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Agence de l'Environnement et de la Maîtrise de l'Energie

Towards post carbon cities: Why? How?

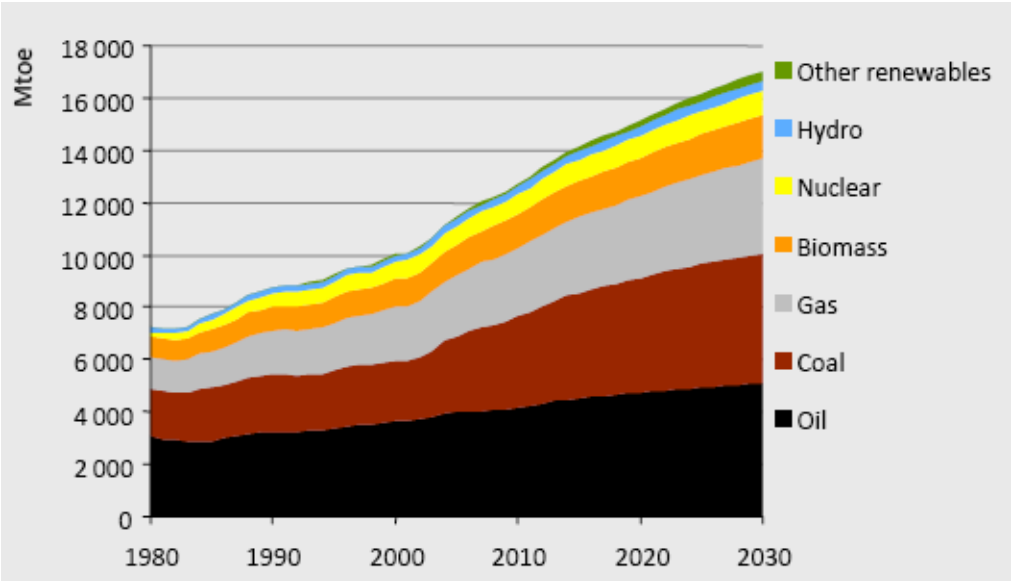
Highlights from the re search program Rethinking cities in a post carbon society

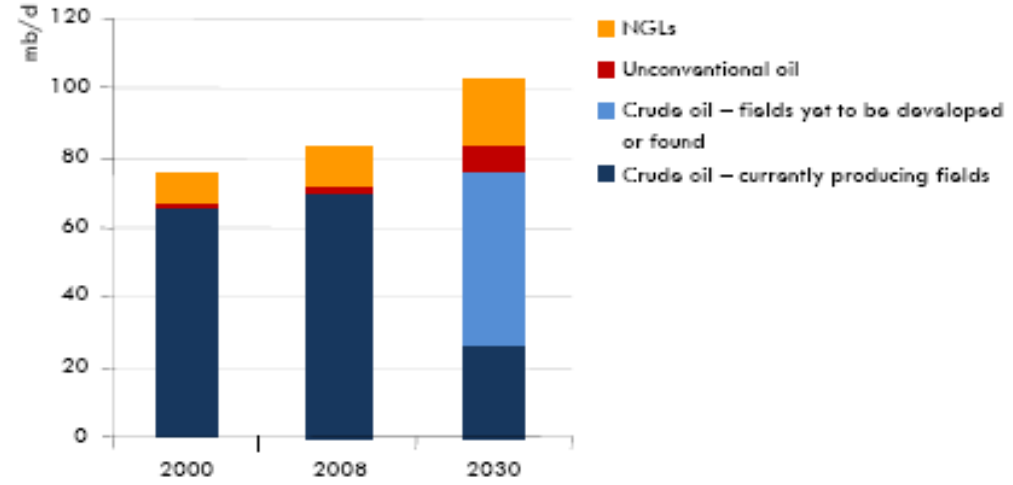
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ECEEE Summer study

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Environnent and Energy Management French Agency

