Energy Infrastructures in France: Climate Change Vulnerabilities and Adaptation Possibilities

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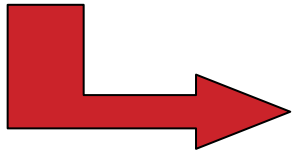
Mission Climat of Caisse des Dépôts

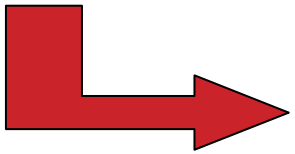
Introduction

- **Existence of climate change:**



mitigation actions

- **Inevitability of climate change impacts:**



necessity to adapt

- **Focus on energy infrastructures in France**

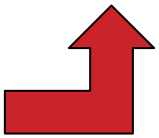
Methodology retained

A three step process

Energy infrastructures at risk	Sensitivity of Energy Infrastructures to Climate Change	Ability to React => Adaptation Options
• Energy system cartography	• Sensitivity to gradual changes and exposure to extreme events based on IPSL and CNRM models	• Hard adaptation • Soft adaptation • Financing adaptation

Vulnerabilities of the energy system

=> Adaptation needs identification



Literature Survey

- **European studies on climate change and energy infrastructures: UK, Ireland, and Spain.**

- **Energy Production**
  - Direct damages to installations and impacts on input and output levels
- **Energy Transport and Furniture**
  - Direct damages to infrastructures
- **Energy Demand**
  - Demand spikes in the summer and lower demand in Winter

Plan

1. The French Energy System

2. Vulnerabilities of the French Energy System to Changing Climate Conditions

3. Adaptation Options for Energy Infrastructures

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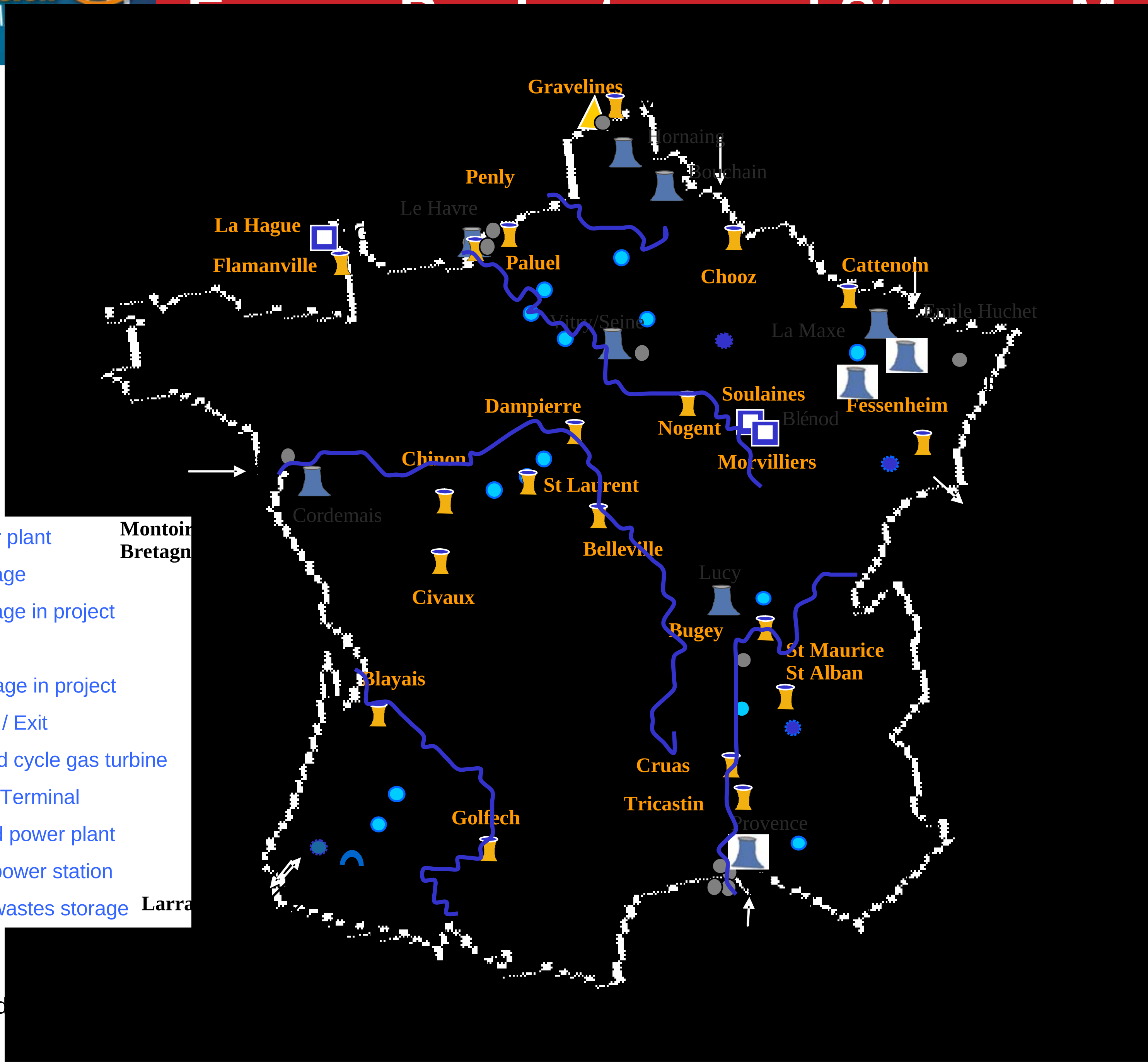
Caisse desDépôts

