORT**
  - low energetic dependence, a priority;
  - strong positive impact on french economy

Recommend reinforcement on R&D in the field of GIV

SAFETY : POST FUKUSHIMA STRESS TEST

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CONCLUSION OF THE FRENCH SAFETY AUTHORITY

(2012, January 3rd)

- Sufficient level of safety of the french fleet (no « cliff hedge phenomena »
- Reinforcement of the « hard core » of key equipments
- Establishment of a « rapid action force »

ABOUT THE ENERGY IN FRANCE

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- Reconsidering the energy mix balance : Nuclear AND_renewables
- Lauching quickly an environmental conference in order to lead to a complementary law on energy at first semester 2013.

WHAT MAYBE THE FUTURE FOR NUCLEAR

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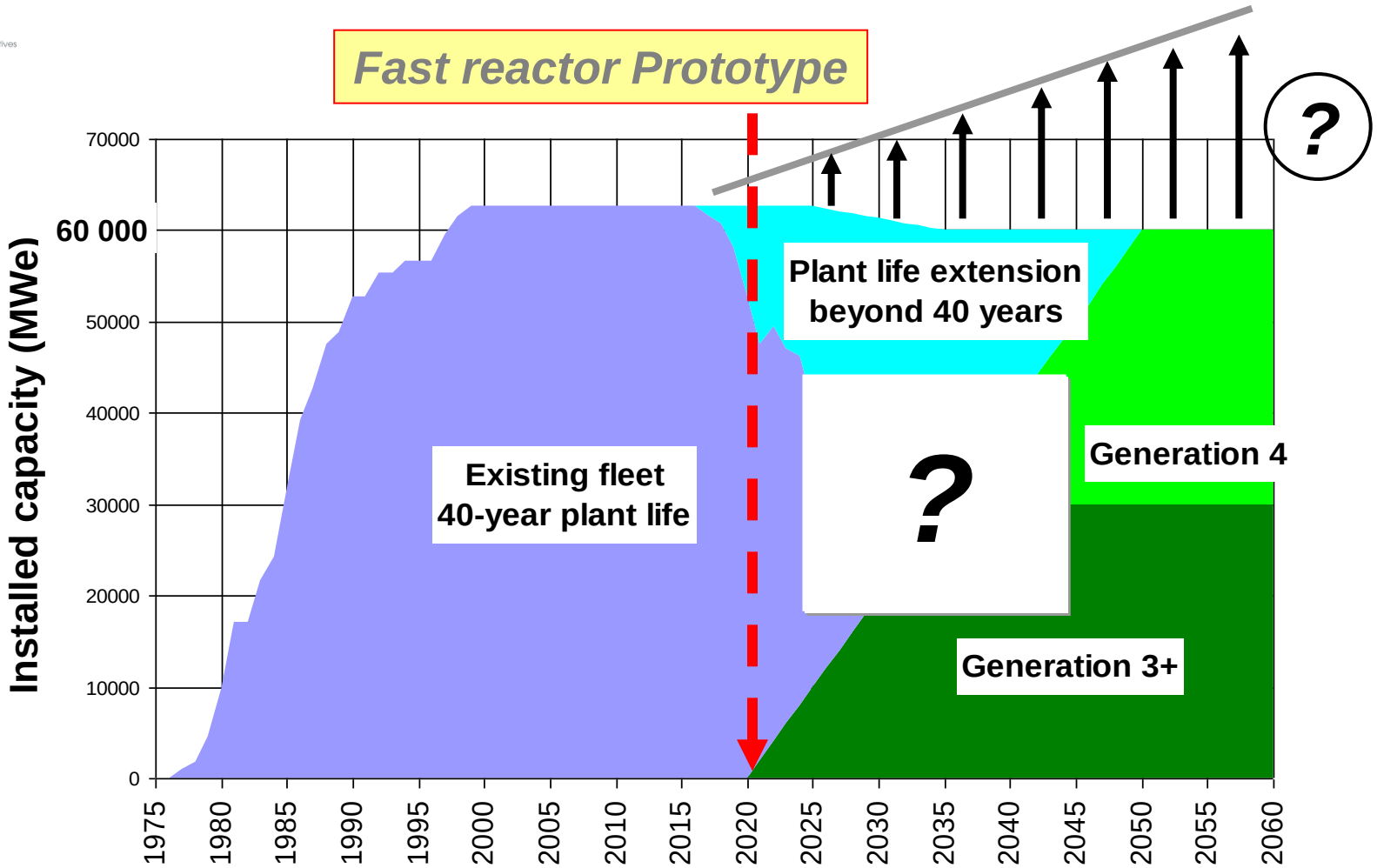
THREE PILLARS OF A LONG TERM NUCLEAR DEVELOPMENT

- life time extension of current fleet and middle term EPR construction
- Prepare the future with FNR (SFR-GFR) GIV reactors
- Pursue on close fuel cycle
  - ➢ : a bridge between LWR (GII/GIII) and GIV FNR

