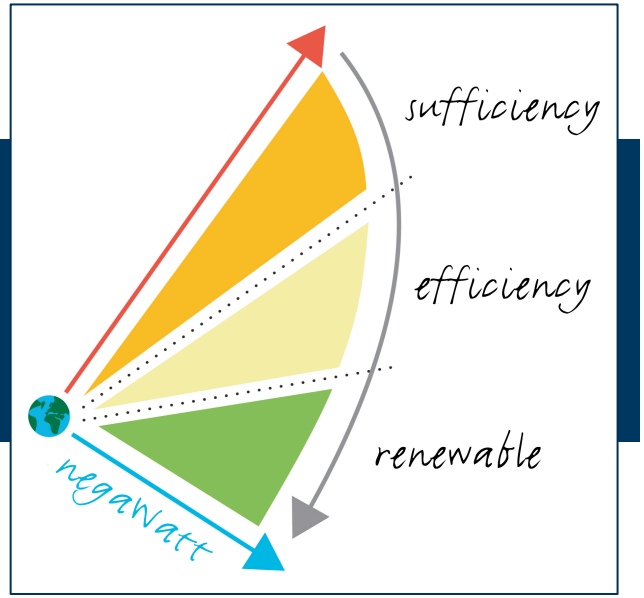
sufficiency, efficiency, renewables

The role of energy sufficiency towards 100% renewables: the **négaWatt** scenario for France



Yves Marignac

Spokesperson & Head of Prospective Analysis / négaWatt

eceee Annual Policy Seminar

Energy efficiency and demand reduction: Europe's key to deliver on the Climate Agreement

Scotland House, Brussels

24 November 2016

négaWatt

ASSOCIATION négaWatt

- Non profit expert organisation
- Created in 2001
- A core of 25 experts (Compagnie des négaWatts)
- Over 1000 individual members
- Dedicated to advance sustainable energy policy

Activity:

- Prospective analysis:
  Scénario négaWatt in 2003-2006-2011
- Proposal of policies and measures
- Lobbying and media work

INSTITUT négaWatt

- Public limited company
- Created in 2009
- Subsidiary of the association

Activity:

- Research, applied studies
- Training (professional publics)
- Development of massification tools for energy transition

The négaWatt approach to energy

Global intelligence on the energy system:

3. Substitution

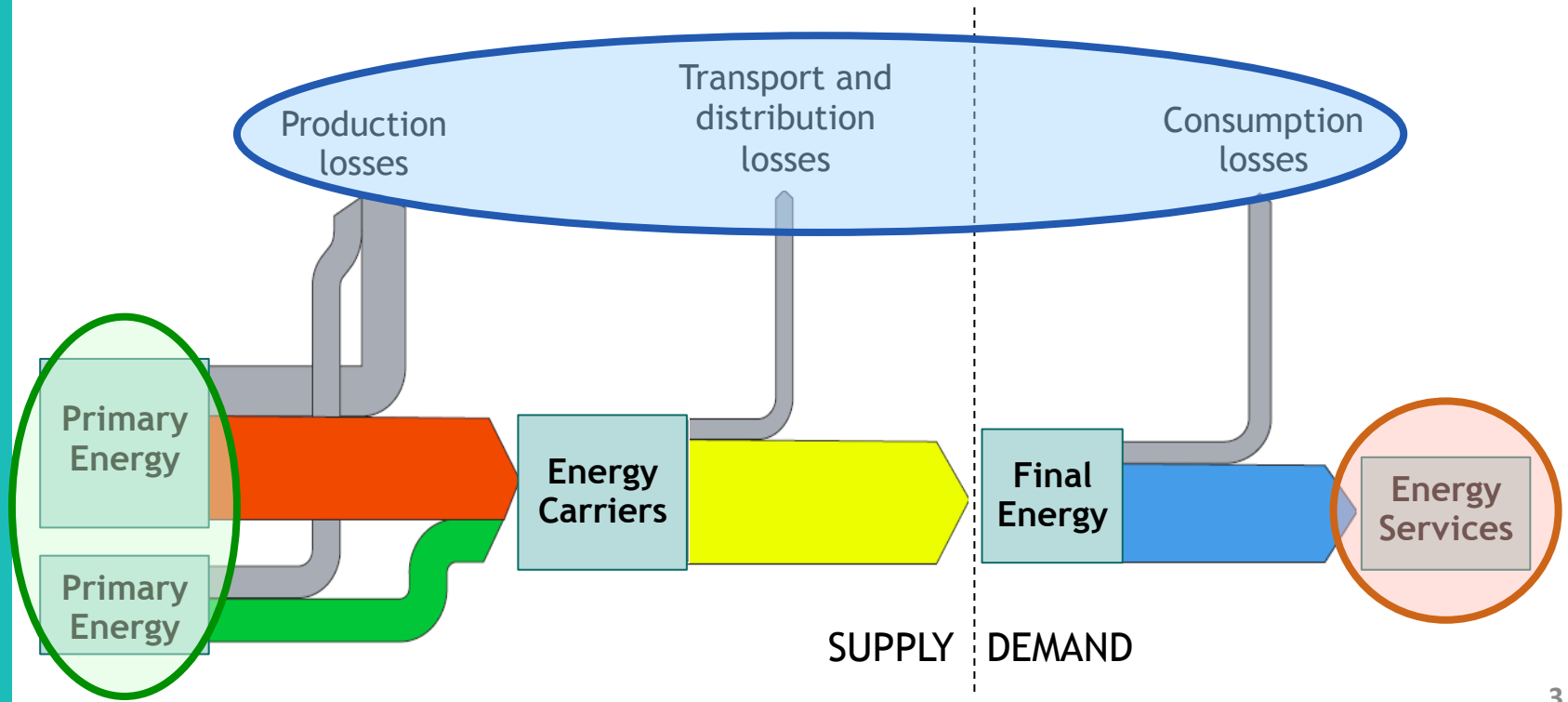
Develop **flow-based** renewables to replace **stock-based** fissile and fossils

2. Efficiency

Reduce the **losses**, i.e. the need of primary ressources to serve end-uses

1. Sufficiency

Prioritize energy end-uses in terms of individual/collective **energy services**



Energy sufficiency and efficiency

Sufficiency:
Reduce the need to use energy down to the satisfaction of really useful and well set energy services

Efficiency:
Reduce the amount of energy needed to satisfy a given level of energy services

Lifecycle energy

Ecodesign (grey energy)	Life-cycle energy optimisation

Delivery of energy services

Dimensional	Size, nominal capacity of equipments
Servicial	Intensity and duration of use of equipments
Organisational	Collective planning and sharing