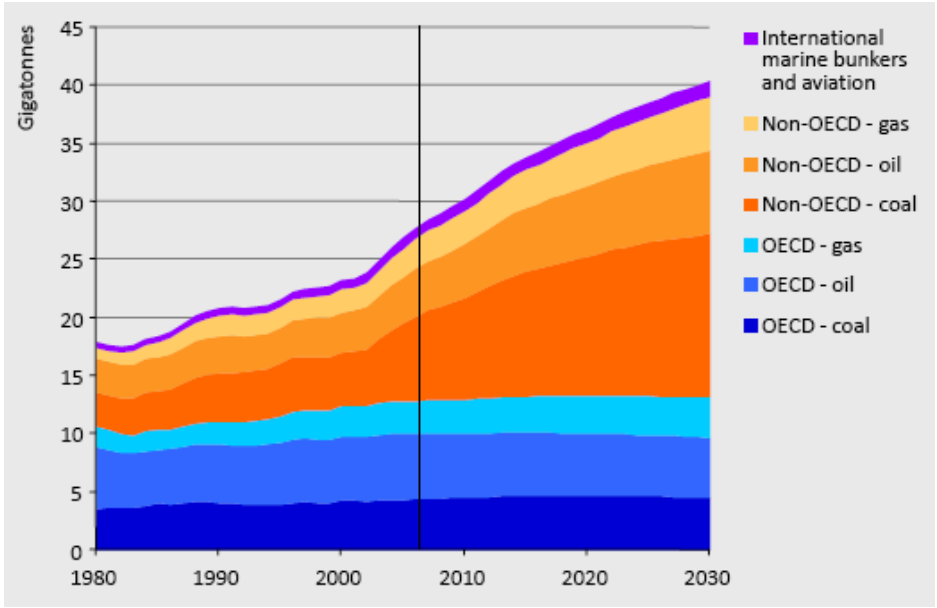
Why cities are concerned

- Energy issues



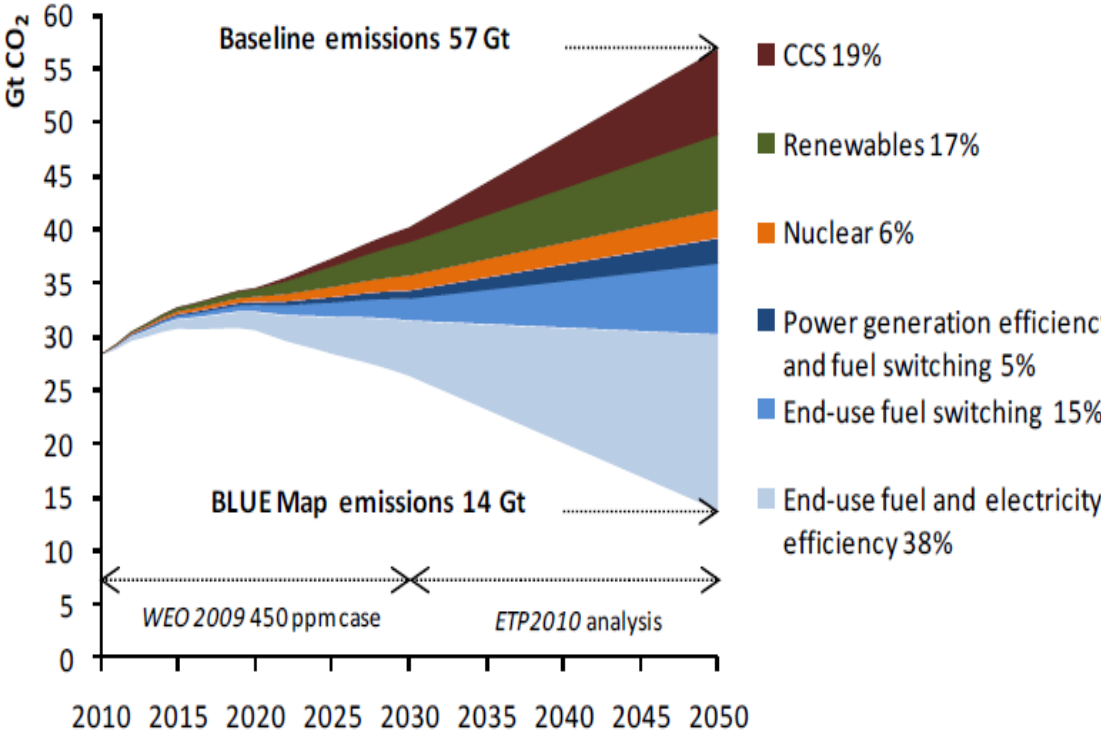


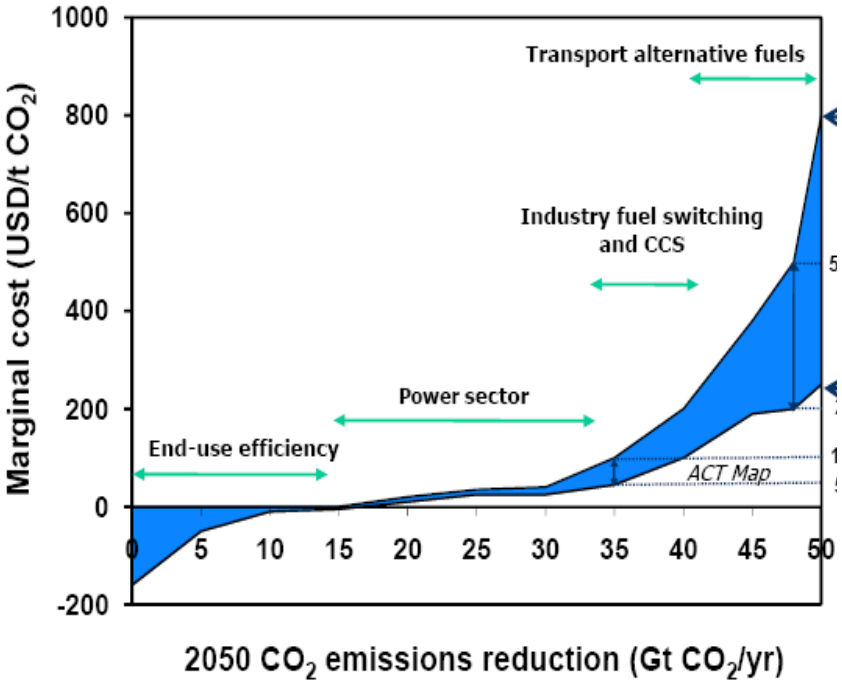
- Climate issues



Source : IEA, WEO 2008 & 2009

Costly in terms of technological mix



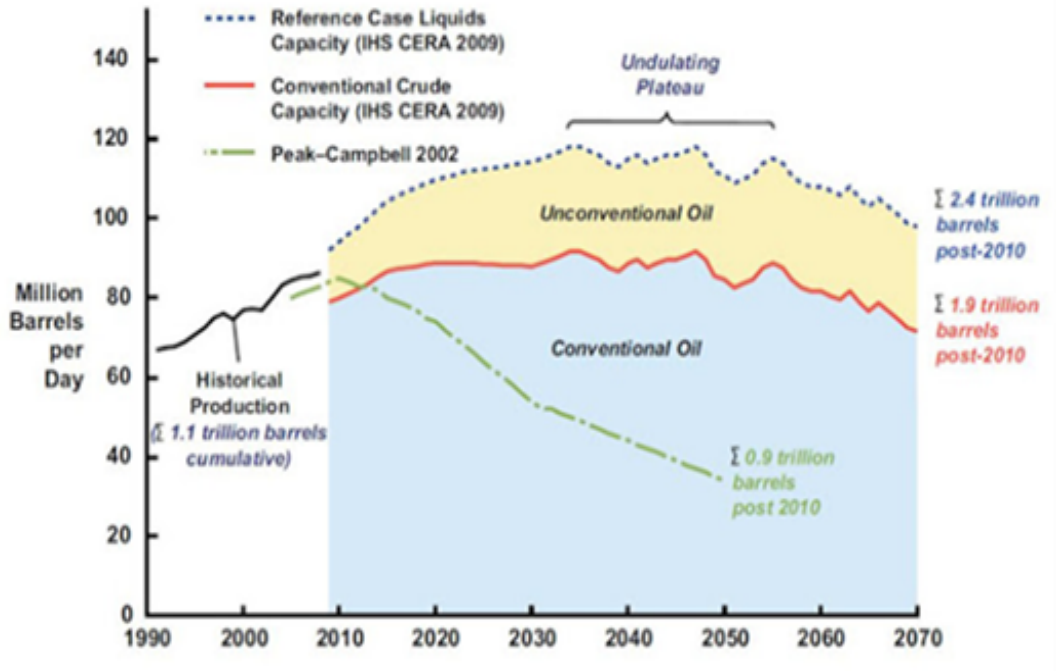


Source : IEA, ETP 2008, 2010

