THERMAL RENOVATION OF BUILDINGS

Large scale insulation of residential and non-residential buildings to reduce air conditioning and heating demand

POTENTIAL

Energy	Emissions
mix energy	GHG
-10% -150 Mtoe	-10% -450 $MtCO_2e$

FOSSIL ENERGY TRADE BALANCE

-€60 bn/yr

TOTAL INVESTMENT

Cumulative until 2050

Timeline

€5,000-20,000 bn

ACCEPTANCE

companies | consumers | citizens

FINANCING, REGULATIONS AND INCENTIVES

- Property owners must make high initial investments to renovate buildings, which will be compensated **by savings on their energy bill in the long run.**
- How efficient are existing incentives to renovate? What type of new financing mechanisms could be designed?

SYSTEMIC IMPLICATIONS AND OPEN QUESTIONS

- **Change management:** it is necessary to educate owners about the advantages of thermal renovation.
- Depending on the context, should the priority be placed on the installation of "passive" and/or "active" devices, and in which order?

THERMAL RENOVATION OF BUILDINGS

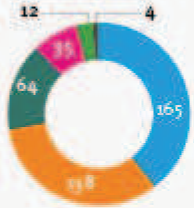
Large scale insulation of residential and non-residential buildings to reduce air conditioning and heating demand

BACKGROUND DATA

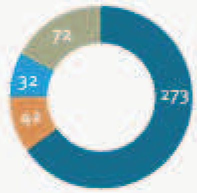
European Building floor space estimate

- Residential: 40 m²/cap → 20,000 million m² (France 2,400 million m²).
- Commercial and public services: 20 m²/cap → 10,000 million m².

Final energy types European buildings (Mtoe)



Final energy usages European buildings (Mtoe)



METHOLOGICAL CONSIDERATIONS

Assumptions for investment estimate

Building type	Energy intensity estimate (kWhp/m²) Today	Energy intensity estimate (kWhp/m²) 2050	Renovation Cost (€/m²)
Residential	220	80	200 - 500
Non-residential	280	140	100 - 1000

Energy savings and emissions reduction resulting from thermal renovation: Total Savings: 150 Mtoe

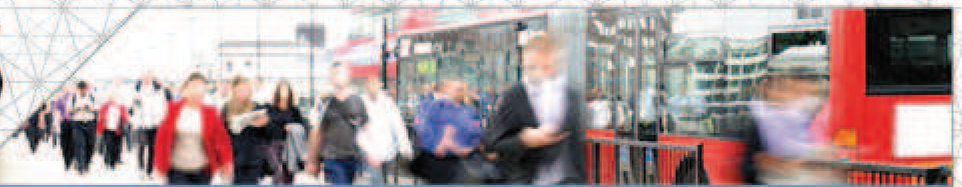
	Final energy savings (Mtoe)	Corresponding emissions ($MtCO_2$)
Coal	10	40
Oil	50	150
Gas	80	210
Electricity	10	50
Total savings	150 Mtoe	450 Mt CO_2

TOTAL INVESTMENT*

Type of expenditure	€ bn
Raw material	2,000 - 3,000
Labour force	1,000 - 2,000
Expertise	500 - 1,000
TOTAL	5,000

*for the lower end of the bracket.

ACTION CARD 5



MASSIVE RISE OF PUBLIC TRANSPORTATION USE

80% of automobile commuting flows are transferred over to express coaches

POTENTIAL

Energy

Oil only

-3%
-70 Mtoe

Emissions

GHG

-4%
-200 $MtCO_2e$

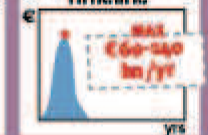
FOSSIL ENERGY TRADE BALANCE

-€40 bn/yr

TOTAL INVESTMENT

Cumulative until 2050

Timeline



€300-700 bn

ACCEPTANCE

companies

consumers

citizens

FINANCING, REGULATIONS AND INCENTIVES

- How will the investments be split between governments and companies? Public support is likely to be a key success factor at a local scale.
- Possible incentives for consumers: time saved, cheaper commuting, improved comfort.

SYSTEMIC IMPLICATIONS AND OPEN QUESTIONS

- Will commuting be faster overall? How will people use the time they have saved?
- Will commuters spend less on their transport budget? How will that impact their saving and spending patterns?
- **Car usage:** will consumers keep their cars? If not, what kind of indirect impact would it have on the transportation sector and overall mobility?

MASSIVE RISE OF PUBLIC TRANSPORTATION USE

80% of automobile commuting flows are transferred over to express coaches

5

ACTION CARD

BACKGROUND DATA

Some successful examples of implementation of express coaches (Bus Rapid Transit, BRT): VAO Madrid, A14 express (France), LISE (Grenoble, France) Transmilenio (Bogota, Colombia).

France data: 18 million people commute daily to go to work. The average distance travelled is 26 km. 75% of commuters use their cars to go to the office (Insee, 2004).

