



ETSAP semi-annual Workshop, Oxford, UK

Models and Studies

The TIMES Energy System Model for the Piemonte Region (TIMES-*Piemonte*)

Rocco De Miglio, Maurizio Gargiulo, Evasio Lavagno
Laboratorio di Analisi e Modelli Energetici - Dipartimento di Energetica - Politecnico di Torino

Objectives of the work

The Piemonte Regional Administration decided in 2002 the development of a modelling tool for the Regional Energy System in order to evaluate

- sustainable energy strategies,
- options for the regional contribution to the fulfilment of Kyoto targets and
- local energy programs (biomass, district heating networks, cogeneration plants).

A particular feature of TIMES-*Piemonte*, related to the objectives of the work required by the Regional Administration, is the very detailed level of description of the energy system,

- in the supply and transport/distribution side, where all large and medium size plants are identified and characterised and four electrical energy grids are taken into consideration,
- in the demand side, where an high number of technologies and energy services (mainly in the residential sector) are included.

Moreover, the particular geographic position of Piemonte requires to take into account **electricity import** and **trade exchanges** with neighbouring regions.

In the RES, the electricity sector (generation and transport/distribution) is described with:

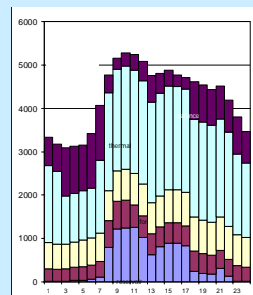
- four commodities representing different voltage levels: **very high** (380-220 kV), **high** (132 kV), **medium** (132 -10 kV) and **low** (10 kV-380 V)
- three grids (considered as technologies, including transport and transformation)

Power Plants are supplying electricity to the three first voltage levels.

The import and the interregional electricity exchange are connected to the **very high** level.

In the RES, the electricity sector (generation and transport/distribution) is described through 35 production units, spatially identified.

Preliminary work has been devoted to the characterisation of the electrical demand through the analysis of the (regional) load curve



The competition among **end use devices** for the fulfilment of each energy service involve, in general, three kind of technologies:

- **existing**, characterised by relatively low efficiency
- **new1**, with improved efficiency,
- **new2**, with higher efficiency.

The last two technologies are, in general, also more expensive (invcost) with a defined payback time.

The competition for space heating starts, for both SF and MF buildings, from the composition of the building stock and evolves with it.

At the beginning the time horizon, two kinds of buildings are present:

- buildings built before 1980 (**old**), with relatively higher energy demand for space heating
- buildings built after 1980 (**new**), with relatively lower energy demand for space heating

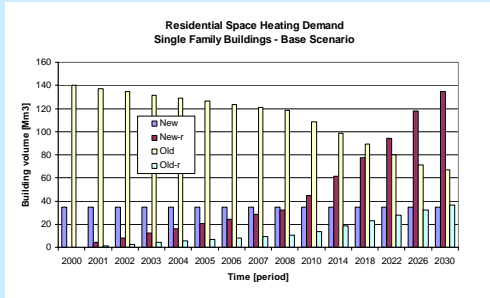
In subsequent periods, the stock may also include, with some constraints in order to assure a realistic evolution:

- old buildings that have been retrofitted to a certain degree (**old-r**),
- old buildings that have been completely retrofitted and new buildings (**new-r**)

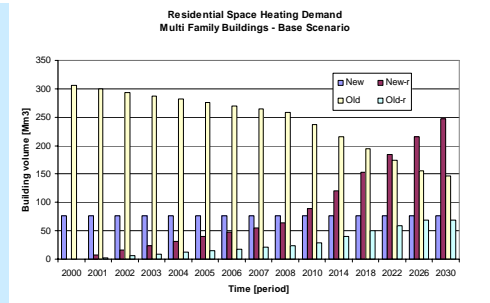
with suitable figures for the space heating demands and the extra costs for the higher performances.

Contemporarily, a certain amount of old buildings disappear.

demand - residential space heating



The two figures show the evolution of the building stock composition for SF (above) and MF (below) typologies.