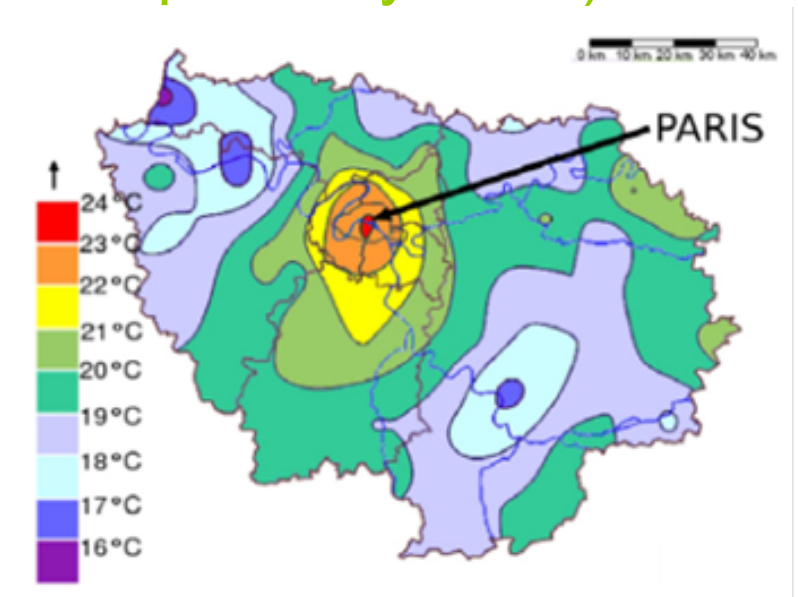
Why cities are vulnerable in energy/climate transition

3 main global issue with local implications

- Peak oil / Availability of energy massively imported



- Mitigation of GHG : Factor 4 in France
- Extreme events (flood, heat island effect…) and climate change (at least +2°C..probably more)