Energy transformation chain

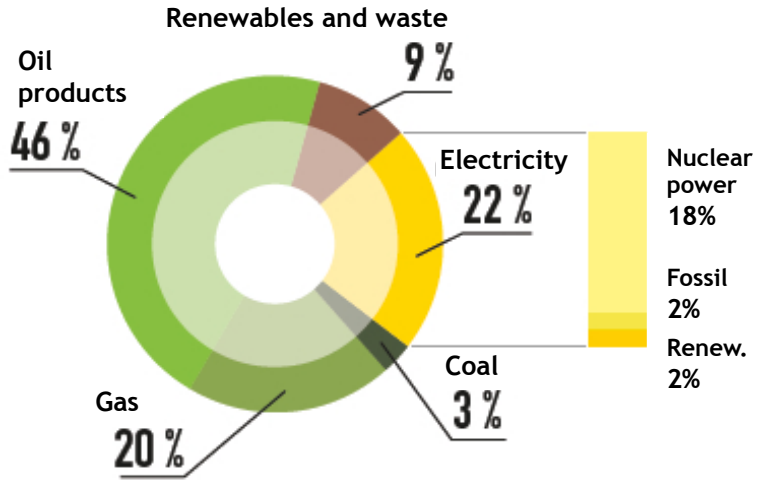
Adaptation (useful energy)	Optimisation of energy exchanges with environment
Equipments (final energy)	Conversion performance of end-use equipments
Production (primary energy)	Conversion performance of production, reuse of energy

French situation – Scenario objectives

French energy profile

- Dependency on fossil fuels remains high (70%)
- GHG emissions considered 4-fold higher than sustainable: "factor 4", or 75% cut by 2050 objective
- Strong dependency on nuclear power for electricity (75%)
- Low/slow development of renewables

France's final energy consumption, share by energy source (2011)



Source: bilan de l'énergie, 2011, SOeS

The négaWatt scenario 2011 in political context

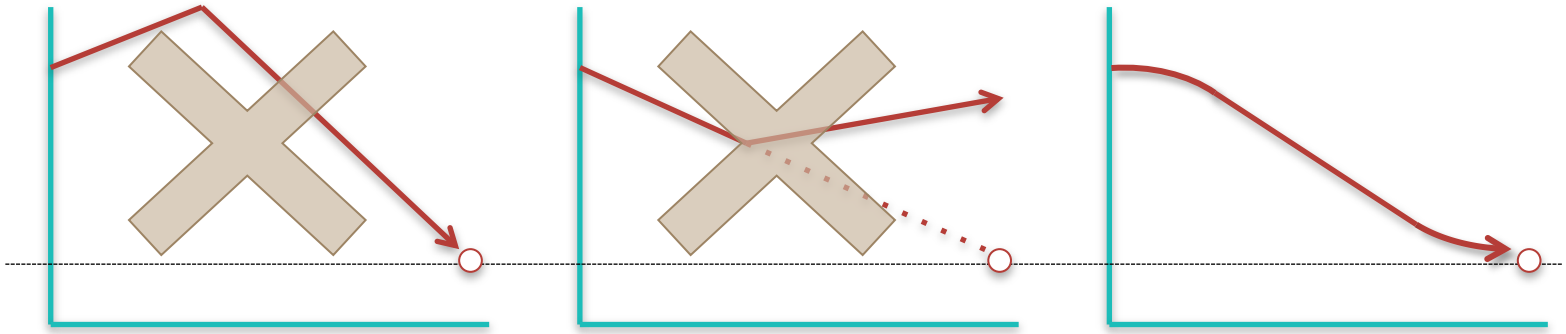
- Provide a sustainable pathway towards low-carbon, 100% renewables
- Show the possibility of a step-by-step implementation of energy transition
- Prepared for the context of the 2012 presidential election, boosted by the energy debate in the aftermath of the Fukushima catastrophy

Fundamentals of the scenario

- A **normative implementation** of the négaWatt approach
  but no normative energy or GHG targets
- **1. Hierarchy of options**
  - First, action on energy demand through sufficiency and efficiency
  - Priority to the use of energies based on flows rather than stocks
  - Thus: **no replacement of nuclear by nuclear, no CCS and no shale gas**
- **2. Technological realism**
  - "Mature" solutions (i.e. at least industrially emerging)
  - Although knowing that ruptures will happen
  - A more robust trajectory still open to good surprises
- **3. Sustainable development**
  - Multicriteria analysis instead of "carbocentrism"
  - Aim to reduce the whole of risks and impacts arising from energy
  - *"Transfering revenues rather than debts to future generations"*

The need of a consistant trajectory

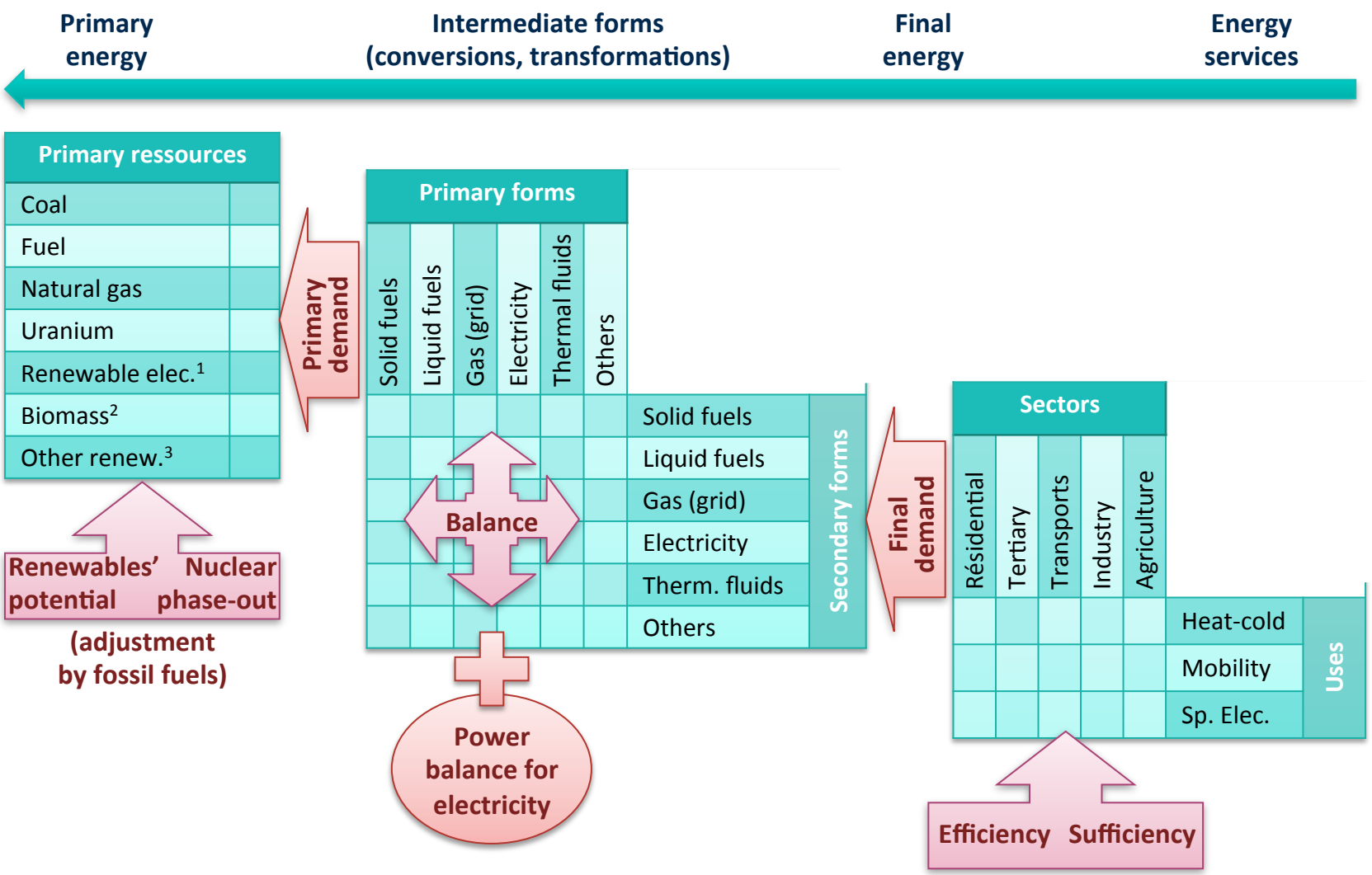
- A prospective analysis to **bring long term concerns in short term decisions**
- A **feasable path** through the combination of a long term vision *and* a trajectory to reach it starting with our current situation