LIFE TIME EXTENSION AND MIDDLE TERM EPR CONSTRUCTION



PREPARE THE FUTURE WITH FNR PROTOTYPES

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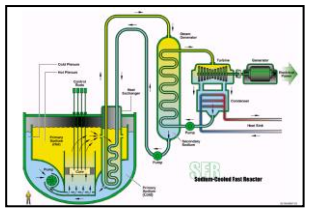
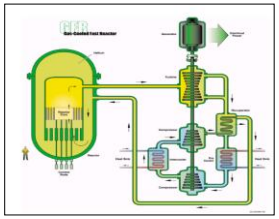


✓ **Sodium Fast Reactor, the reference option : ASTRID, the prototype**

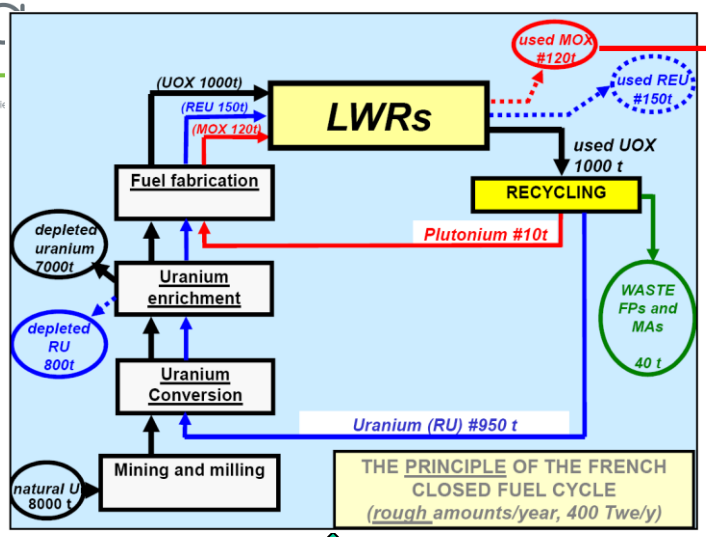
- maturity, possible further improvments (safety, operability, economics)
- commercial level 2040 in France, sooner in other places
- developped with industrial and international partners



✓ **Gas-cooled Fast Reactor, a long-term option: ALLEGRO, experimental-scale project**

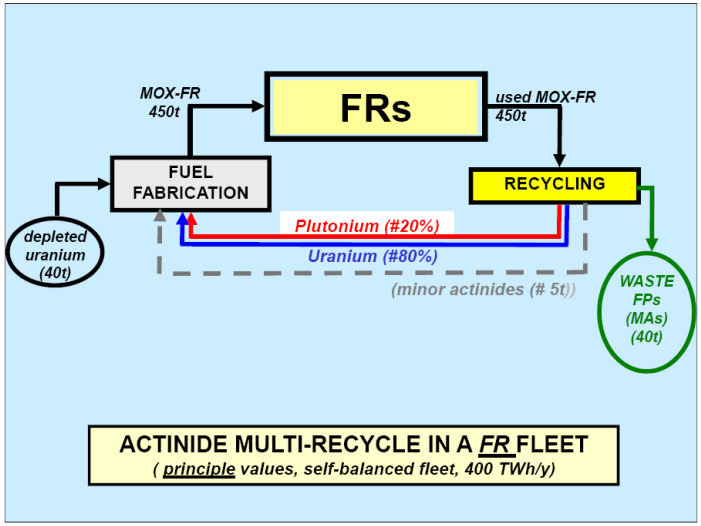
- attractive potentialities
- but heavy challenges (materials, fuel, safety)
- In Europe ?
- Long term

Closed fuel cycle : a bridge between LWR And SFR



Pu stored in MOX SF recycled in MOX SFR to start the SFRs deployement

Scenarii can be flexible
Both systems can coexist during a transition phase



CONCLUSION

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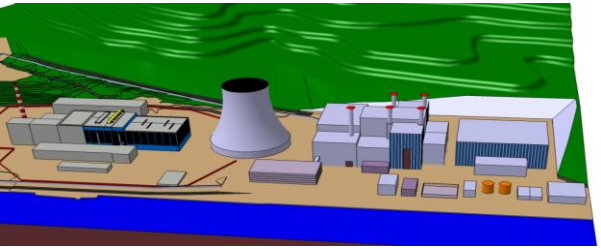
- Fukushima accident strongly challenged the safety but did not deeply modify the long term nuclear energy strategy
- Nuclear Energy will remain a strong contributor to the french energy mix
- GII, GIII and GIV will co-exist in the 21st century
- fuel cycle technologies : a benefit for the present and an asset for the future



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ASTRID PROTOTYPE Schedule

Preliminary choice of options

Decision to continue

Decision to build

Fuel loading

ASTRID

2009 2010 2011 2012 2013 2014 2015 2016 2017

Conceptual design -1

Conceptual design -2

Basic design

Detailed design & Construction

Facilities

Position Report on minor actinides partitioning and transmutation

Core manufacturing workshop (AFC)

MA bearing fuels fabrication facility (ALFA)