MISSION CLIM

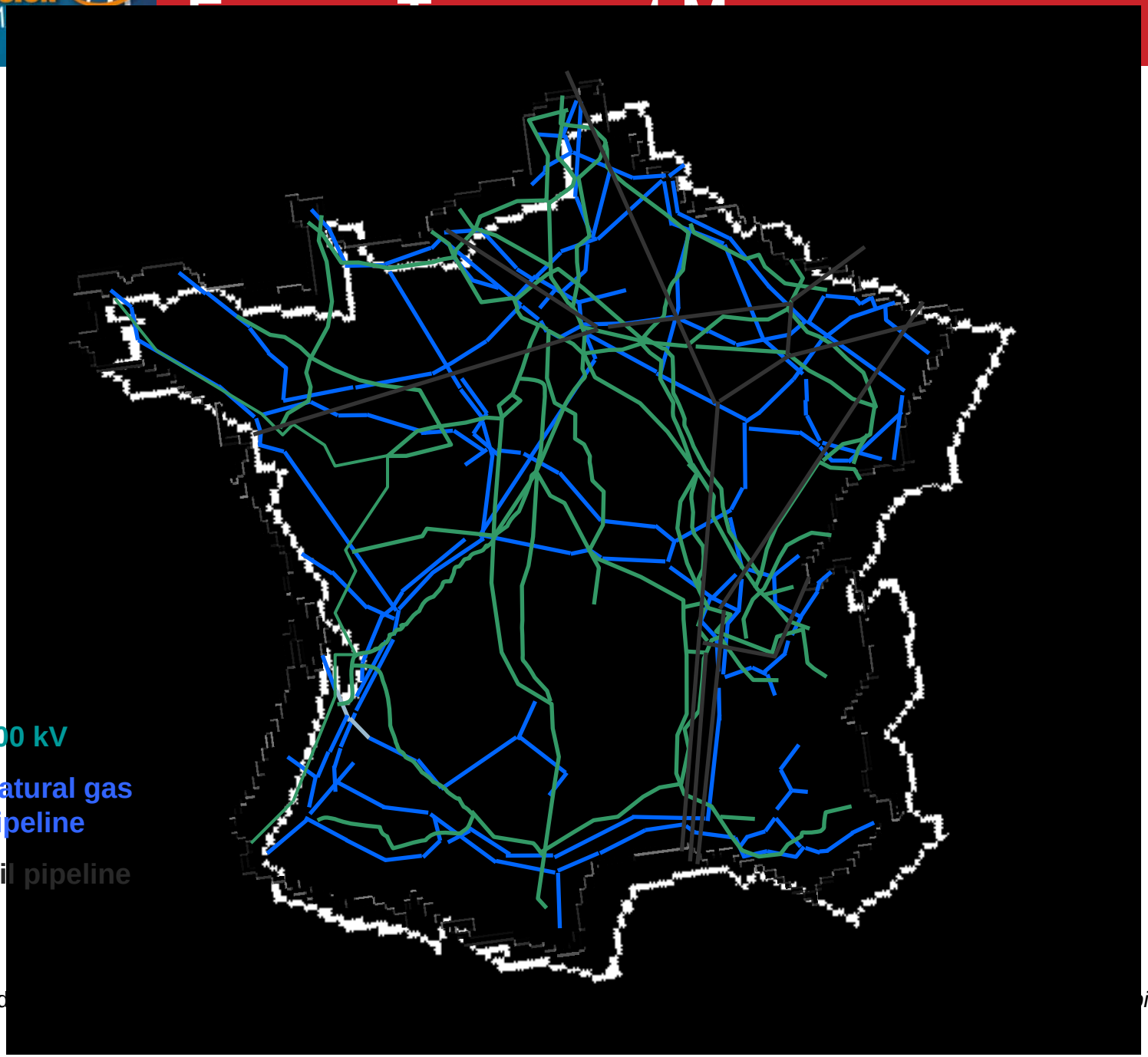


- Oil power plant
- Gas storage
- Gas storage in project
- Gas field
- CO_2 storage in project
- Entrance / Exit
- Combined cycle gas turbine
- Methane Terminal
- Coal-fired power plant
- Nuclear power station
- Nuclear wastes storage