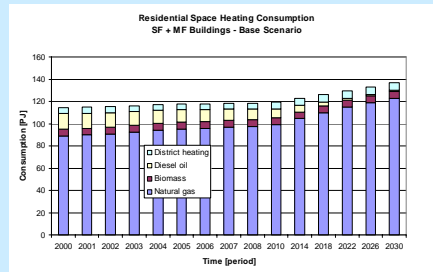
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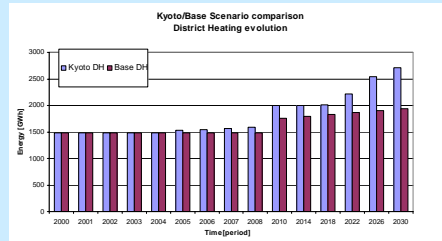
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space heating

The first figure shows the evolution of the **space heating consumption** in the Residential sector.



The second figure shows the growth of **district heating** (characterized by a relevant role of cogeneration plants) in the Piemonte Residential sector, subject to Base Scenario and Kyoto Scenario constraints.

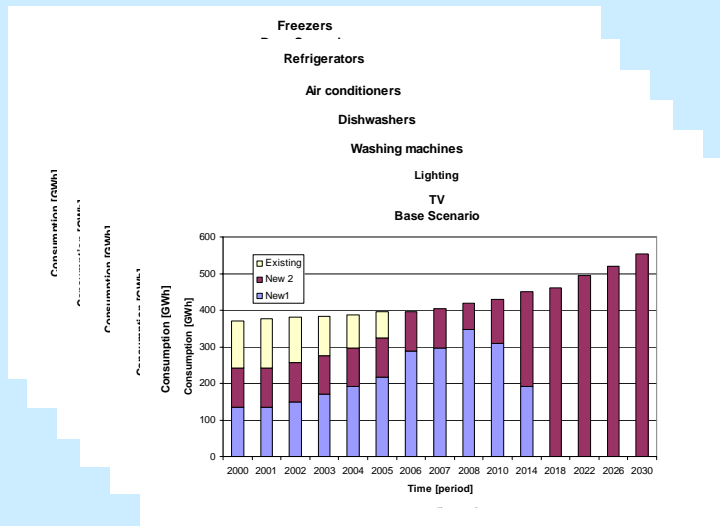
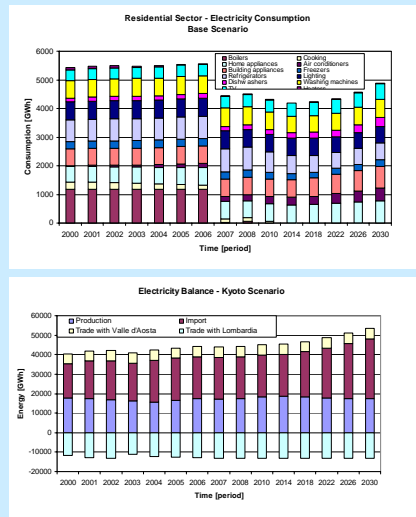


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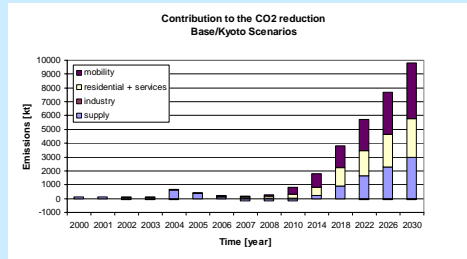
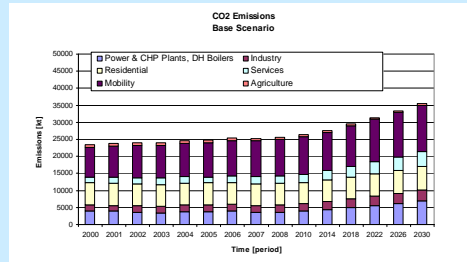
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The figure shows the **electricity consumption** in the same sector. The energy trajectories show the combined effect of the increase in energy efficiency of appliances as well as in the demand of energy services.



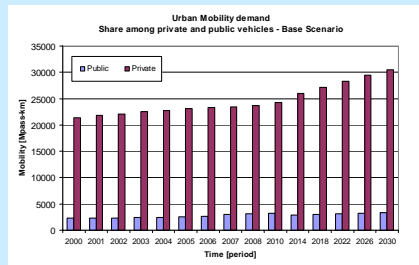
CO2 contribution of the sectors

The contribution of the various sectors to CO2 emissions and CO2 reduction along the whole time horizon.

