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Questions about energy autonomy  
revealed by **scenarii of urban energy coordination**

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# Energy transition as sociotechnical regimes change

- Landscape: towards low-carbon energy systems:
  - Renewable energies to replace fuels
- Niche: eruption of local actors (citizens, local communities, emergent companies) to contribute to energy systems:
  - Experiments in many cities, namely with eco-districts, could prefigure what the future energy systems would be in urban areas
- Impact on regime ?
  - Intermittent energies replace storable fuels → need of storage means
  - Ability to generate renewable energies "on-the-spot" instead of use of exogenous fuels (Western Europe)
- Where will generation and storage be located? Who will manage them?
- Especially: what will happen if they are closely linked to consumption, that is to say in cities ?

# 4 Scenarii according the main stakeholder

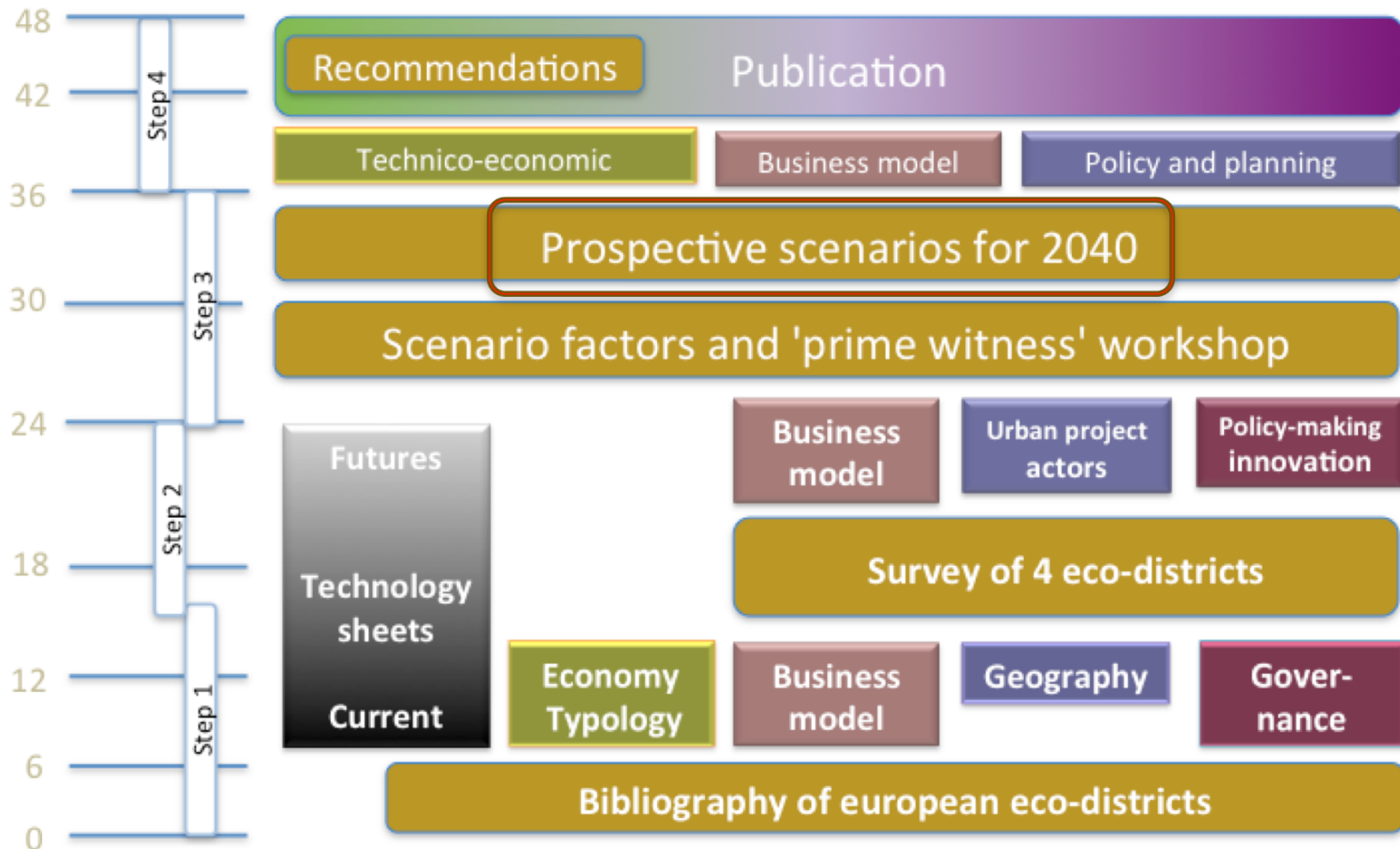
- Illustrate various forms of interdependancy between political, urban and technological dimensions of energy
- 4 scenarii
  1. Large companies, supplying urban energy systems and services
  2. Cooperative actors, inhabitants collectives seeking to regain control over energy
  3. Local government, steering territorial planning
  4. The State, acting as the central power framing rules and regulations