And why city can see an opportunity in the energy/climate transition

- Strong actions have already been launched
  - *Pionneers cities*

    Freiburg im Breisgau, Hanover in Germany;

    Vaxjo, Malmo, Gothenburg and Stockholm in Sweden;

    Bristol, Woking and the eco-district BedZED in UK

    Copenhagen in Denmark;

    Boulder, Colorado in the United States;
  - *Networks*

    Associations or active networks such as Local Governments for Sustainability (ICLEI) in the 1990's,

    Climate Alliance

    Energy-Cities,

    Convenant of Mayor…



How can we go further

Integration of spatial dimension in foresight studies or researches

- At international scale

  World Energy Outlook 2008, IEA

  Cities, Towns and Renewable energy 2009, IEA

  Urban Energy Systems, 2012, IASA

- At French scale
  - *New researches in french laboratories and institutions (LEPII, CIRED, CMA, CERNA-IDDRI…) with spatial approach*
  - *Studies about tradable quotas for cities (Mission Climat CDC…)*
  - *Forecast exercises by cities or regions*

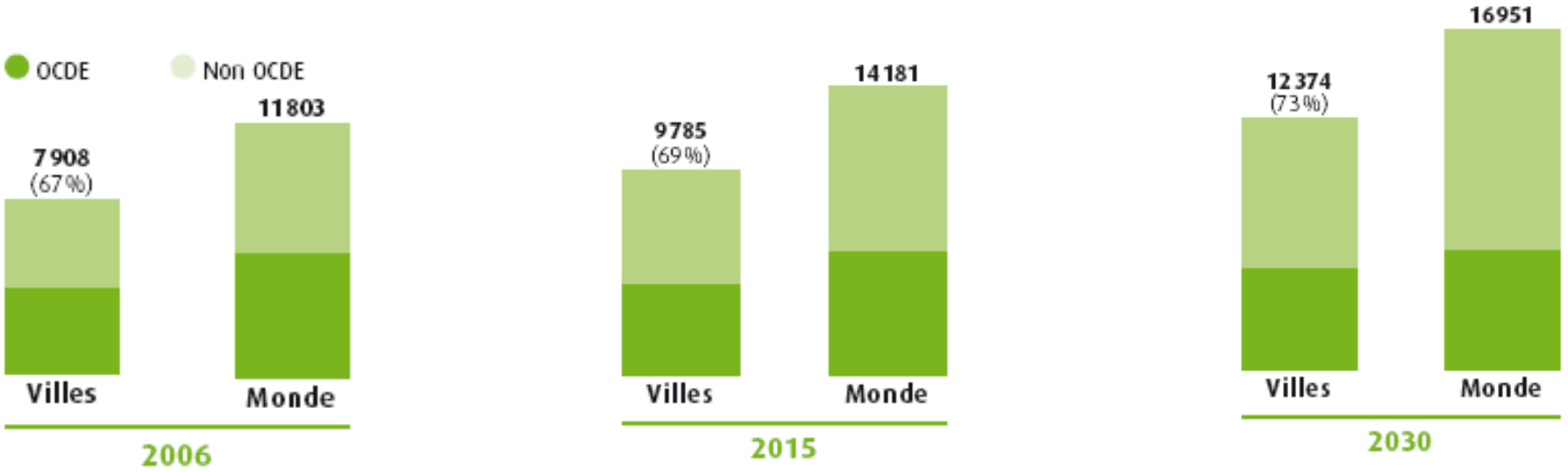


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Some details from the chapter dedicated to Cities in the WEO 2008

- **Observation : a huge impact**
  - ***2/3 of energy is consumed in cities (8Gtoe in 2006)… and 50% of population live there***
  - ***Urban inhabitant consume more coal, gas and electricity…and less oil compare to rural inhabitant***

- **Perspectives : Worrying trends**
  - ***Rise from 8Gtoe to 12,4Gtoe in 2030 in the BAU***
  - ***87% of energy will be consumed in cities in USA in 2030 (80% in 2006, and respectively, 75% concerning UE versus 69% today)***



- **Main questions : which responsibilities and which levers to activate at local/urban scales ?**
- 3 main components
  - Workshop (with researchers and experts) to built contrasted transition scenario
  - Seminars on specific topics (transport, biomass, housing…) addressed to stakeholders-researchers
  - Call for researches

    Thematic researches : governance, lifestyles, social and territorial inequalities, urban forms...

