

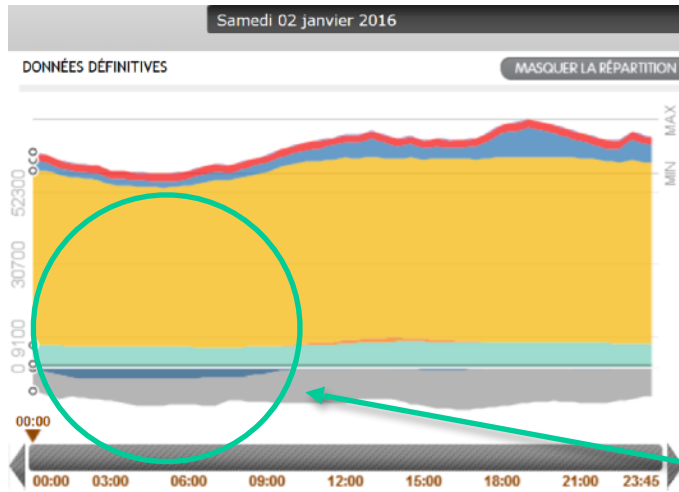
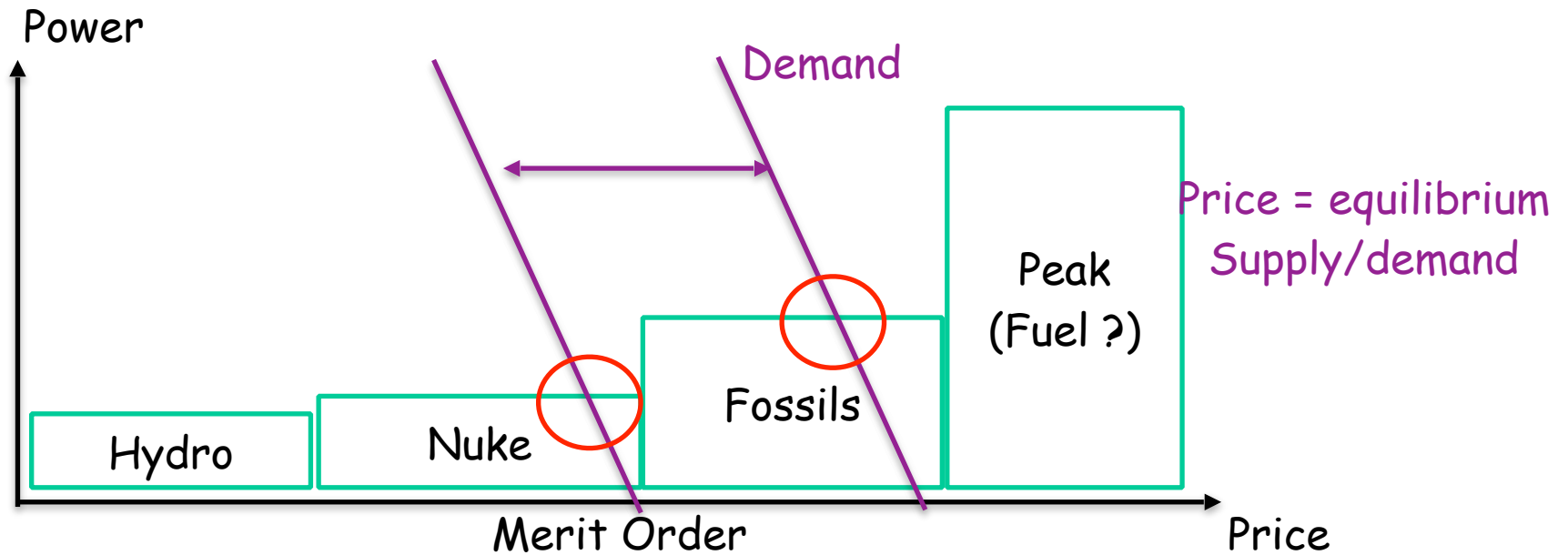
Technical Workshop on Nuclear Fuel Cycle Simulation 2021

Session : « Nuclear fuel cycle interaction with electrical and energy systems »