# The Eco-district NEXUS Energy project

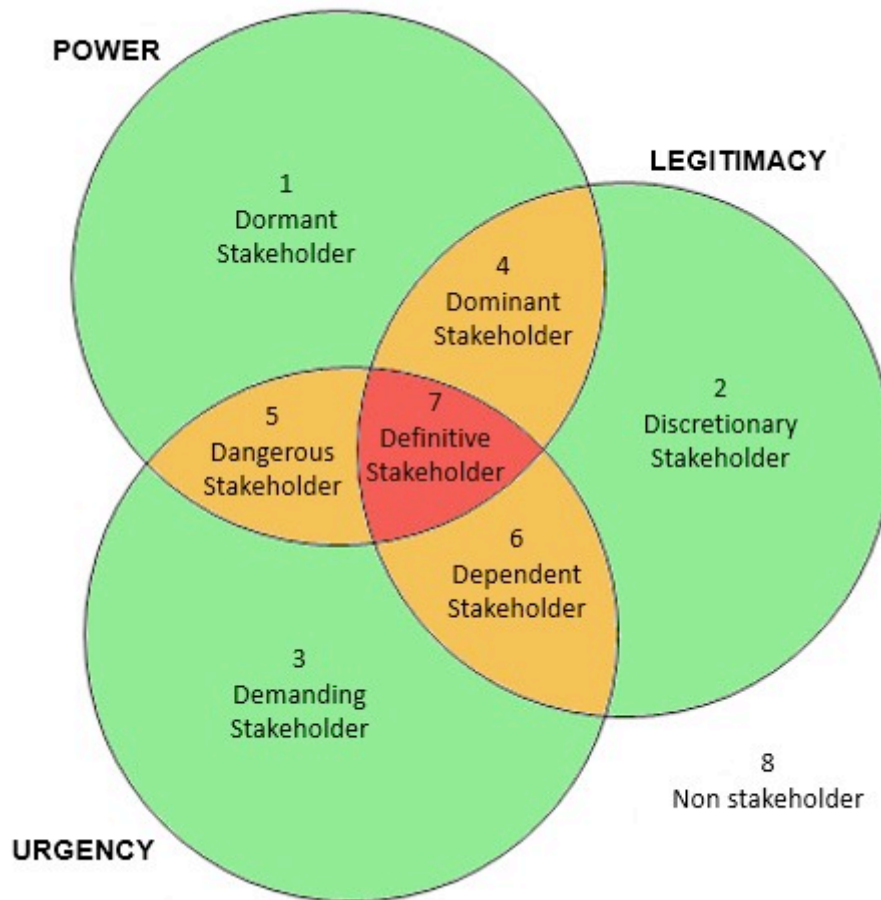
- Aims of the project :
  - What do innovative energy systems teach us about the future evolution of energy production and consumption in urban areas and cities?
  - How should we grasp organizational, political and planning dimensions of urban energy management?
  - What are the sociotechnical possibilities for renewable energies at the local scale (city / district ) ?
- Complex questions that require complementary approaches from different scientific disciplines
  - Technology
  - Geography and urban planning
  - Economy / management
  - Sociology
- Methodology :
  - Considering energy system as an assemblage (Farias and Bender 2010)
  - of Socio-Energy Nodes
  - Providing new knowledge on actors interplay and on local/national rules effects
  - Elaborating future scenarii of urban energy coordination



# The NEXUS research process



# The scenarios making process



- Definition of pivotal actors around which each scenario is built
- Workshop with major witnesses (PAT-miroir method): checking the key issues about urban local energy systems?
- Main variables to be considered
- Redaction of the scenarii
- Reaction from a panel of "major witnesses" on scenarii