    And Local Foresight to develop post/low carbon transition at urban scale : Mulhouse, Tours et Plaine de France



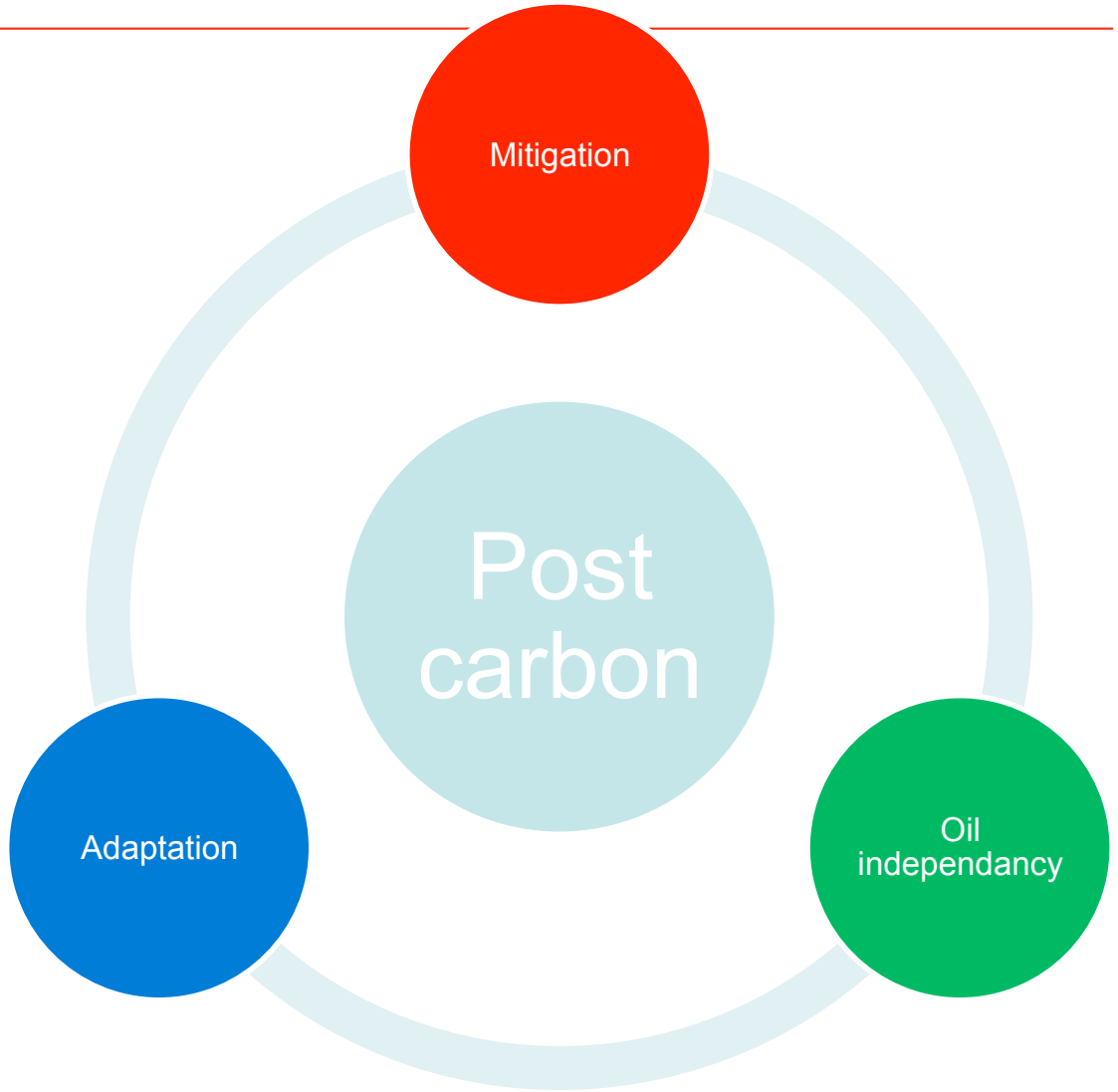
Post carbon issue, a way to coordinate resilience and sustainability ?

POST CARBON transition will be successful if the three aims are pursued simultaneously : **it is a paradigm shift**

And it must be deal **under uncertainties**

It is a time frame coordination :

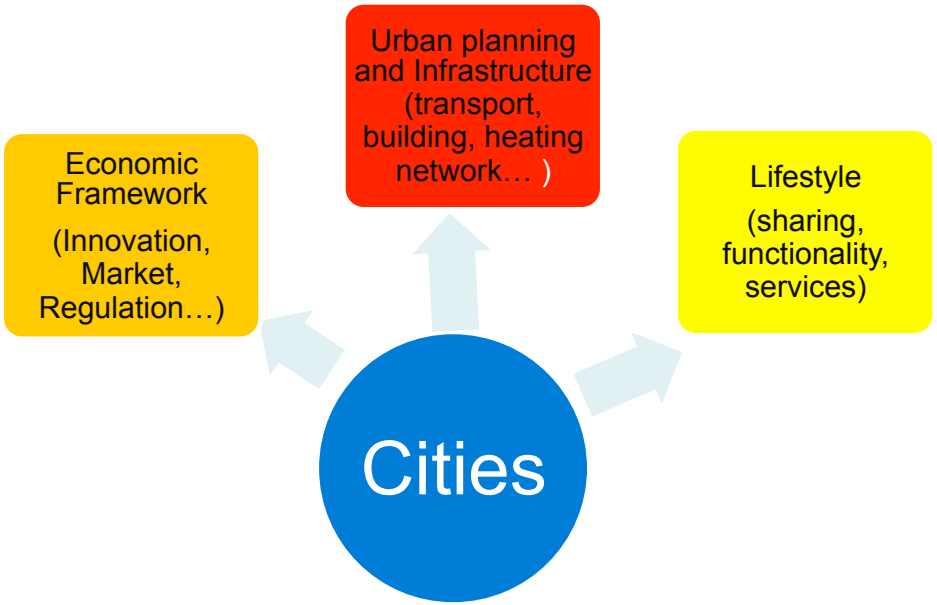
- **peak oil** (and generally energy dependency or fuel poverty), **and adaptation are a short term issue**
- **Mitigation is a long term issue**