Chair : Adrien Bidaud, Associate Prof, Grenoble Institute of Technology



« spot » price fixing

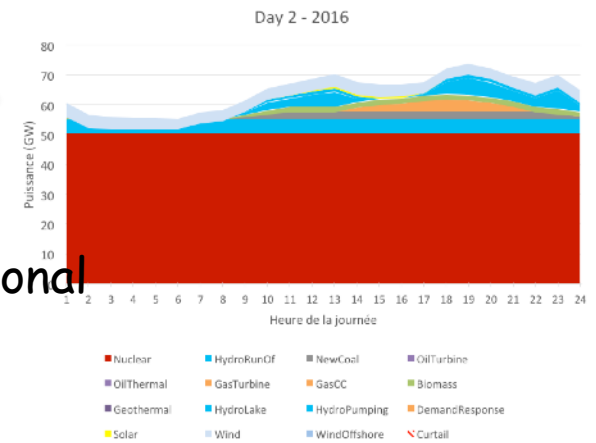


Real

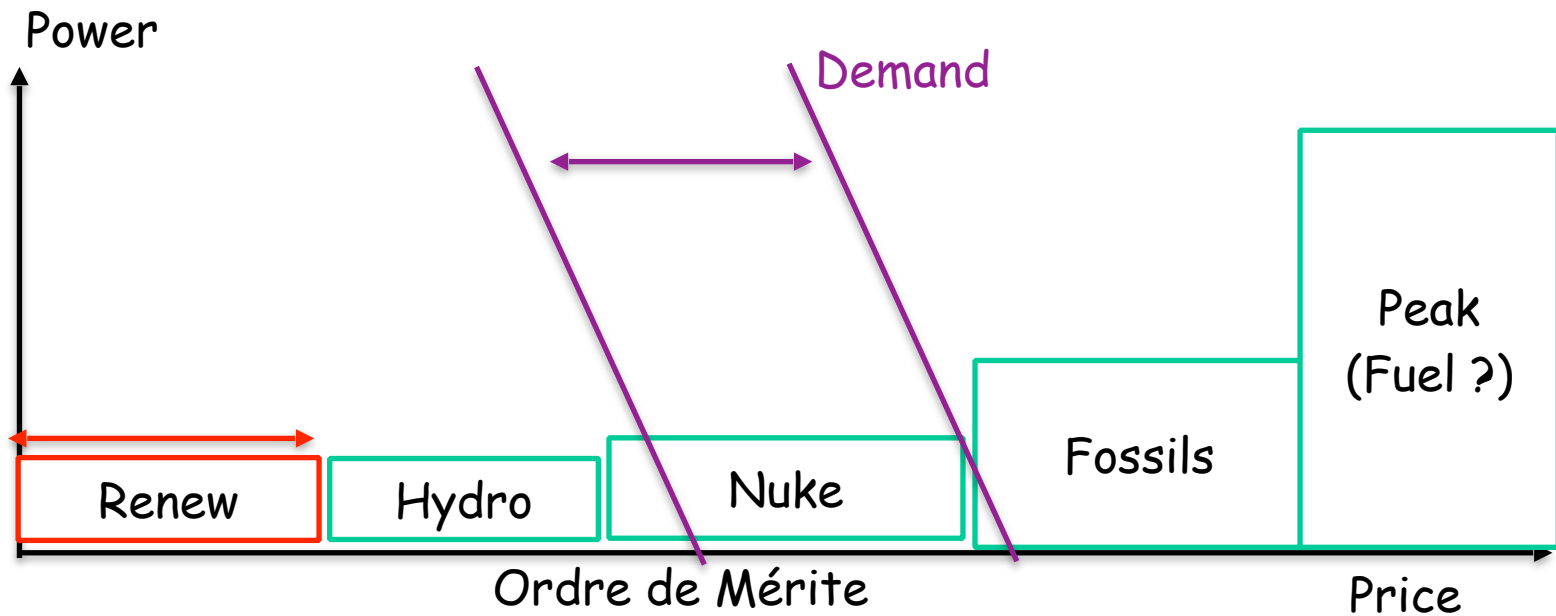
Simulation =

Minimising daily operational costs in Europe

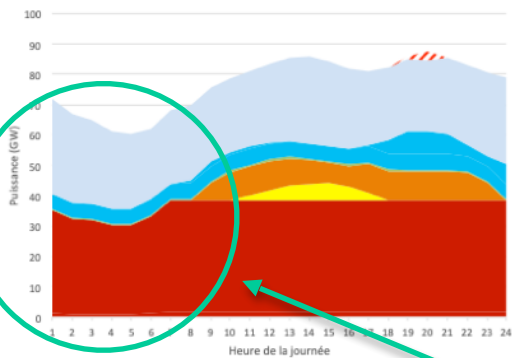
By using storage ?