Montoir Bretagn

Larra

of Caisse
servatoire


400 kV
Natural gas pipeline
Oil pipeline

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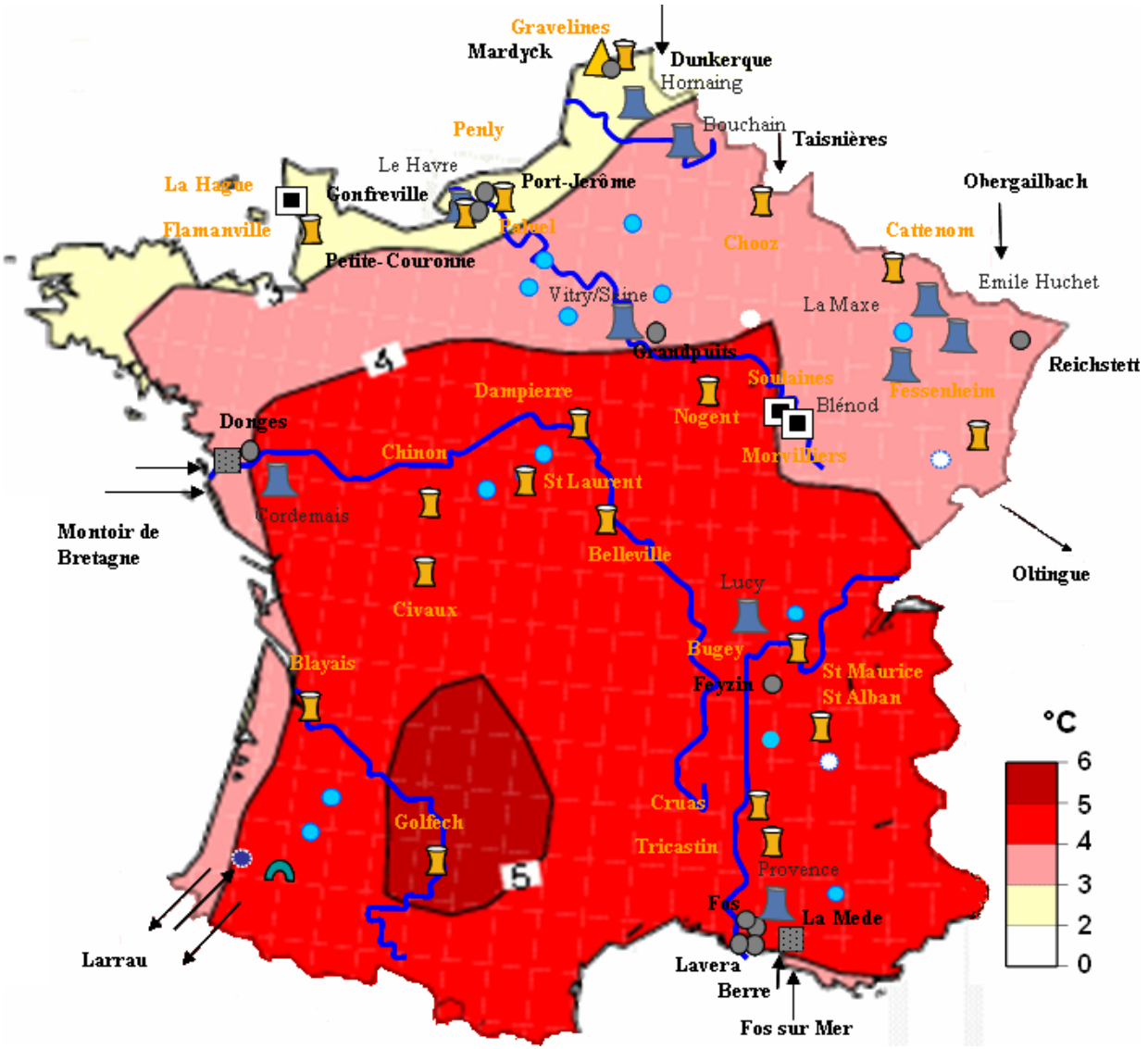