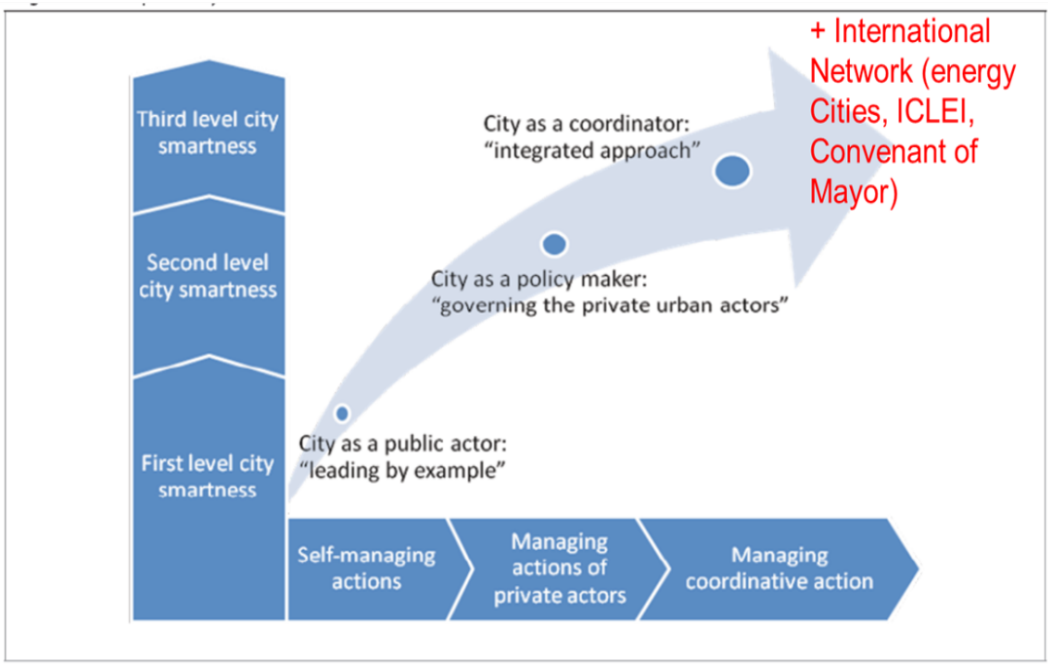
City, as an ecosystem, a coordinator

Local authorities directly control only a small part of GHG emitted in their area : roughly some 2 % coming from local authorities' buildings or infrastructures, as well as from municipal services (i.e : Paris, 2007 ; Rennes, 2011).

- Horizontal stage



- Vertical stage



Source : FP7 THINK, Initiative to Smart Cities Topic 2



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Workshop Foresight Visions
6 Backcasting scenarios

Each scenario :

- *Contrasted*
- *Defined by a vision*
- *Innovative*
- *Desirable*
- *Realist*
- *Credible*

Degree of flexibility

Uncertainties

	Major role of context (technology and price signal)	Urban Investments and infrastructures	Actions on urban forms and lifestyle
Context **Business As Usual**	**Smart waiting** **(soft climate and energy plan)**	**New energy and climate infrastructures** **(new building and retrofitting existing buildings)**	**Maintained city** **(management of land rent)**
Context **Breakdown**	**Carbon Creativity** **(price signal and carbon taxe)**	**Bio city** **(energy decentralization and biomass)**	**Sober / Lean city** **(lifestyles)**



Methodology of the workshop

Phase 1: Definition of system variables
Two meetings were necessary to build a first system of 70 variables influencing the post carbon transition. The 70 variables were grouped into 15 components or group of variables classified in 3 types: contextual, transversal and thematic.

Phase 2: Hypothesis / groups of variables
The objective of phase 2 was to build micro group of variables or partial scenarios. To do so, contrasted assumptions (A, B, C, D, E) for each component (C1 to C15) were built to have a “scenario Blueprint”. For instance, considering the component (C1 International regulation), a set of 5 hypothesis has been done.
A consistent description was done for each assumption of component.