# Main variables to be considered

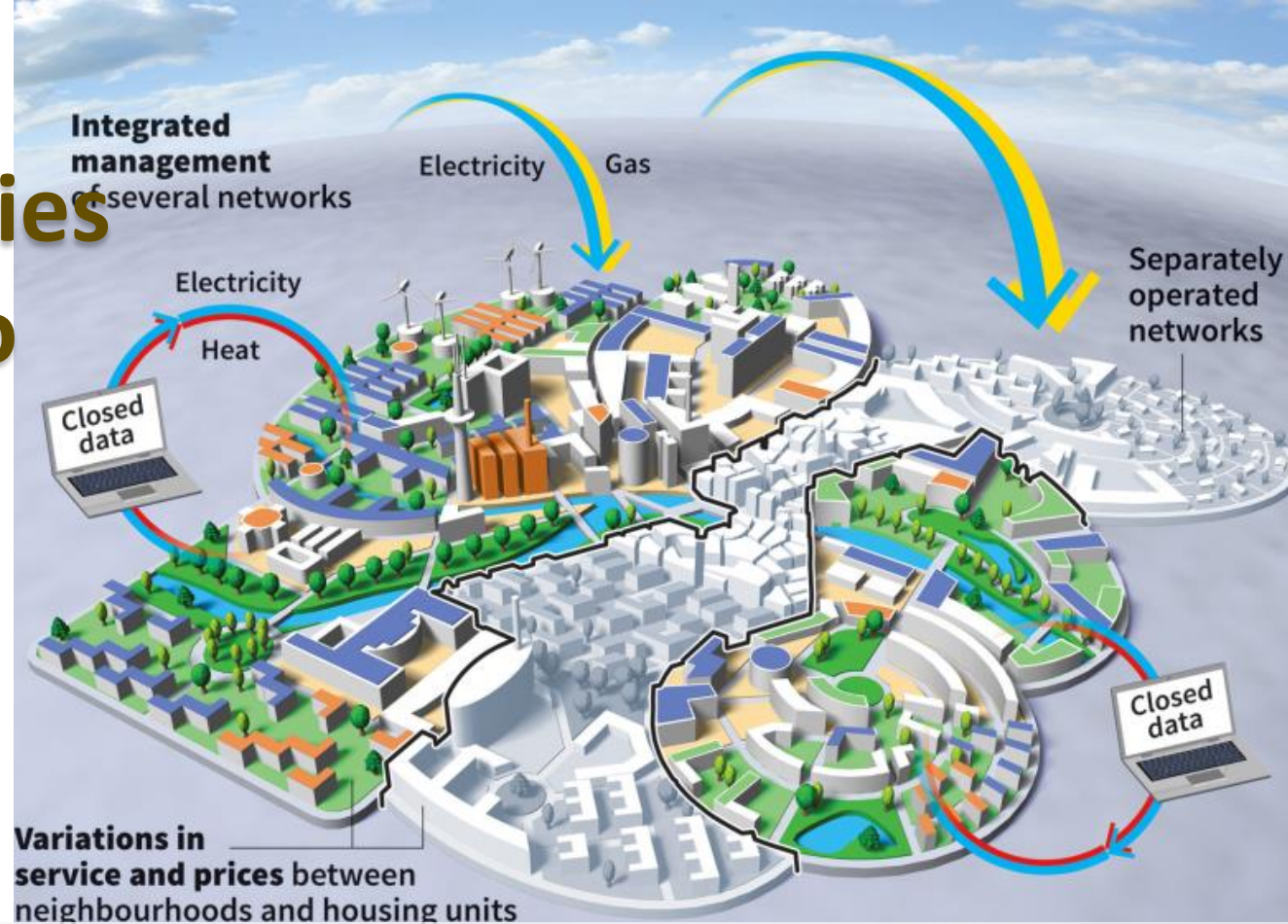
Variables	A - large companies	B - local authorities	C - centrale government	D - cooperative actors
<i>Product, value chain</i>	Rentabilité	Développement économique Cohésion sociale	Indépendance énergétique	Partage
	Solutions high-tech hautement capitalistiques		Prix bas	Valeurs peu monétisées
<i>Public policies, regulation</i>	Deux types de territoires :	Planification des ressources et des équipements en liaison avec lieux de consommation	Planification d'équipements massifs par régulation centralisée	Régulation par les normes sociales plutôt que réglementaires
	a) gestion multi-énergie			
	b) concession mono-énergie			
<i>Scale of energy systems</i>	Le quartier (ou morceau de ville) ressource pour des échanges via le réseau interconnecté européen	Ramification dans hinterland en complément d'équipements urbains	Bâtiment et réseau national	(Groupes d') Immeubles visant autonomie relative par mise en réseau
<i>Autonomy, auto-consumption</i>	Autonomie quartier limitée par des énergies exogènes compétitives	Autonomie à l'échelle du territoire urbain élargi (hinterland)	Autoconsommation logement/immeuble et autonomie nationale	Autonomie à échelles multiples infra et intra-coopératives
<i>Socio technical resilience</i>	Réseaux parcellisés	Technologies éprouvées	Fiabilité électrique capitale assurée par des capacités de réserve	Capabilité des entités plutôt que résilience technique du réseau
	Fiabilité dépendante des entreprises ensemblières	Réseau national comme secours mais limité		
<i>Inequalities and energy poverty</i>	Inégalités d'accès à l'énergie entre habitants et entre quartiers	Tarifs uniformes mais mixité sociale	Tarifs uniformes	Solidarité interne
			Tarifs sociaux	Risque de gatted communities
<i>Innovation and social acceptance</i>	Gamme de services basée sur technologies smart grids	Accompagnement social (rénovation, maîtrise conso...)	Smart grids obligatoires pilotés à partir du réseau national, voire européen	Low-tech
				Habitants initiateurs et acteurs

