



# Modelling and scenario work on energy efficiency: results from recent Italian experiences.

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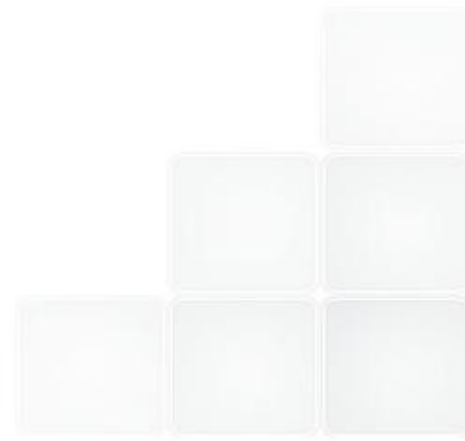
CA-EED Workshop  
Munich, March 8, 2017



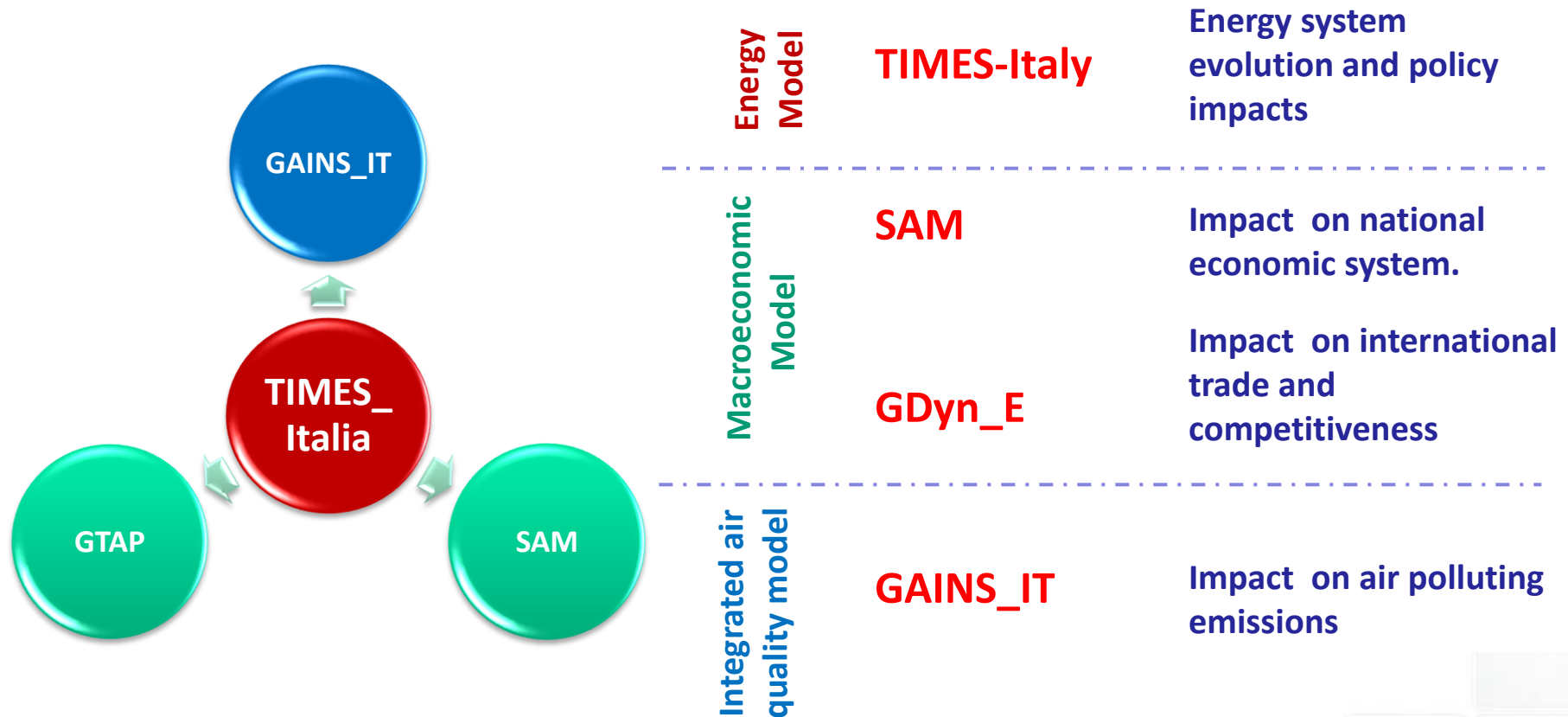
# Overview



- Modeling tools used at ENEA
- Applications on energy efficiency: a few examples
  - The Reference and Policy scenarios for 2030
  - Some efficiency scenarios