"Facteur 4" scenario (2005) **"Post-Grenelle" scenario (2010)** **Consistant trajectory**

- A tool to project and quantify action:
  priorities, level of ambition, rythm of **policies and measures**
- An analysis consistant with physical constraints and realities:
  an energy model to question the economy instead of the opposite!

Bottom-up energy and power model



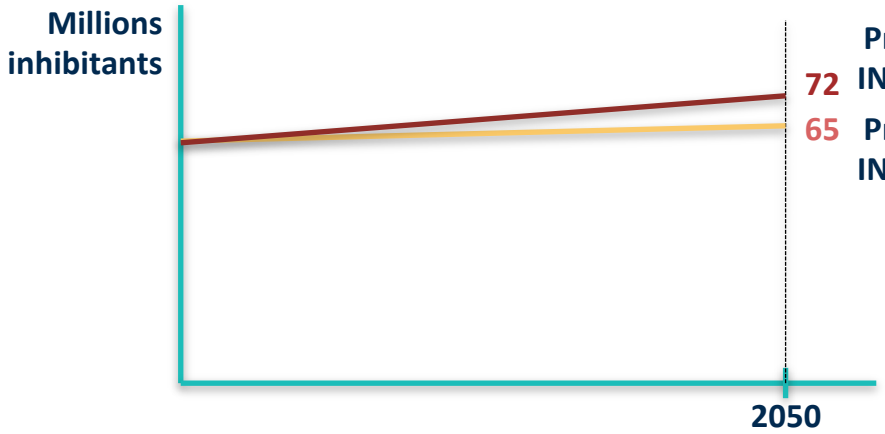
[1] Primary electricity from renewables: hydro power, wind power, photovoltaics, marine energies…
[2] Solid biomass, liquid biomass and biogas.
[3] Other renewable energies: solar (thermal), geothermal energy, waste…

Framework hypothesis

- Base year (stats): 2010
  Horizon of the scenario: 2050

  5 years less to act (compared to 2006 scenario) **while urgency grows**

- **Demography:**



7 millions inhibitants more by 2050
(compared to 2006 scenario)

- **Geographic basis:**
  - Metropolitan France (Corse included, DOM-COM excluded)
  - Search for a self-sufficiencient balance or an excess of exchanges

- **Trend or "business as usual" scenario:**
  - Demand: smooth stabilisation (post economic crisis, post Grenelle…)
  - Production : nuclear status quo, slow development of renewables

Implementation on energy demand

Buildings

Moderating surfaces/person or activity
Deep and large thermal retrofitting
Constructing positive energy new buildings

- **Sufficiency :** average surface per person is stabilised, tertiary growth is limited
  - Recohabitation policy (e.g. joint tenancy for students)
  - Priority to small collective buildings (compared to individual houses)
  - Priority to multi-functional buildings

Also: efforts on heating levels (stabilised temperatures), hot water needs (-20%), etc.

Implementation on energy demand

Buildings	Moderating surfaces/person or activity Deep and large thermal retrofitting Constructing positive energy new buildings
Specific electricity	Implementation on every uses, on average of best equipments and behaviours of today (but also including a provision for new uses)

- **Sufficiency:** a case-by-case detailed analysis (20 uses in residential, 10 in tertiary)
  - Increased rate of use of appliances, at an increased share of their capacity
  - Limited growth of average capacity, rate of equipment
  - Decreased diversification of electronic appliances for audio, video and communication
  - Limitation of public lighting

Implementation on energy demand

Buildings	Moderating surfaces/person or activity Deep and large thermal retrofitting Constructing positive energy new buildings
Specific electricity	Implementation on every uses, on average of best equipments and behaviours of today (but also including a provision for new uses)
Transports	Urban planning to reduce need for distances Modal transfer (road-rail, individual-collective) Efficiency of vehicles and adaptation to uses

- **Sufficiency:** a slow decrease of distances per person and freight volumes
  - Siting of new buildings restricted by infrastructures and services proximity criteria
  - Mixity of uses, co-working spaces
  - More local production and consumption loops

Also: car-sharing, speed limitation, reduction of plane traffic

Implementation on energy demand

Buildings	Moderating surfaces/person or activity Deep and large thermal retrofitting Constructing positive energy new buildings
Specific electricity	Implementation on every uses, on average of best equipments and behaviours of today (but also including a provision for new uses)
Transports	Urban planning to reduce need for distances Modal transfer (road-rail, individual-collective) Efficiency of vehicles and adaptation to uses
Industry	Extended recycling of materials Reduced need of goods Efficiency in manufacturing processes (but also including a relocalisation of production)

- **Sufficiency:** a case-by-case action on the need for primary and secondary goods
  - End to paper publicity (-35% on corresponding need for paper)
  - Limited growth of equipment rates for electric appliances
  - Reduction of replacement rates of equipments (repair and reuse policies)
  - Reduced need of bitumen, iron, etc. (consistent with changes in transports, buildings…)

Implementation on energy demand

Buildings	Moderating surfaces/person or activity Deep and large thermal retrofitting Constructing positive energy new buildings
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Roughly 50% cut in final energy consumption in each sector by 2050

Behaviour changes over 2011-2050… not really stronger than over 1971-2010
The new thing is that they have to be driven by long-term concerns

Implementation on energy demand

Buildings	Moderating surfaces/person or activity Deep and large thermal retrofitting Constructing positive energy new buildings
Specific electricity	Implementation on every uses, on average of best equipments and behaviours of today (but also including a provision for new uses)
Transports	Urban planning to reduce need for distances Modal transfer (road-rail, individual-collective) Efficiency of vehicles and adaptation to uses
Industry	Extended recycling of materials Reduced need of goods Efficiency in manufacturing processes (but also including a relocalisation of production)
Agriculture	Same approach on land-use & use of biomass Change of food-habits (less meat, etc.) *(coupling négaWatt and Afterres scenarios)*