# Main common assumptions

- Climate change impacts:
  - Increasing need of cooling in summer
  - Decreasing need of heat in winter (amplified by building thermal refurbishment)
- Ambitious aims for renewable energies in Europa
  - Competitiveness of renewable / fuels
  - Low prices for power during numerous periods of solar and wind surplus
  - Energy storages (especially thermal ones) development that could also favours self-generation
- Europa no longer orders disjunction between distribution and retail

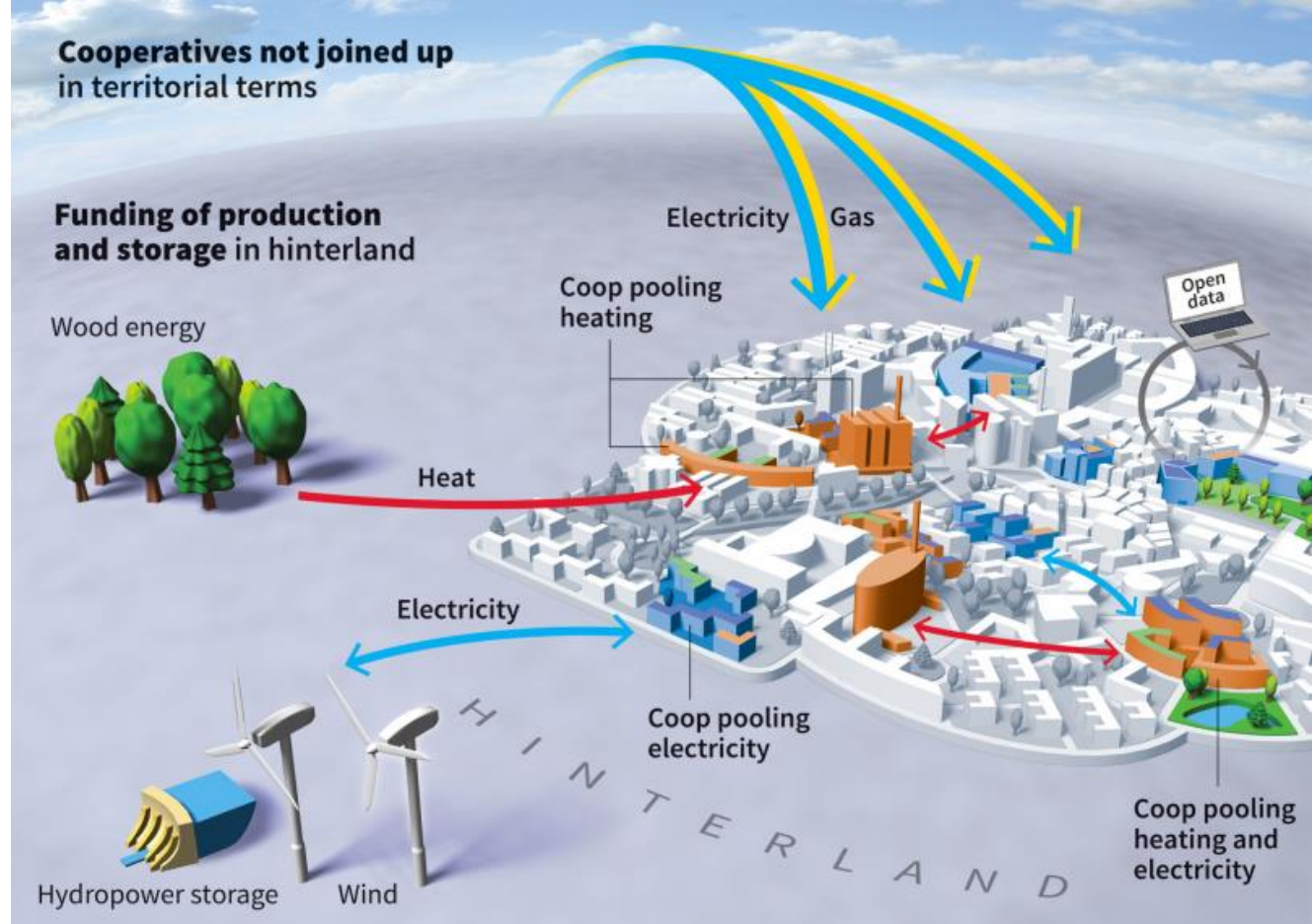