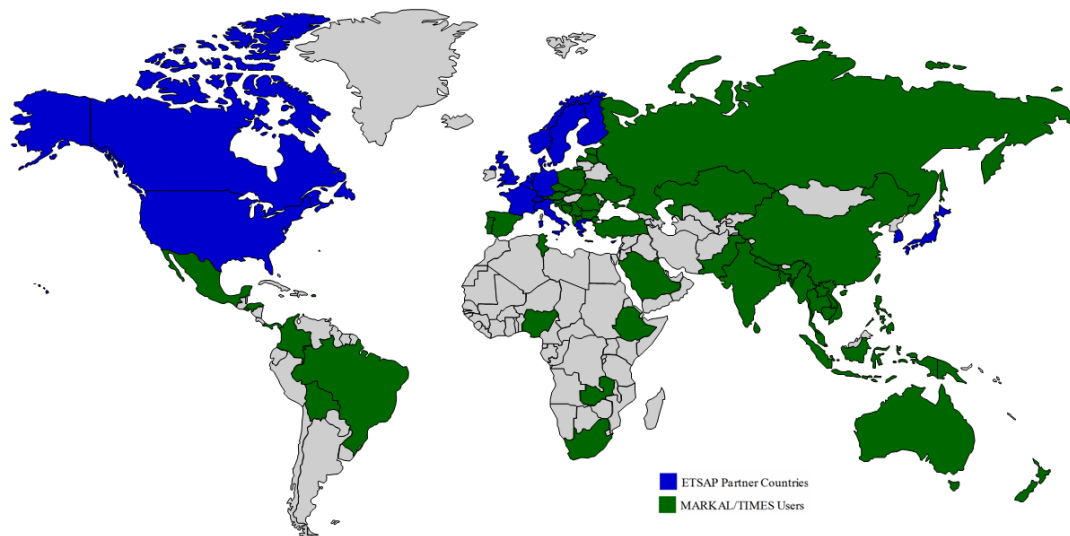
# Modeling suite used at ENEA



*The TIMES-Italy model has been soft linked to the other models in order to allow assessment of economic and environmental impacts of energy scenarios, thus capturing different dimensions of the policy questions*

# The TIMES-Italy model

**TIMES-Italy** is a bottom-up, technology rich, linear optimization model of the MARKAL-TIMES family, developed within the Energy Technology Systems Analysis Program (ETSAP) of IEA . It was developed by ENEA from a TIAM structure.



*Countries where a model of the “MARKAL-TIMES family” is implemented*

TIMES-Italy provides a mathematical representation of the Italian energy system as a set of energy resource flows (commodities), technologies and of the physical connections among them. ***It minimizes total energy system cost*** subject to **environmental, energy and technology constraints**.