With Variable Renewables

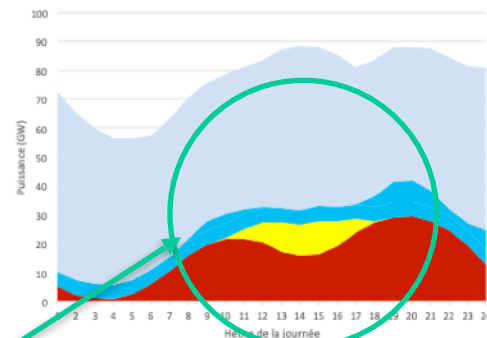


EUCAD - scénario RTE AMPERE - 02/01/2030



France 2030

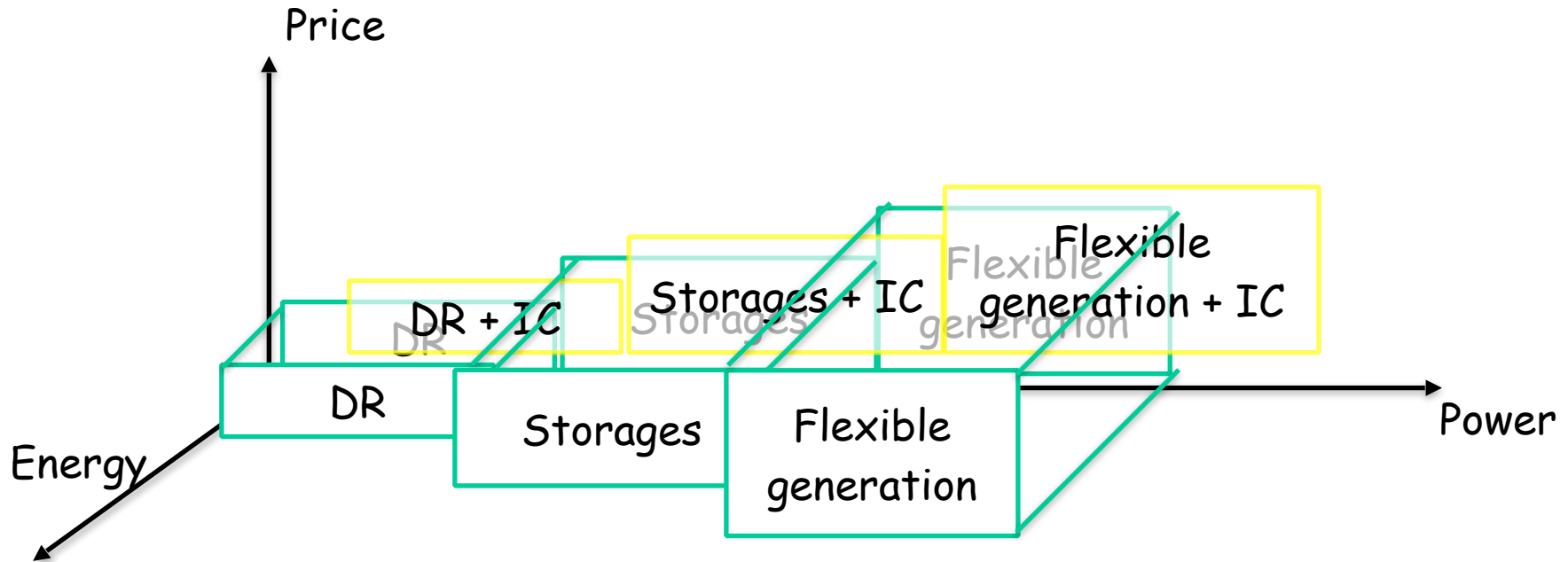
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Renewable *2

Dispatchable flexibility

Can we define a Merit Order for Flexibility Options ?