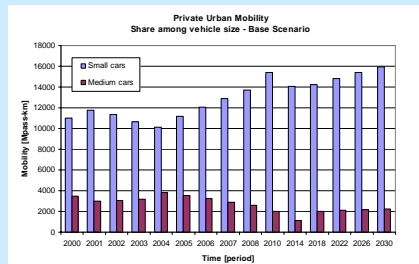


energy consumption - mobility

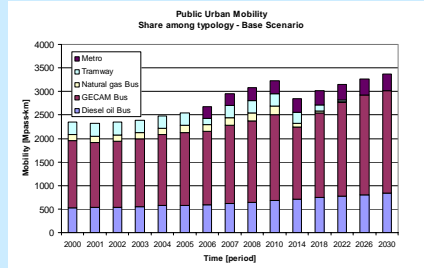
Urban mobility demand
Share: private - public



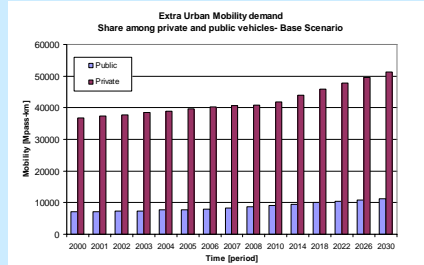
Private urban mobility
Share: small - medium cars



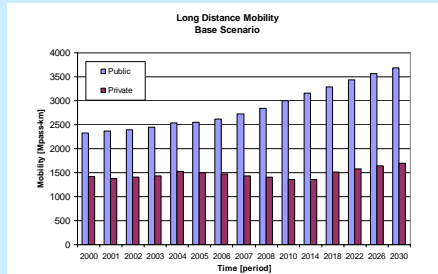
Passenger mobility consumption of fuels



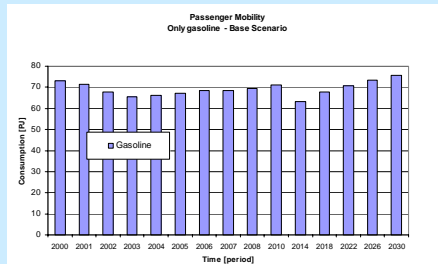
Passenger mobility CO2 emissions



Long distance passenger mobility Share: private - public

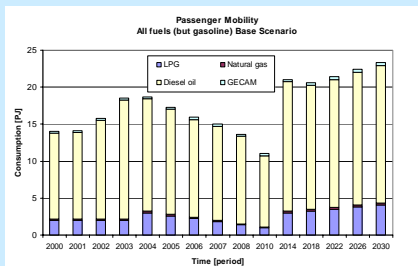


Passenger mobility Gasoline consumption

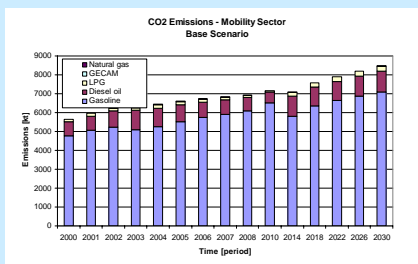


energy consumption - mobility

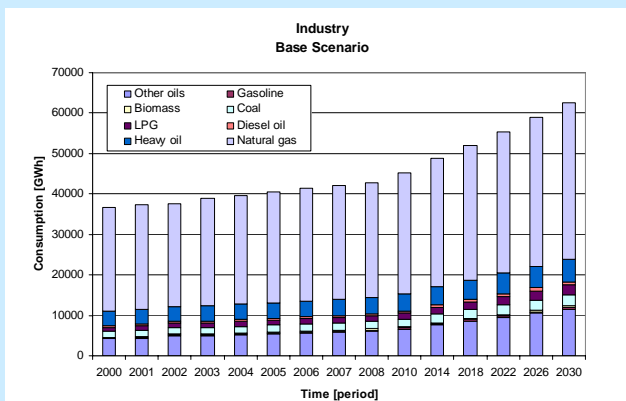
Passenger mobility:
fuels consumption
(all but gasoline)