© Scott Dalton, NY Times

METHOLOGICAL CONSIDERATIONS

Assumptions

2012 commuting levels are assumed to remain constant (1,500 Gpkm)

- Deployment of fast 30km-long lanes in major cities.
- 1 coach every minute on work days, 60 coaches per lane, 80 passengers per coach.
- 140 million workers shift from car-commuting to coach-commuting at a European scale, one lane for 15,000 workers.

Investment

- 8,000 new coach terminals x €3-30 million each = €30-300 bn.
- 8,000 dedicated traffic lanes (30km) x 0.5 to €1 million per km each, = €100-300 bn.
- Initial purchase of coaches would be less then 10% of the total investment (480,000 coaches x €100,000 each = €100 bn).

Greenhouse gas emissions

Unitary emissions pkm (passenger.km)

- Cars: 160 gCO_2e/ pkm
- Coaches: 20 gCO_2e/ pkm

Energy savings

Fuel consumption

- Cars: 8L/100 km
- Coaches: 50L/100 km

TOTAL INVESTMENT

Type of expenditure	€ bn
Coach terminals	30 - 300
Dedicated traffic lanes	100 - 300
Purchase of coaches	100
TOTAL	200 - 700

ACTION CARD **11**

MASSIVE INCREASE OF WIND AND PV ELECTRICITY

Wind and PV represent 2/3 of Europe's electricity demand
Reinforcement of Hydro-storage and power grid capacity

POTENTIAL

Energy

Electricity only

2,000 TWh
2/3 of 2010 electricity demand

Emissions

CO_2

GHG

-20%
-850 $MtCO_{2e}$

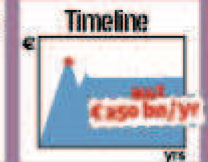
FOSSIL ENERGY TRADE BALANCE

+/- €20 bn/yr neutral

TOTAL INVESTMENT

Cumulative until 2050

Timeline



€8,500 bn

ACCEPTANCE

companies

consumers

citizens

FINANCING, REGULATIONS AND INCENTIVES

- Governments: such a project requires strong European cooperation.
- Consumers: **increased price of electricity**.
- Companies: major infrastructure deployment requiring public support.

SYSTEMIC IMPLICATIONS AND OPEN QUESTIONS

- **Impact for European power system design: how should the massive development of connections across borders be spread among countries?**
- **Adequacy issues:** will day/night and seasonal variations of load fit with demand?
- **Security of supply:** which are the appropriate mechanisms to hedge black out risks? Is the deployment of hydro storage infrastructure close to sea shore acceptable?

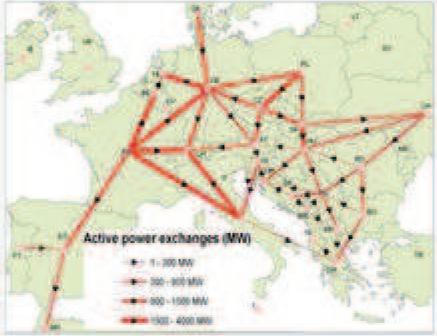
MASSIVE INCREASE OF WIND AND PV ELECTRICITY

Wind and PV represent 2/3 of Europe's electricity demand
Reinforcement of Hydro-storage and power grid capacity

11 ACTION CARD

BACKGROUND DATA

Hydroelectric pumped storage capacity in 2010
EU 27 = 40 GW
(Norway = 25 GW)
Technical potential for Europe hydroelectricity: 2,700 TWh/yr



Current interconnection capacity in Europe (max 4 GW across a border).

METHOLOGICAL CONSIDERATIONS

Assumptions

Current consumption of electricity is assumed to remain constant.

Investment is partially renewed (years 2030-2040) to replace production infrastructure **(turbines and PV lifetime 20-30 yr).**

Capital investment for **grid reinforcement** based on an approximate ratio €2bn/1GW transmission added, 500 GW additional capacity, (line length not taken into account).

Deployment of storage capacity: as most of the potential is likely to be saturated, we assume capacity implementation on seashore cliffs.

Remaining 1/3 production: nuclear phase out and flexible production remains.

Hydro (existing 100 GW remains with an average capacity factor of 50% is approx. 400 TWh) Gas fired (200 GW, average 60% load factor is approx. 1,000 TWh) This capacity does not necessarily reflects an unchanged 2010 picture, any investment resulting from this difference is not taken into account.

Investment assumptions

Tech	Cost (€/kW)	Installed (GW)	Capacity factor	Annual production (TWh)
PV	4,000	300	20%	500
Wind	2,000	600	30%	1,500
Storage	4,000	600	(50%)	2,000 (flow)

Greenhouse gas emissions

Compared to 2010 +30% CO_2 from gas fired electricity (100 $MtCO_2$); -950 $MtCO_2$ (coal-fueled and oil-fueled power plants phase out).

Fossil fuels bill

-200Mtoe Coal ; -20 Mtoe Oil; +50Mtoe Gas, **net impact is rather neutral (from -20 to +20 bn/yr).**

TOTAL INVESTMENT

Type of expenditure		€ bn
Wind & PV capacity	2 x	2,500
Hydro pumped storage		2,500
Grid reinforcement		1,000
TOTAL		8,500