# Large companies Scenario



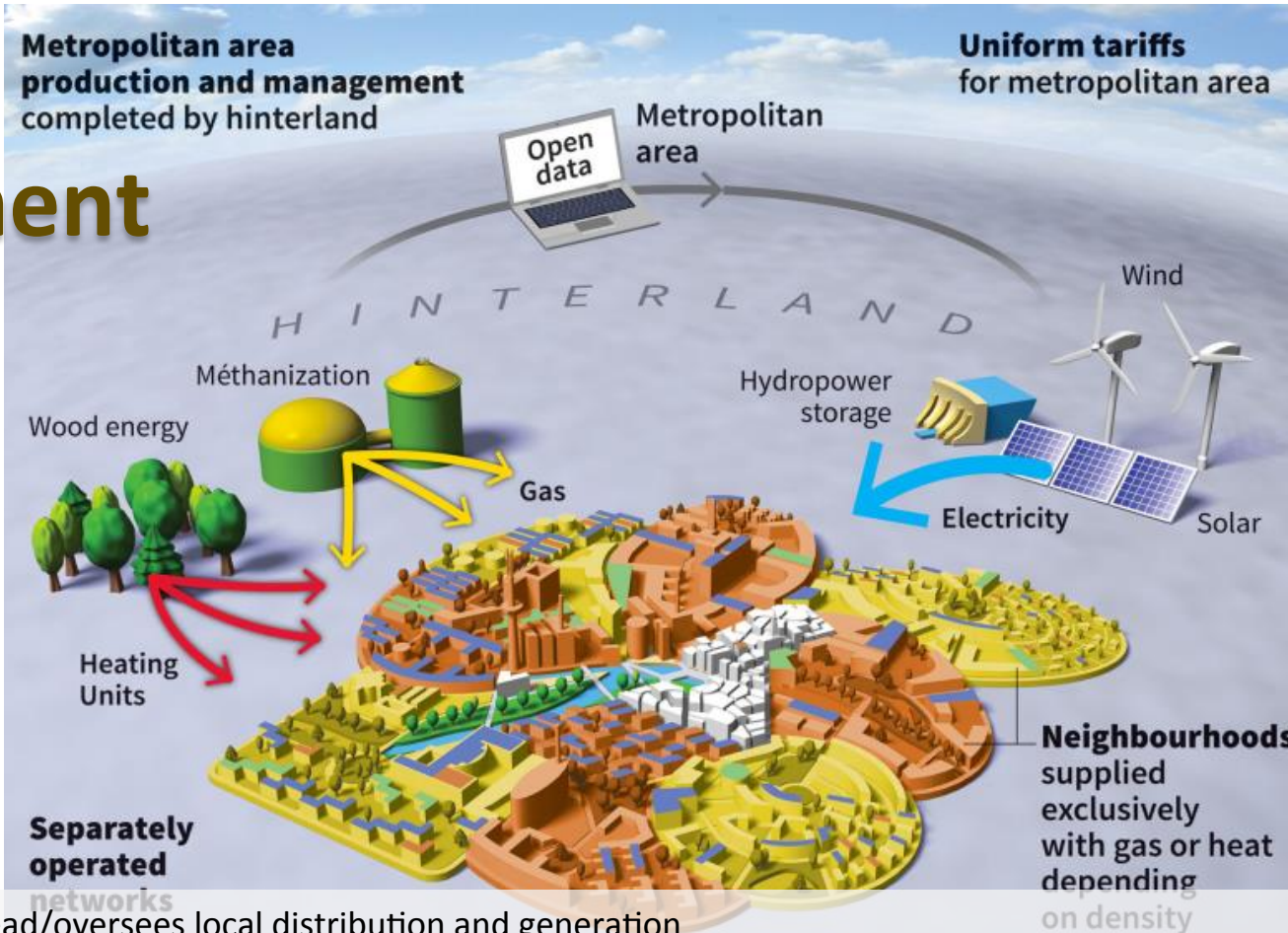
- Multi-energy companies operate on a restricted urban area
- Provide a basic energy service defined by public authority and an assortment of optional premium ones
- Use local infrastructures as a resource to deal on the European market for profitability
- Partially local renewable
- Technologies: multi-energy smart grid, PV plus geothermal energy, storage linked to building or district heating, demand response, national grid
- Inequity between householders and between districts
- European interconnected grid