Passenger mobility:
CO2 emissions

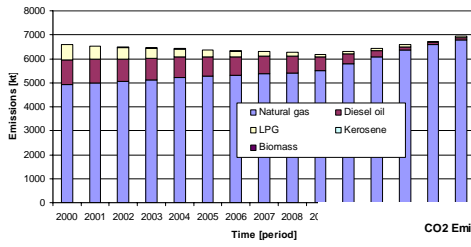


industry fuels consumption

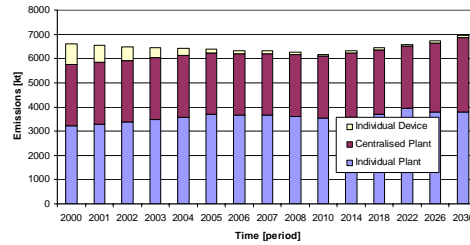


The figure shows the consumption of fuels in the industry sector

CO2 Emissions - Residential and Services Space Heating
Decentralised Devices - Base Scenario



CO2 Emissions - Residential and Services Space Heating
Building Devices - Base Scenario

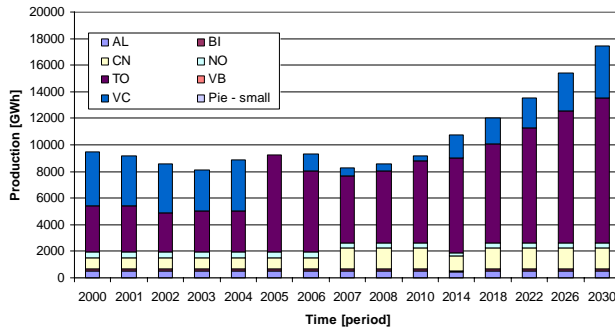


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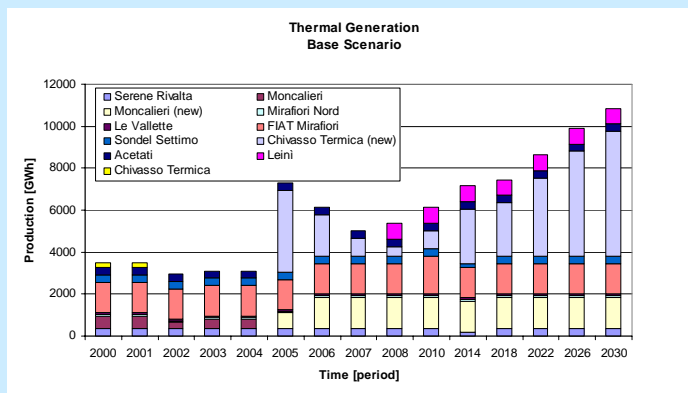
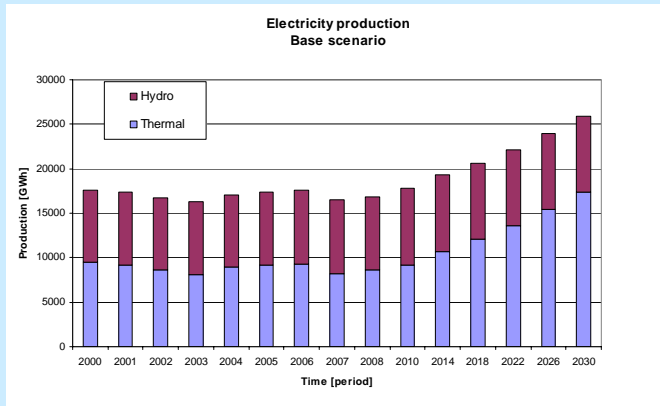
Thermal-Electricity Production - Share among Provinces
Base Scenario

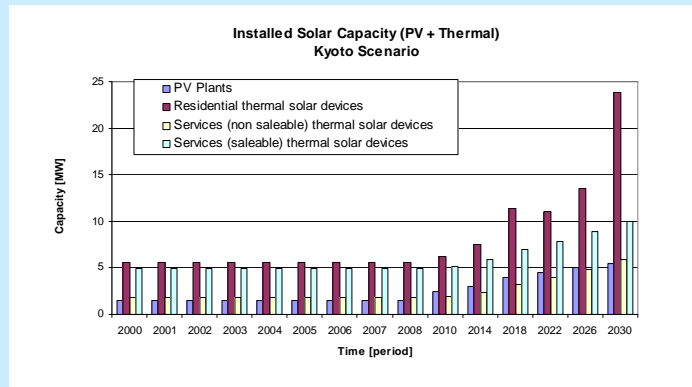


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The next Phases of the Project are presently involving:

- the discussion of the results with the Regional Reference Team (First Report)
- runs with alternative scenarios (White Certificates, Emission Permits Trade).
- Development of proposal and solutions for a disaggregation of the demand at province level and generation of new provincial Reference Energy Systems.

Thank you

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