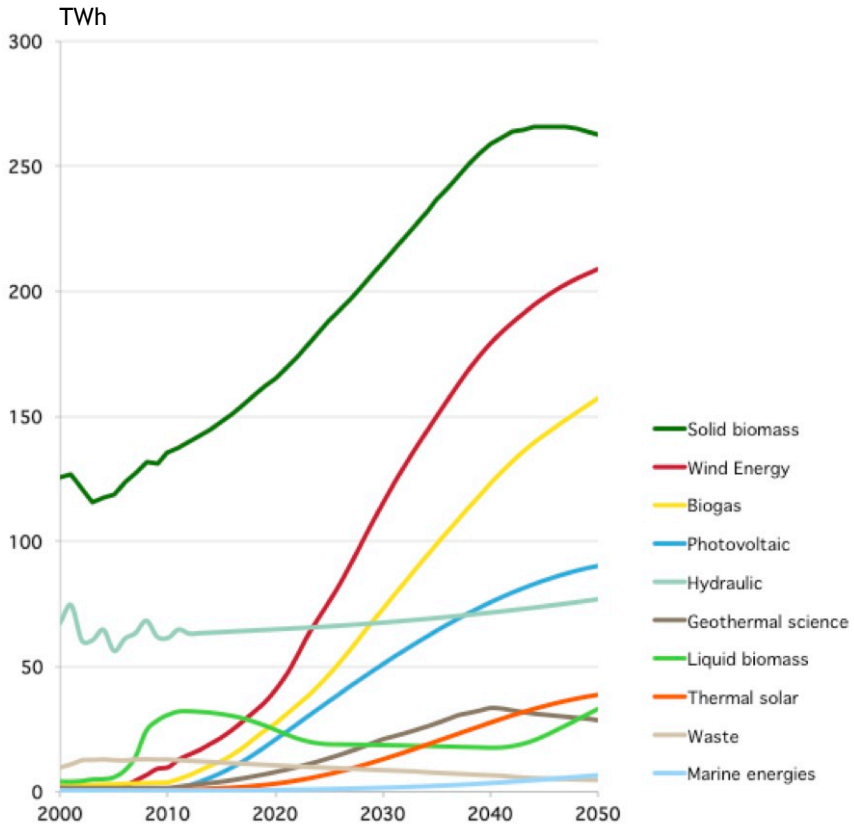
Roughly 50% cut in final energy consumption in each sector by 2050

Allows for sustainable use of bioenergy

Implementation on energy resources

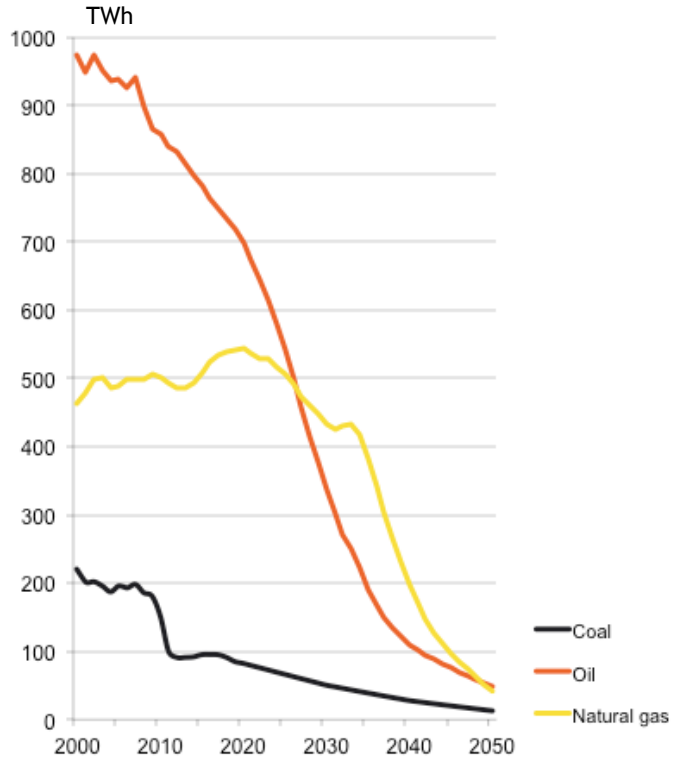
Strong development of renewables

- Biomass (mostly wood and biogas)
- Electric renewables (mostly wind and PV)