BUT

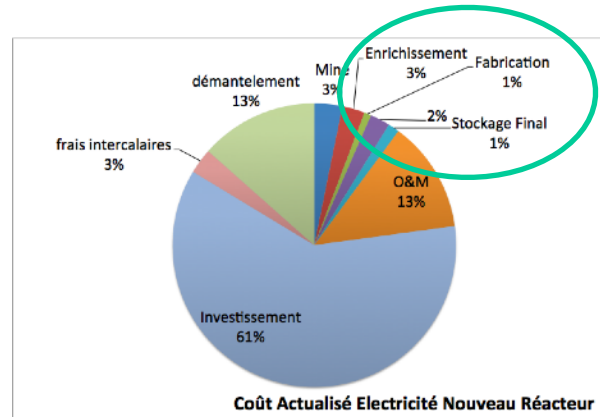
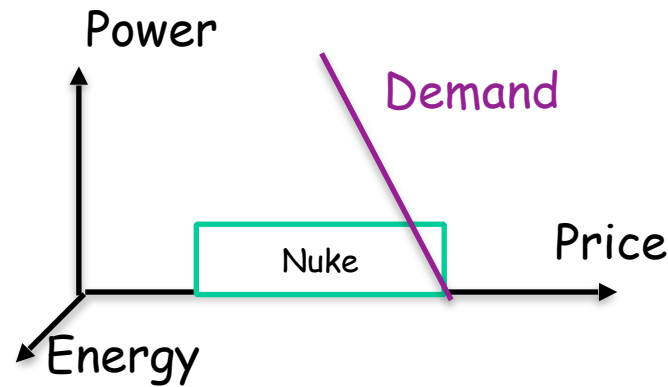
Time constraints (Demand cannot be postponed forever)

Energy limits (limited storages)

Difference in Efficiencies

=> Fascinating open question !

This session's organization



Offer :

Flexibility = reduced load factor

Demand : (in) Flexibility = lost sales

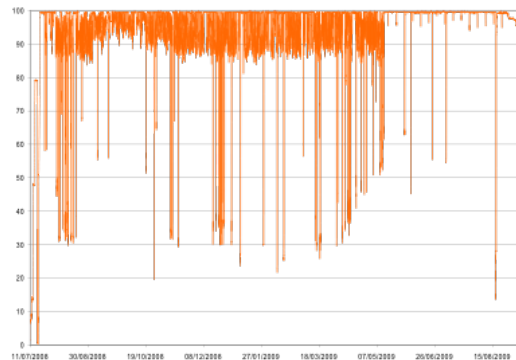
Flexibility = Ancillary services

Offer : Flexibility = unknown load Factor

= Fuel cycle variability

1 / Anne-Laure Mazaure @ CEA

Adaptations of a current nuclear reactor towards more flexibility



3/ Miguel Macias @ IRSN

A new Power history generator tool (PROTO)

2/ Charly Boudot @ CEA

Small Modular Reactor based solutions to enhance the grid reliability

Schedule

9:00am – 9:15am: INTRODUCTION

9:15am – 9:45am

Adaptations of a current nuclear reactor towards more flexibility in order to accommodate a power system with a high insertion of variable renewable energy sources

Anne-Laure Mazauric (CEA, France)

9:45am – 10:15am

Small Modular Reactor based solutions to enhance the grid reliability: identification of relevant criteria and preliminary assessment – *Charly Boudot (CEA, France)*

10:15am – 10:30am: BREAK

10:30am – 11:00am

A new PowerR histOry generaTOol (PROTO) for French nuclear power stations at IRSN
Miguel Macias (IRSN, France)

11:00am – 11:30am: DISCUSSION

Questions

Load Following = increased constraints on the NPP

- on the fuel (material), core (pressure vessel) classical part => increased costs
- reduced load factors => increased costs

-> **NEW research fields = what projects do you have running ?**

- reduce extra costs associated with flexible generation
- ATF ?
- reactivity management (SMR without boron a priori a BAD option !)
- fuel (material @ fuel) issues

What times scales : primary/secondary/tertiary reserves days/weeks/seasons ?)