# Main analyses carried out with these models at ENEA

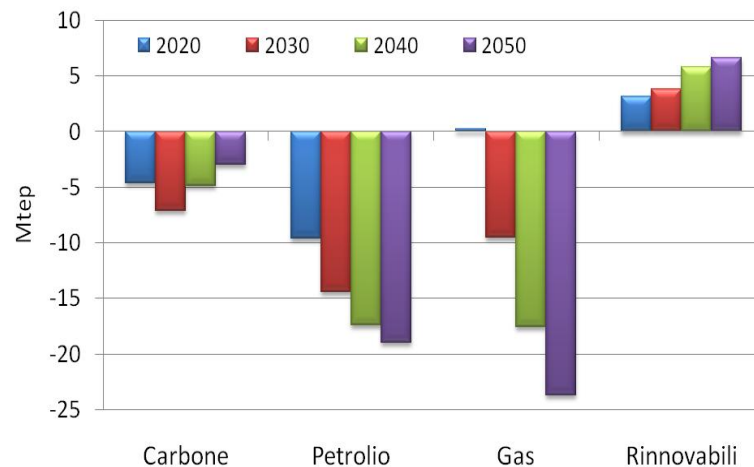


- **NES Energy scenario 2013** → Assessment for MiSE of the National Energy Strategy (with **TIMES\_Italy**).
- Support to preparation of 2011 **PAEE (National Energy Efficiency Plan)** → impact on the energy system of specific energy efficiency measures (with **TIMES\_Italy**).
- **Impact assessment of energy and climate objectives to 2030** for MiSE (2014) →
  - A Reference scenario (**TIMES\_Italy**) comparable with the PRIMES 2013 scenario
  - Two decarbonization scenarios (**-36% e -40% CO<sub>2</sub> vs 2005**) with **TIMES\_Italy**.
  - Economic impact assessment with a **SAM** and of trade impacts with **GDyn\_E**.
- **Scenarios for Assogasliquidi/Federchimica (2015)** → energy impact analysis of different fuels use for buildings heating use to 2030 (**TIMES\_Italy**). Air pollutants emissions scenario and related concentration maps at a resolution of 20x20km realized with **GAINS\_IT Model**.
- **Deep Decarbonization Pathways Project (2015)** → three deep decarbonization scenarios to 2050 (**TIMES\_Italy**). Macroeconomic assessment of the same scenarios with the model **GDyn\_E** in collaboration with **FEEM**.
- **Energy Efficiency scenarios (2016)** (**TIMES\_Italy** and **Gdyn-E**)
- **Climate and Energy Scenarios to 2030 (2016-2017)** (**TIMES\_Italy**).

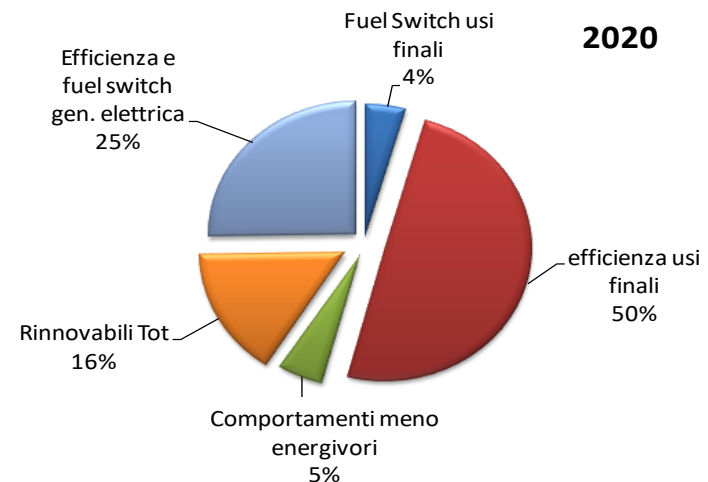
# 2011 National Energy Efficiency Plan

Estimate the impacts of different policies in terms of:

- *Primary energy consumption reduction*
- *Variation of the energy mix and energy dependence*
- *GHG emissions reduction*
- *Reduction of final energy consumption*