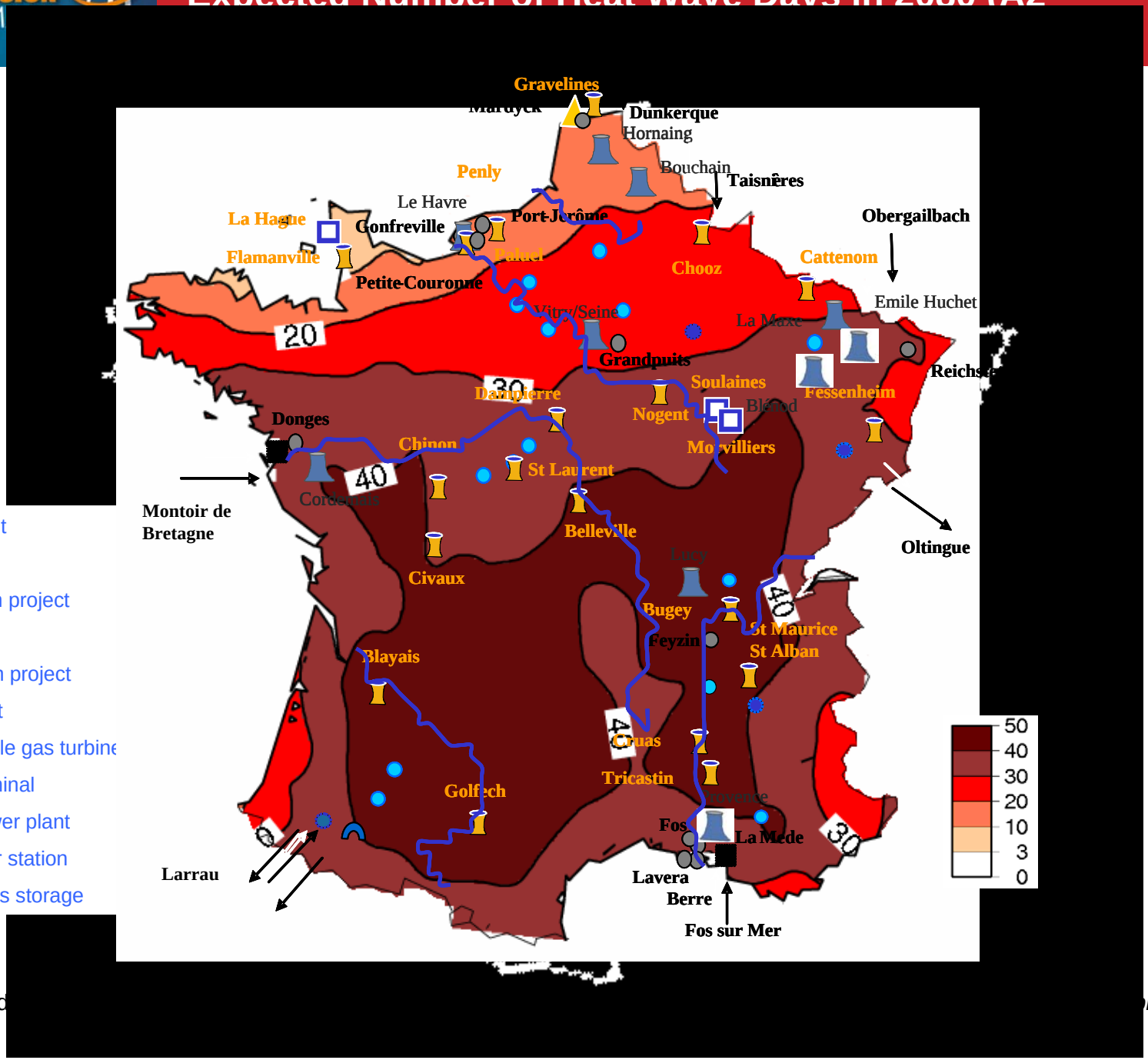
Rise in Summer Temperatures by 2070-2099 (A2 scenario) and French Energy Production and Storage