Phase 3: Seminar 'frames of the scenarios
A seminar (a day and half) was dedicated to the definition of the scenarios (articulation of the 15 components).
Additional interviews were conducted with experts (external from the initial group if needed) when issues required it (biomass, carbon tax, mobility, rehabilitation of the housing).

Phase 4: Detailed Description of the paths of the scenarios / Issues and tracks for public action
A synthesis has been proposed by the coordinator of the workshop (Mana). Some last interactions with experts has been done (two times a half-day, with one focused on the energy system –generation and uses- due to its importance considering the topic), to be sure, narrative description of scenarios is relevant and coherent for all scenarios.
Throughout the process, the working formats have evolved from the more open formats (brainstorming) to some others more focused on a topic (thematic working group).



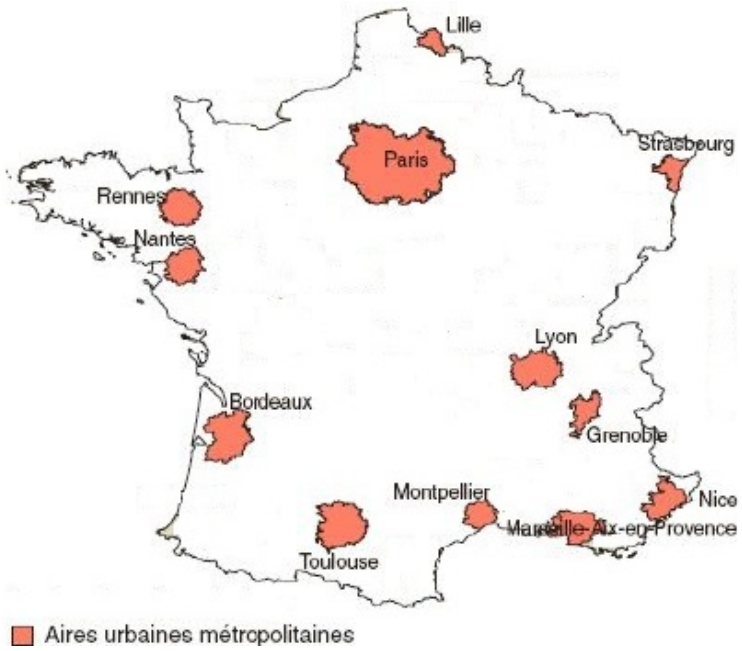
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15 Components uses to built the scenarios

Context variable	Transverse variable	Thematic variable
C1 International cooperation (energy-climate)	C3 Public policies	C8 Productive systems
C2 Economics Context (national and international)	C4 Decentralization and local governance	C9 Energy systems
	C5 Urban systems (hierarchy and cities structure)	C10 Urban policies
	C6 Lifestyles and values	C11 Transport system (technologies)
	C7 Adaptation to climate change	C12 Mobility policies
		C13 Residential and tertiary buildings
		C14 Dwelling policies
		C15 Social policies and fuel poverty

Macro Evaluation of the transitions paths
CIRED

- Quantitative evaluation (via GEC Model with development of a spatial part)



Source : Waisman and Allio, 2012

- **Local data (2010)**
- ***General characteristics***
  - *Population*
- ***Production***
  - *GDP*
  - *Companies*
  - *Jobs*
  - *Average annual income*
- ***Consumption***
  - *Average income per person*
  - *Price evolution*
  - *Value of dwelling*
  - *Price per square meter (euros/m²)*
- Urban costs
  - *Urban transports cost*
  - *Urban transports cost per households (euros)*



Quantitative description for the modelization

	Scenario 1	Scenario 2
Transport	Low Development of Electric Vehicles (5%) Reduction of uses of private cars Development of Coal To Liquid and Biofuels (10% each)	Development of electric vehicles (40% of the fleet) Reduction of uses of private cars Development of biofuels (20%)
Building	Reduction of energy consumption of buildings (-25%)	Reduction of energy consumption of buildings (-35%)
Energy	Low development of renewable energy (<20% of primary energy mix)	Development of nuclear power plants