# Cooperative actors scenario



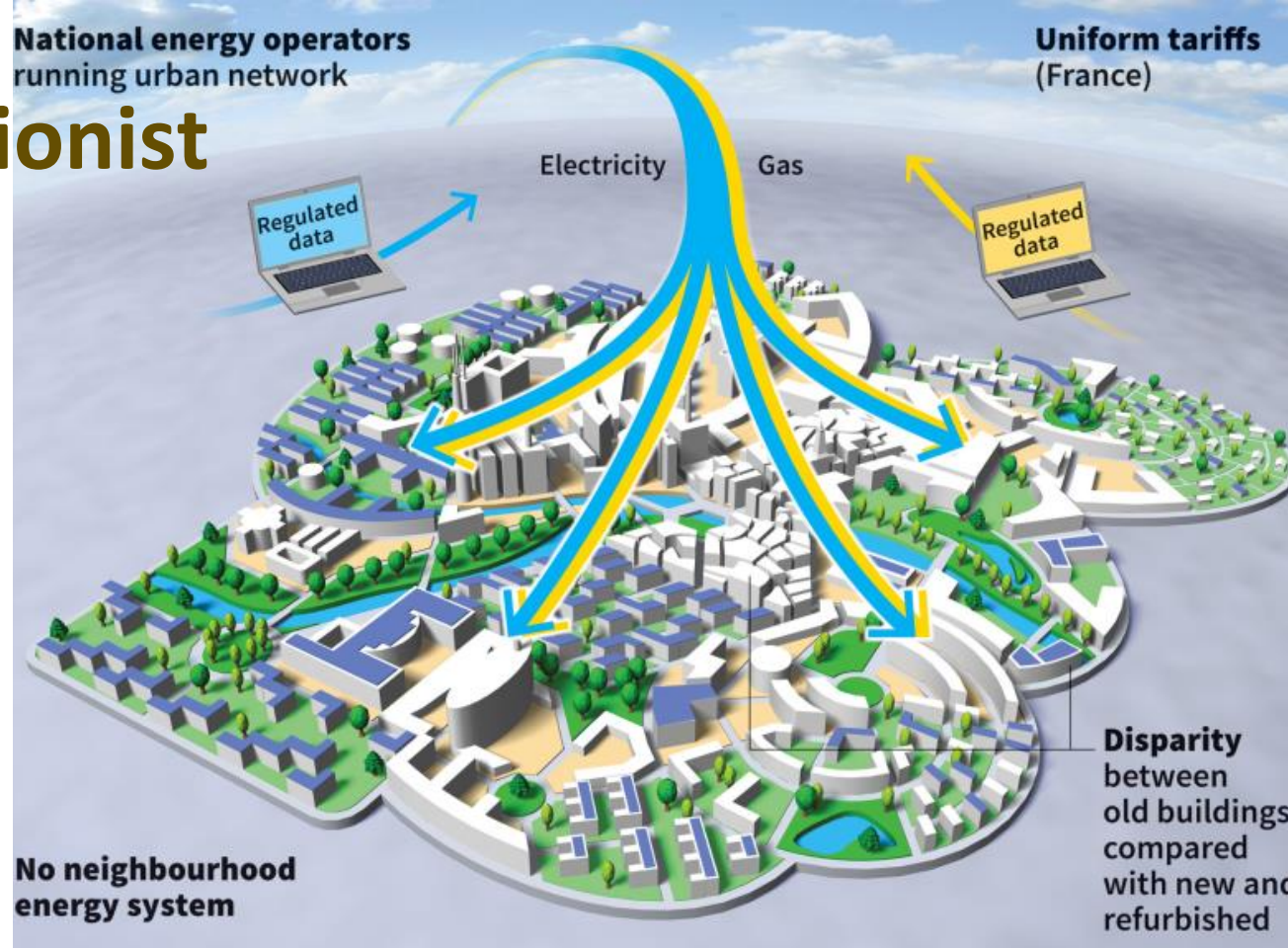
- Energy autonomy desired but the scale of building may be a barrier
- Exchanges of energy with other buildings (especially complement with shops or offices)
- Cooperative members defining the rules of energy uses and the price (thank to open data)
- Consensual proven low-techs (when compared to technologies used by large companies): woodfuel, solar panels, thermal storage
- Cooperatives commitment in renewable energy located –as a priority- in the hinterland
- Differences between cooperatives – a model restricted to a segment of the population and some places in the city
- Deal with local authorities: avoiding cooperatives' autarcy in exchange for reduced tax