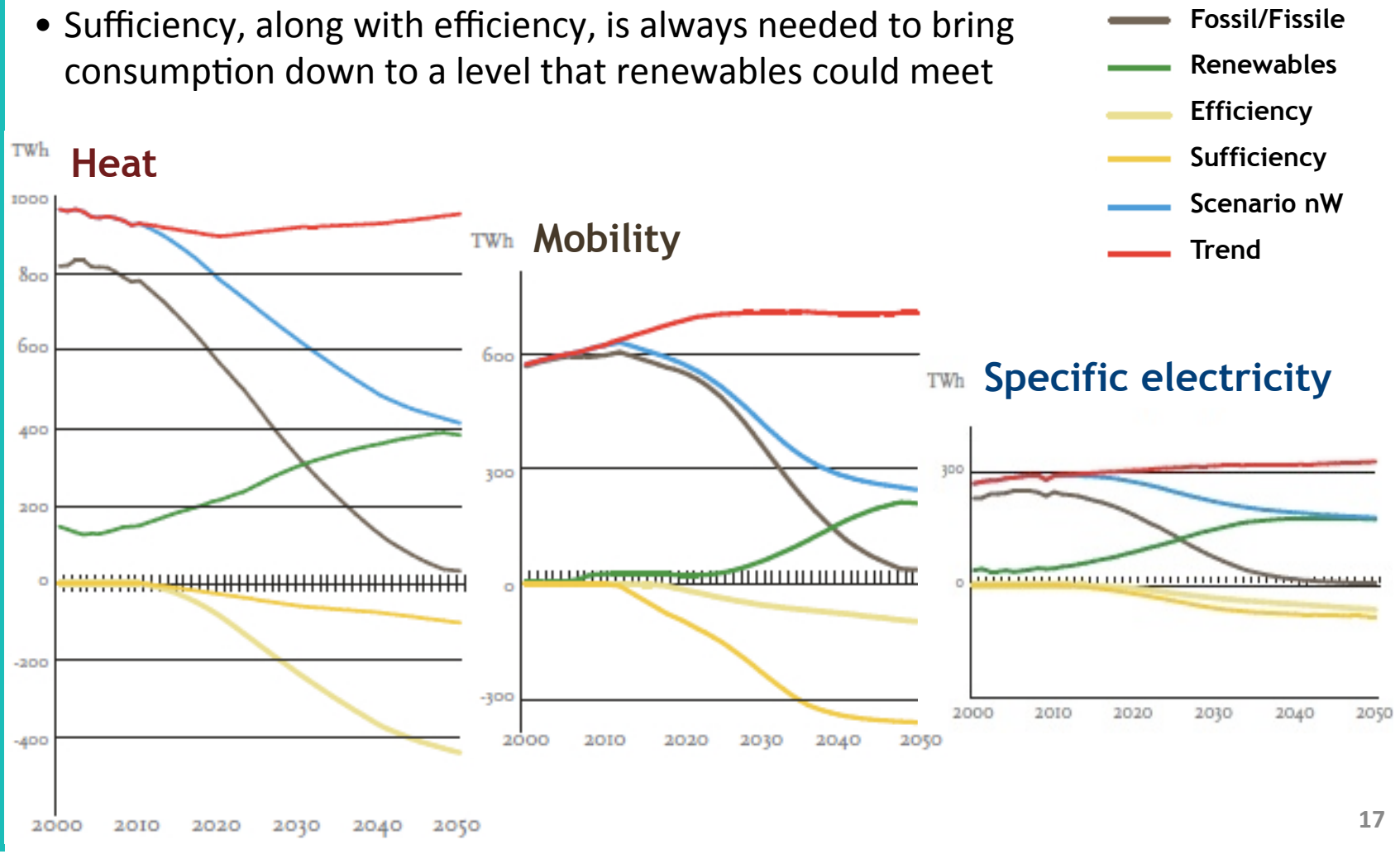
Phase out of stock-based energies

- 58 nuclear reactors gradually shut-down (before 40 years lifetime)
- Residual use of fossil fuels