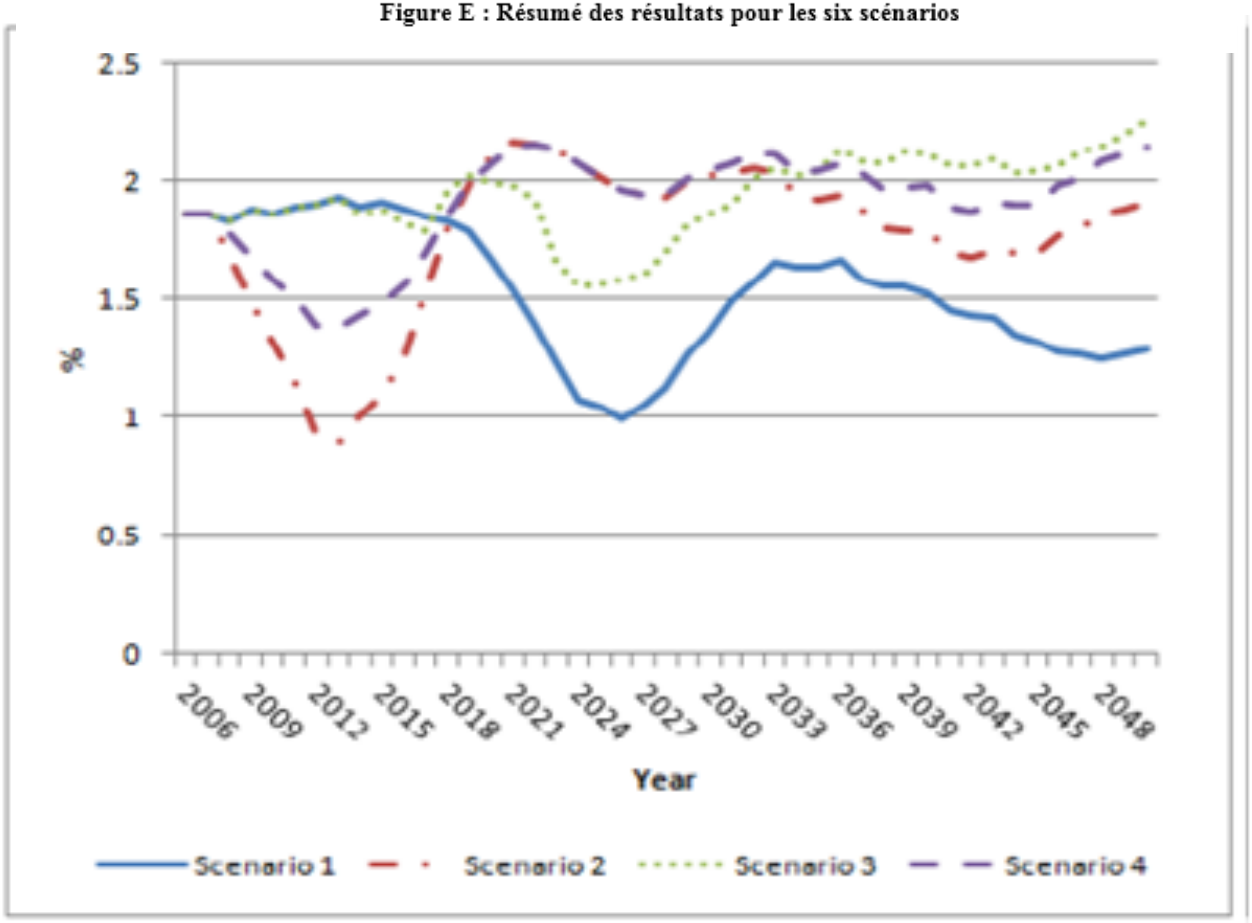
	Scenario 3	Scenario 4
Transport	Development of electric vehicles (2(% of fleet in 2050) Development of alternatives fuels (20% Coal To Liquid and 10% biofuels)	Important Development of Electric vehicles (40% of fleet) Increase of uses of private cars Alternatives fuels (30% of biofuels)
Building	Reduction of energy consumption (50%) by thermal retrofitting (renovation rate 0,6%/year up to 2030, then 1,5%/year)	Reduction of energy consumption (50%) by thermal retrofitting (renovation rate 0,6%/year) More deconstruction/reconstruction
Energy	Development of renewables production with reduction of nuclear production (75% of electricity generation) Development of Carbon Capture and Storage	Important development of renewable energy Decrease of nuclear production (50% of electricity generation)

But difficulty to translate the two last scenarios, about lifestyles, in such a model

Quantitative evaluation of the scenarios
In terms of macro economy
Team : CIRED

	Scénario1	Scénario 2	Scénario 3	Scénario 4	Scénario5	Scénario 6
Croissance moyenne	1,47%	1,52%	1,47%	1,27%	1,44%	1,41%
Population urbaine en 2050 (en millions d'habitants)	30,5	33,8	39,7	12,8	57,6	29,7
Réduction des émissions de CO2	-41,5%	-59,4%	-48,2%	-58,3%	-72,1%	-76,8%

Figure E : Résumé des résultats pour les six scénarios





Discussion

Methodology

- Program with foresight workshop, researches, and seminars
- Complementarity of qualitative (scenarios) and quantitative (models) methods to think the transition
- Focus with thematic researches (governance, inequalities, fuel poverty, lifestyle, local experimentation…)

Results

- Cities are vulnerable but they can find opportunity to act
- They can play a major role in energy transition, and they already have lever even in France

Implications

- Reduce controversies (about peak oil, impact of CC…) and try to learn to act under uncertainties
- Get coherence in multiscale governance (in spatial planning document, and different schemes…)
- Articulate measures at different timeframes (from urgency to long term view)