Source: Mission Climat of Caisse des Dépôts based on Observatoire de l'Energie and Greenpeace-Climpact (2005)

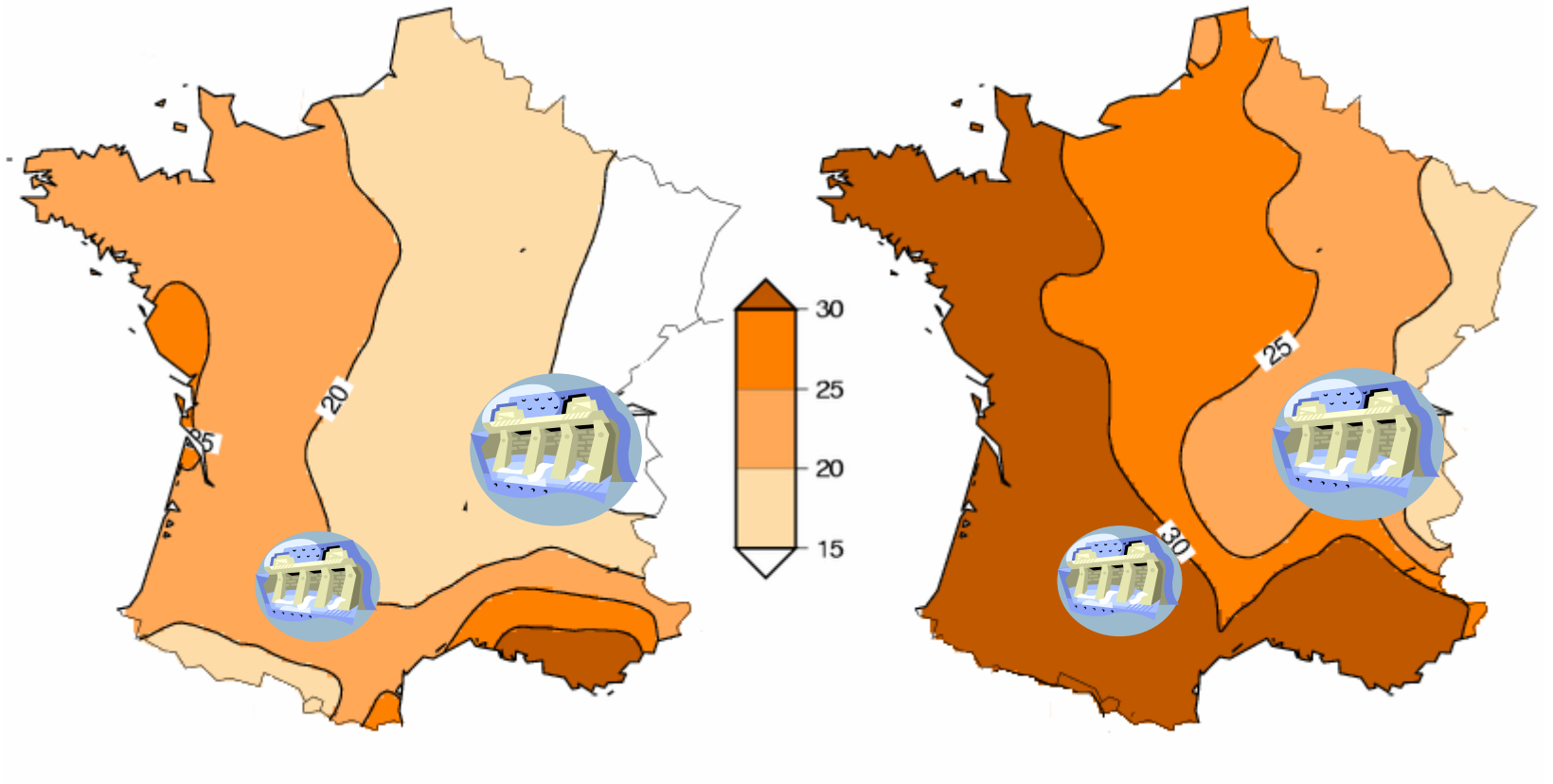
Expected Number of Heat Wave Days in 2080 (A2



Max. number of consecutive dry days in Summer and French hydro plants

Current Climate

End of XXI century previsions



Source: Mission Climat of Caisse des Dépôts based on Observatoire de l'Energie and IMFREX Final Report.

Plan

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Adaptation Options for Energy Infrastructures

- **CLASSIFICATION:**
  - Anticipatory vs. reactive; local vs regional; short vs long term...
- **ENERGY INFRASTRUCTURES:**
  - Protective infrastructures → hard adaptation measures
  - Adapting energy infrastructures themselves → soft adaptation measures
- **Examples of soft adaptation measures : PLAN**
- **Importance of no-regret adaptation measures**
  - Energy efficiency
- **Financing adaptation measures:**
  - actors, factors, the role of climate uncertainty

Concluding Remarks

- **Much still to be done at on adaptation to climate change**
- **Adaptation is local**
  - Difficult to standardize adaptation measures
- **Difficulty of adapting to climate change: uncertainty regarding climate change impacts at the local level**
  - Difficult to chose among the measures available

FLEXIBILITY is NEEDED

- **French energy system**
  - Vulnerable to climate change (production, transport, storage)
  - Change on energy consumption patterns
  - Wide range of adaptation options
- **Adaptation opportunity cost**

- **Research Adaptation Program:**
  - Adaptation to climate change and infrastructure choice

- **Club ViTeCC**

Thank you for your attention!