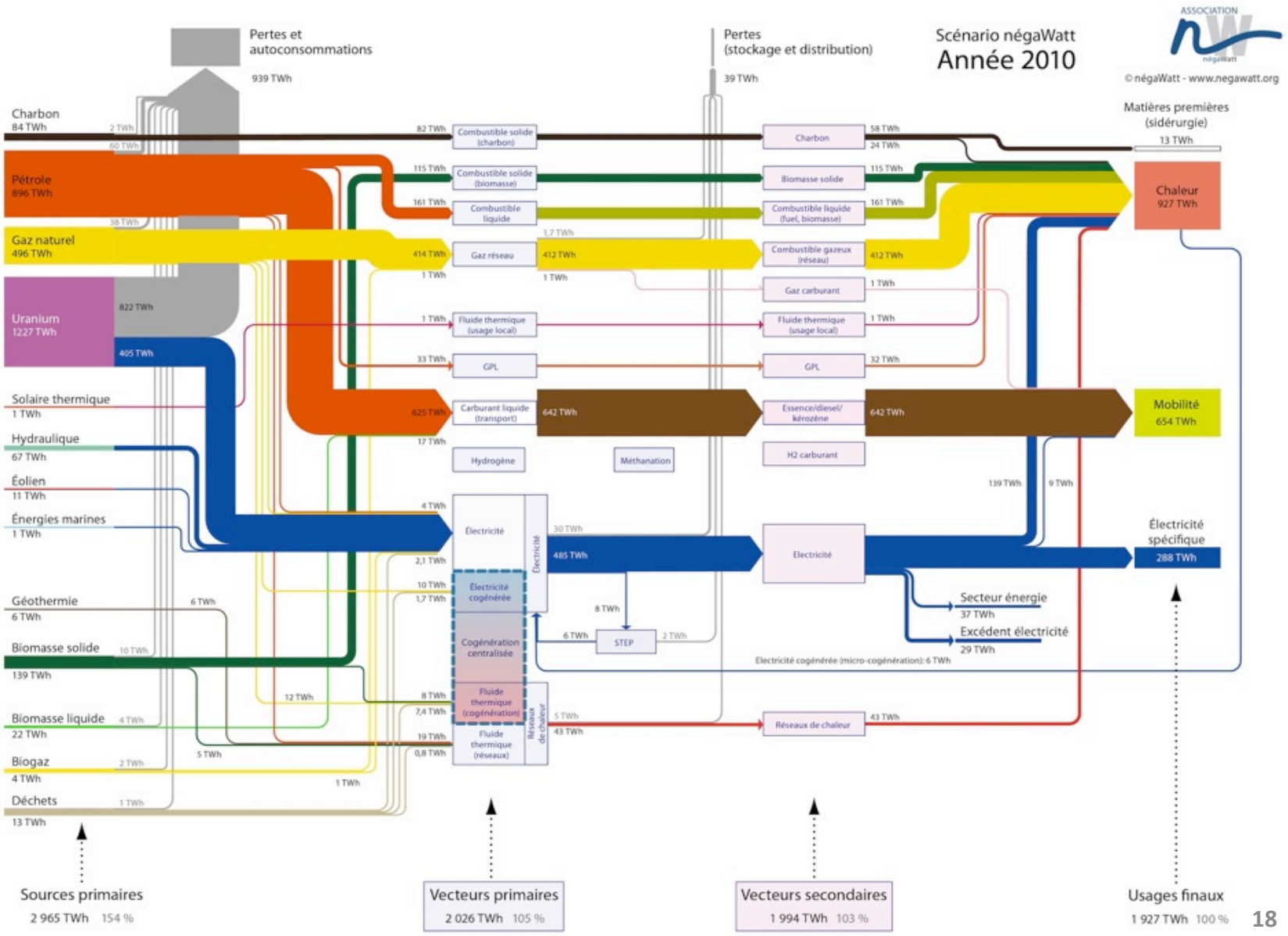


Final energy balance

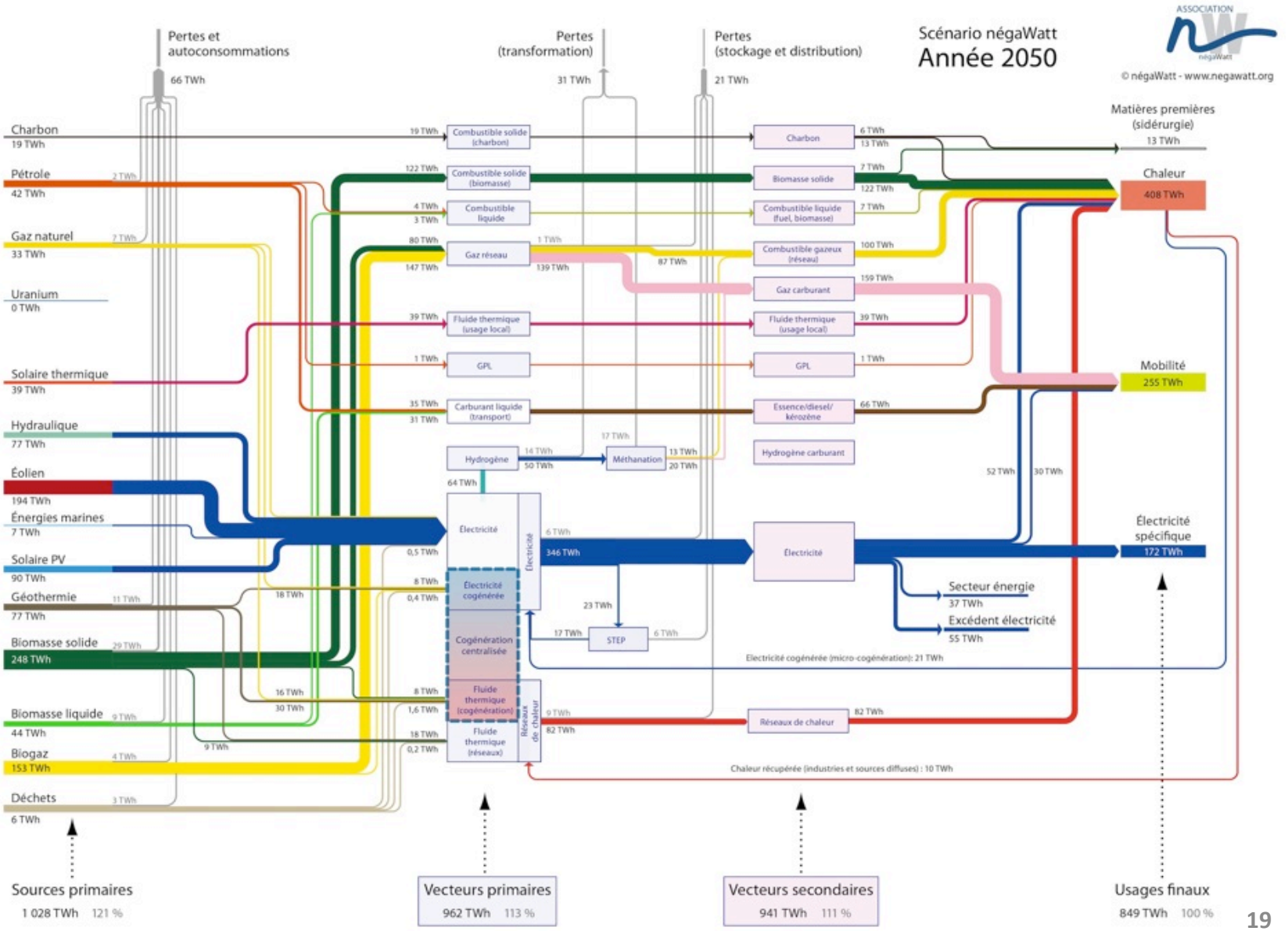
- **The pace of transition and the respective roles of sufficiency and efficiency is varying depending on the type of energy uses**
- Sufficiency, along with efficiency, is always needed to bring consumption down to a level that renewables could meet