# Local government scenario



- City or metropolis lead/oversees local distribution and generation
- Provides a standard energy service
- Maximizes local energy in order to keep/developp wealthy and jobs in the area
- Cooperation with surrounding territories for access to renewable ressources and storage
- Optimisation of the energy infrastructures at the urban level
  - district heating based on CHP supplied by woodfuel, biomass gas or solar pannels (with thermal storage)
  - gas districts elsewhere especially where less density and consumption (highly retrofitted buildings)
- Uniform energy prices at the local level but gaps between territories
- Electricity and gas transmission grids shrink

# Interventionist state scenario



- The State plans energy infrastructures and prescribes what actors have to do
- It favours energy independancy, social and territorial equality (uniform tariffs) and reliability
- Concentration/centralization of renewable massive production in few places in rural areas: solar and wind farms, hydropower reservoirs, gas large production (biomass and power-to-gas) and large storage → regional specialisation
- Requirement of "net zero energy" buildings finally increases self-generation
- Withdrawal of local communities: no commitment in urban or district heating
- Economic vulnerability of conventional electricity producers (because low price during solar and windy periods) and of national transmission operator (because decrease of permanent flows but high load counterbalancing regional intermittency of solar and windpower)

# Spatial scales of energy autonomy and link during operating phase

Scale Scenario	Housing unit	Building	District	Metropolis	State	Europe
Big companies		Market		Market		
Cooperative actors	Deliberation			+Deliberation	+Market	
Local government	Market and/or deliberation				Market and/or deliberation	
Interventionist State		Market				

# Conclusion

- Each scenario ensures an overall coherence of relations between actants
- But scenarii do not look for realism (not a business as usual scenario intended to forecast THE future ); we design contrasted scenarios to imagine possible futures including rules disruption in order to generate reflexion / discussion
- The on-the-spot harvest of renewable energies and smart technologies enable various forms of autonomy - considered as an ability to reduce external dependancy
- Considering **connected autonomies** instead of **network and prosumer**
- Thinking together **archipelago (horizontal)** and **stacking (vertical)**
- Relations between housings/buidings and local/intermediary are crux of the matter for the relation between local and national → overtaking the "décentralisation" question
- New questions about energy autonomous bodies (intermediaries?):
  - Modalities of the inner decision process for commitment and, then (during operating phase), of internal links: market or deliberation?
  - Contribution to reliability of large network and to social and territorial solidarities
- Towards a new "contrat social" taking into account the energy autonomies?