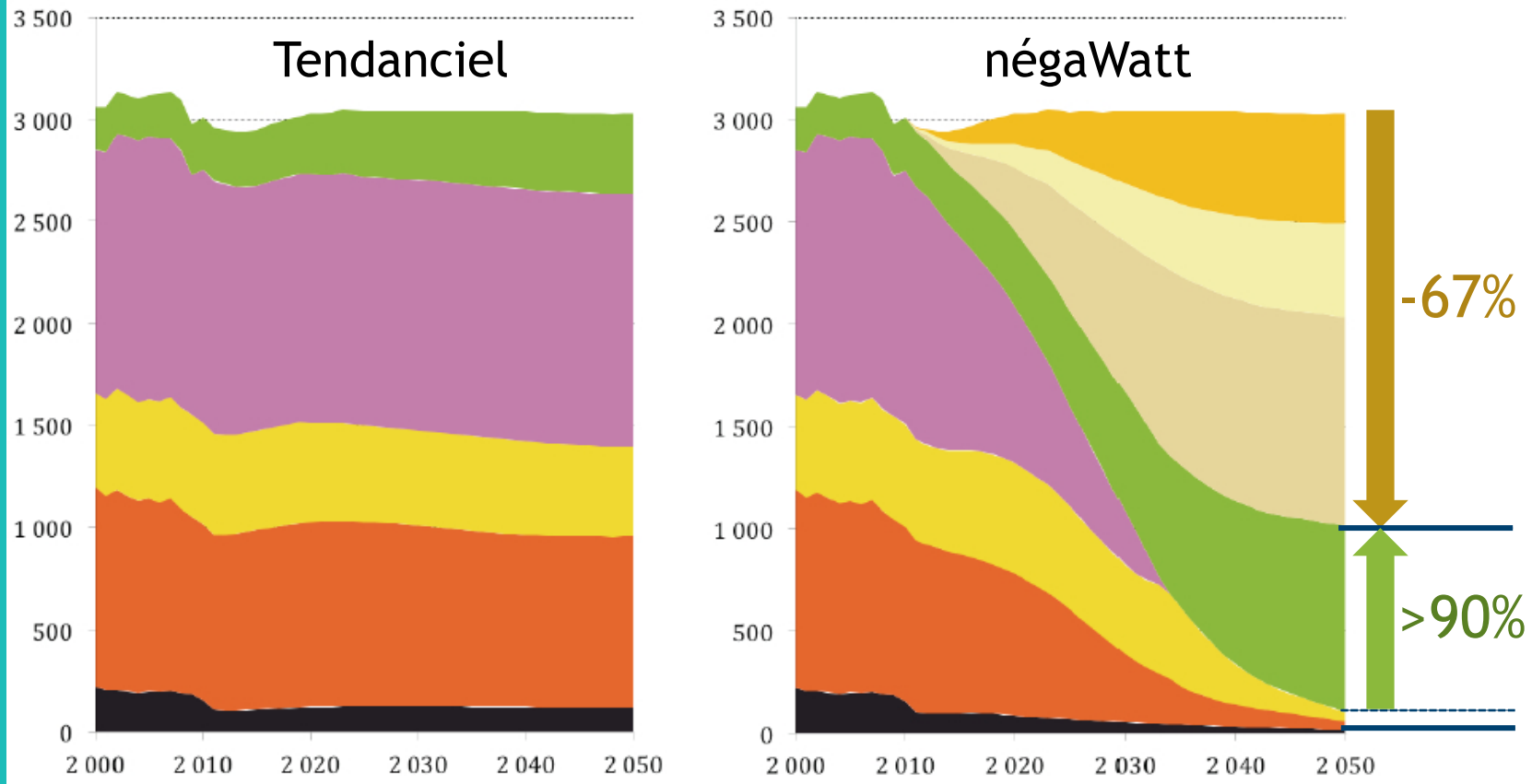
French energy balance - 2010



French energy balance – négaWatt 2050



Primary energy balance 2010-2050



Reduction of demand is key to substitution

Greenhouse gas emissions

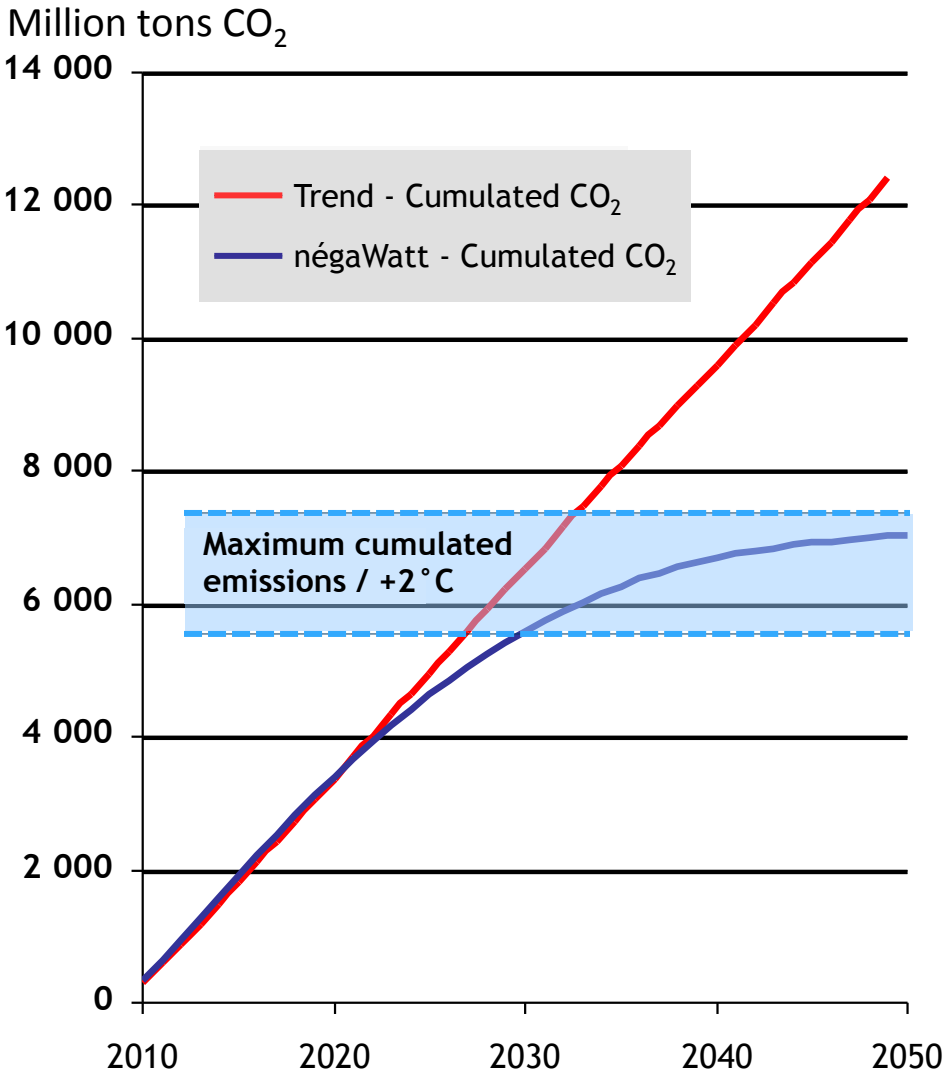
- **Factor 5 on GHG emissions by 2050**

  Compared to 2010, CO_2 emissions divided by 16 by 2050, *estimated* GHG emissions divided by 5

- **Cumulated CO_2 emissions 2011-2050**

  In line with France's fair share in a global mitigation scenario (keeping global warming below 2°C)*

* Based on carbon budgets, cf. study by Postdam Institute



Economic discussion

Savings on national energy bill
(up to 60-70 G€ per year)

Investments with predictable payback
(energy conservation)

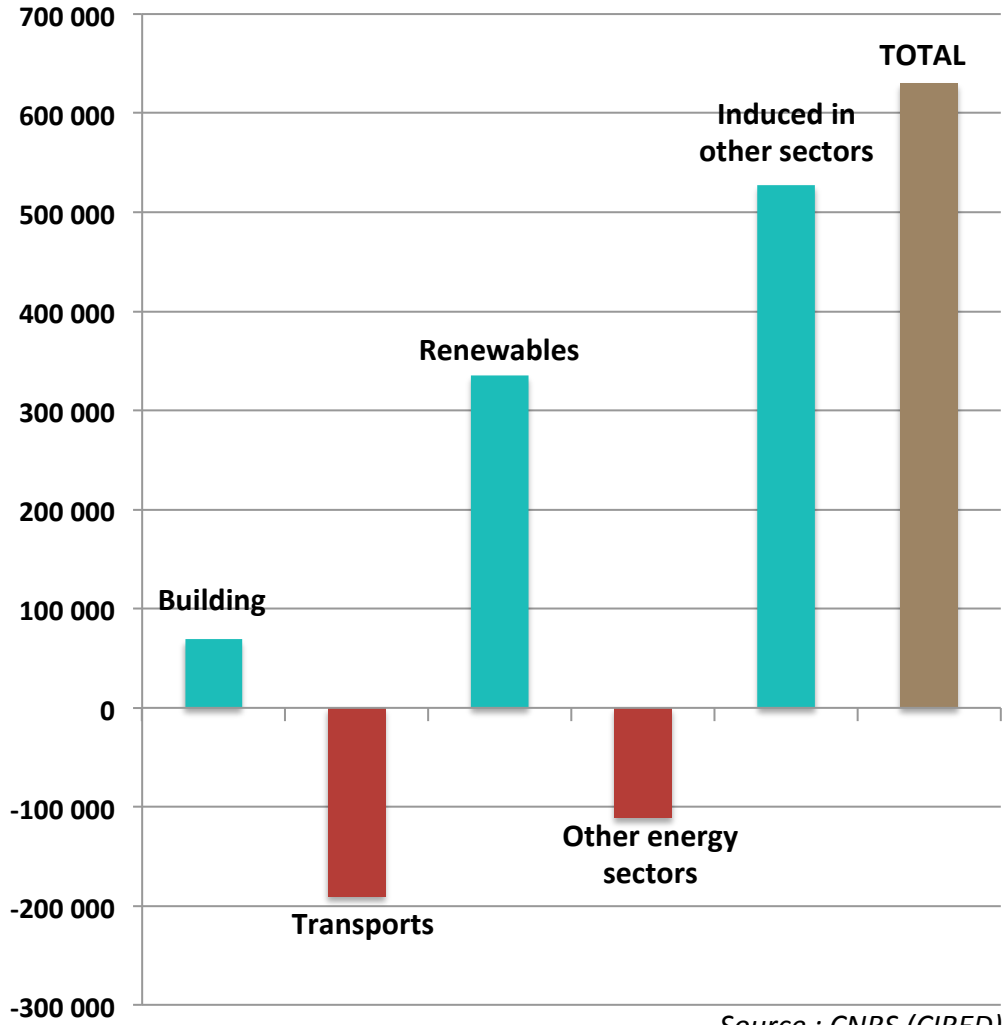
Long term competivity
(decreasing costs of renewables, vs. increasing costs of fossils & nuclear)

Jobs creation
(+ 600.000 net by 2030)

Less economic poverty
(now up to 12 million people)

+ Run with two distinct macroeconomic models with positive results (Three-Me & IMACLIM-Air)