# Merci de votre attention

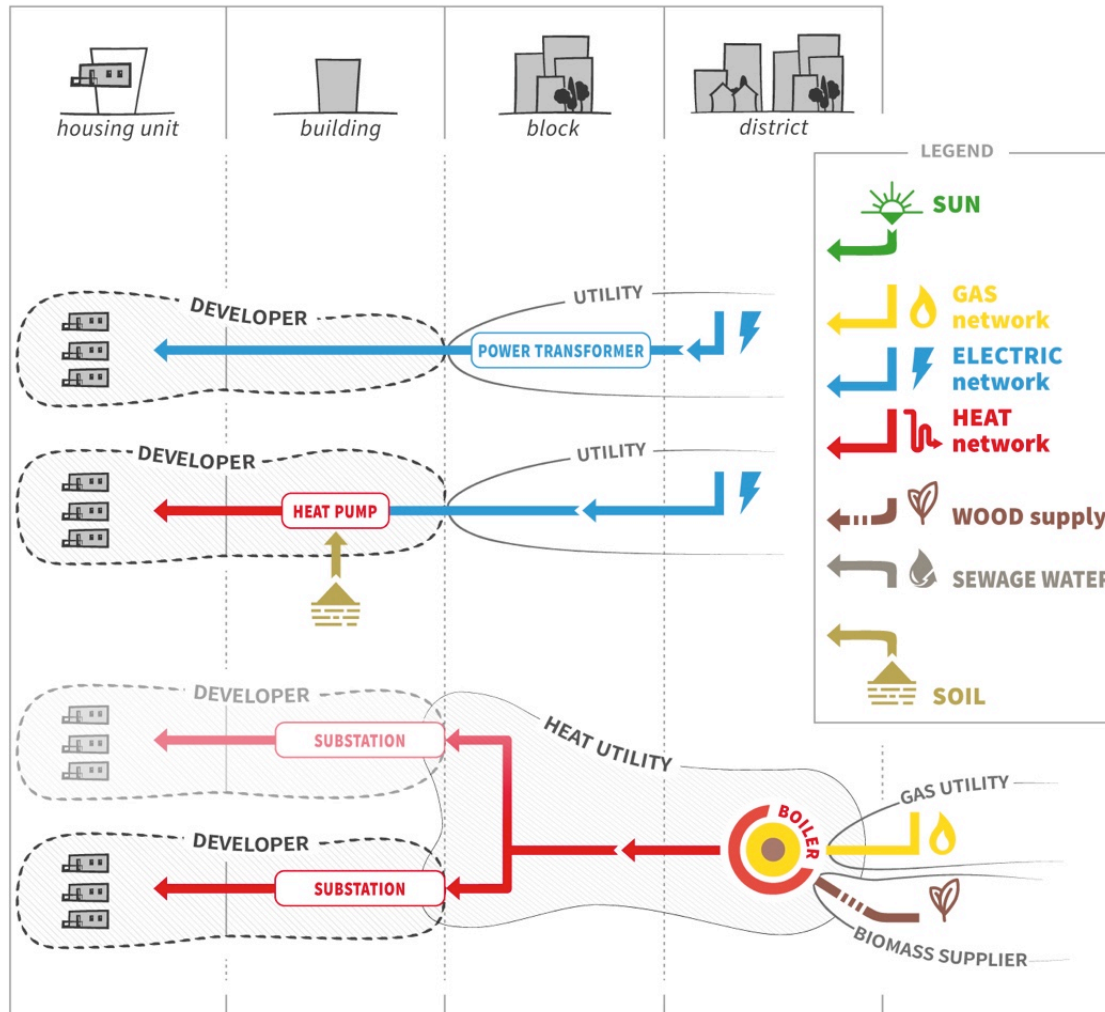
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[www.nexus-energy.fr](http://www.nexus-energy.fr)

- Vidéos des scénarios
- Publications de l'équipe
- Résultats intermédiaires
- Fiches Ecoquartiers et Fiches technologiques
- Base de données biblio sur 50 écoquartiers européens



# Socio-Energetic Nodes concept



Debizet et al.  
2016  
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production