Jobs in the négaWatt scenario compared to trend, by 2030



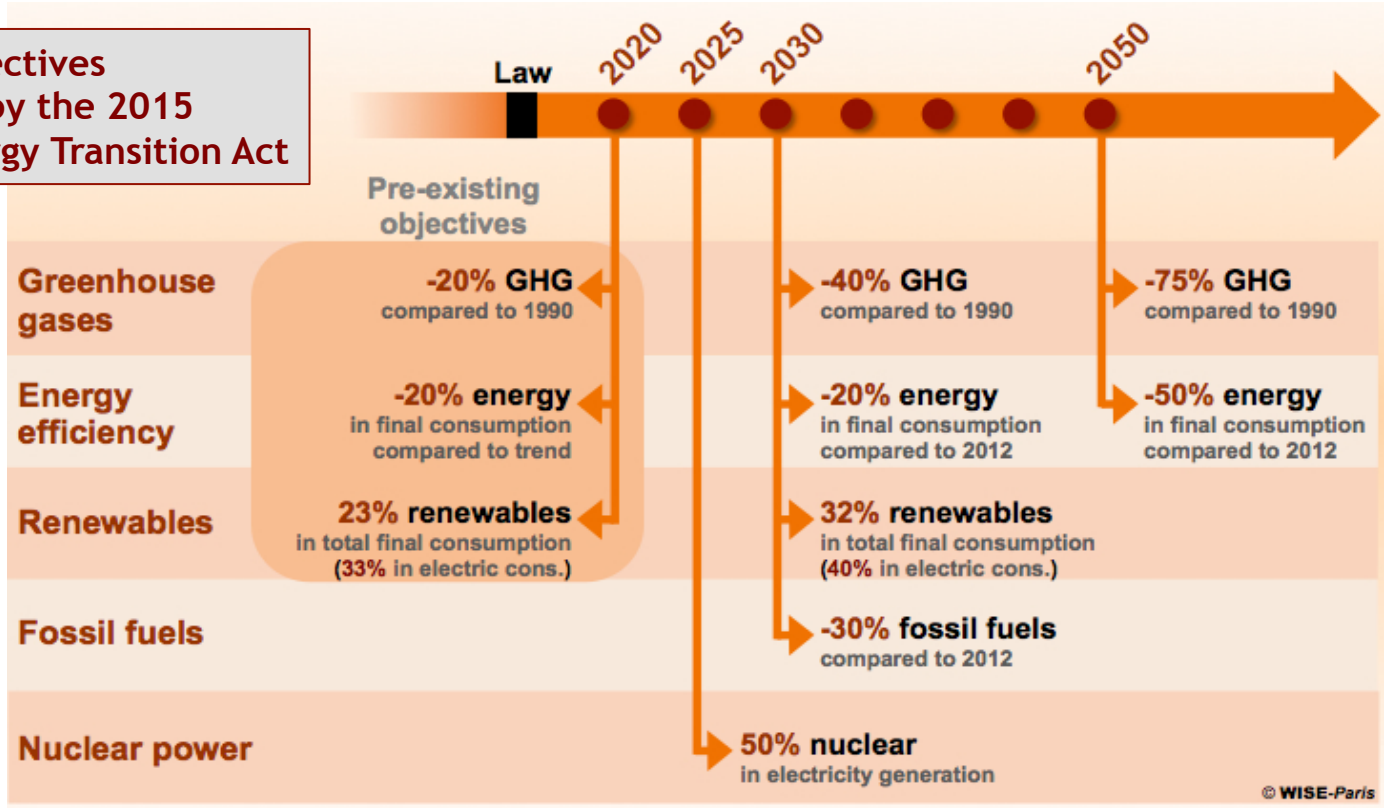
Source : CNRS (CIRED)

Conclusions and recommendations

- Based on existing and emerging solutions, it is possible to implement energy transition of a country like France to **almost 100% renewables by 2050**
- A strategy based on **intelligent energy uses, technical solutions and choice of resources** is needed to meet required ambitious climate objectives
- In particular, energy related CO_2 emissions must be strongly reduced, which requires 50% reduction in final energy consumption by 2050 (to allow for substitution, and not partial addition by renewables)
- Such a level of reduction in energy consumption needs to mobilise both **sufficiency and efficiency solutions** in a comprehensive way
- The **négaWatt approach is based on strong values** of fairness, equity, minimum risks, and 'no-regret' path
- The recommended solutions and policies have **social and economic benefits**

Political outcome

- The négaWatt scenario has played its role in framing the French energy debate since its publication in 2011
- It was one of the 4 scenarios used as reference in the National energy transition debate in 2012-2013, and **one of the 2 scenarios meeting GHG objectives**
- The strategy of sufficiency / efficiency / renewables for energy transition and **most objectives set by the 2015 Act are in line with the négaWatt scenario**



Next step

A scénario 2017 on the way:

- **Need to update** (5 years…)
- **Try to stay at the forefront in the French energy debate**
- **Connect with ongoing work on NDCs at European and international level**
- **Improve our prospective analysis on key issues:**
  - further intergrated vision of urban planning / buildings / mobility evolutions
  - robustness of the energy transition trajectory to climate conditions and disruptive events
  - reinforcement needs to reach a trajectory compatible with a 1.5°C target (sufficiency?)
  - broader range of environmental externalities (carbon footprint, air pollution, raw materials)
  - develop a regional approach consistent with the national trajectory

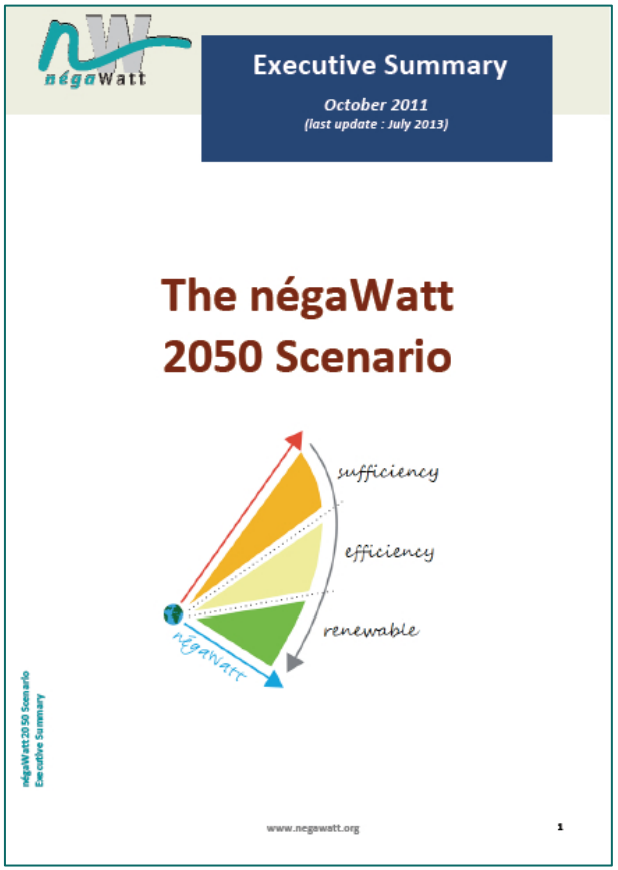


Public presentation of the scenario négaWatt 2017-2050:

National launch by négaWatt / ***Paris - 25 January 2016***
Assises européennes de l'énergie / ***Bordeaux - 26 January 2016***

Thank you for your attention!

To learn more:





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