Change in the fuel mix

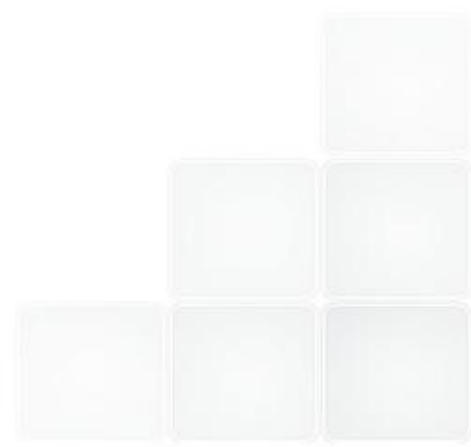


Contribution to emission abatement

# Reference and Policy scenario for 2030



Some preliminary results



# The Reference or BASE Scenario: characterization



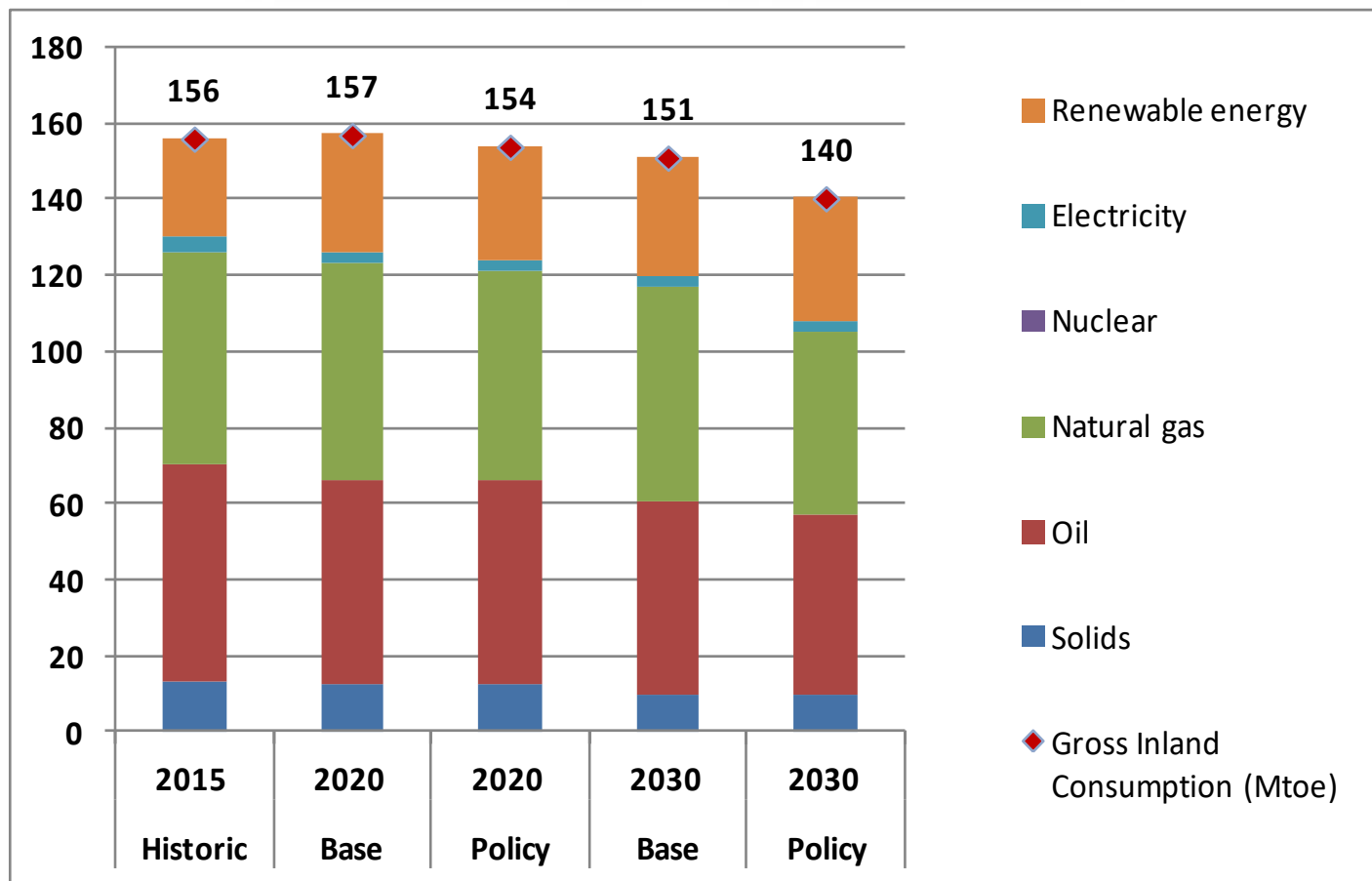
- Reference scenario to 2030 «Base»: Describes the evolution of the energy system based on policies enacted by **31 December 2014 (including a 1.74% a.a. reduction of ETS allowances to 2030)**
- Is fully comparable with the **PRIMES Reference 2016** scenario, of the EC (based on the same macroeconomic drivers: GDP, VA, POP, int.l fuel prices, CO<sub>2</sub> price)
- Energy service demand, or physical output projections: exogenous but based on PRIMES
- Technology inputs for the power sector based on GdL2
- Experiment terminated at the end of 2016, as soon as Base Scenario was completed, but scenario work goes on towards NES and *Integrated energy and climate plan*



The **policy scenario** builds upon the BASE scenario (same exogenous drivers) discussed and is optimized subject to two constraints:

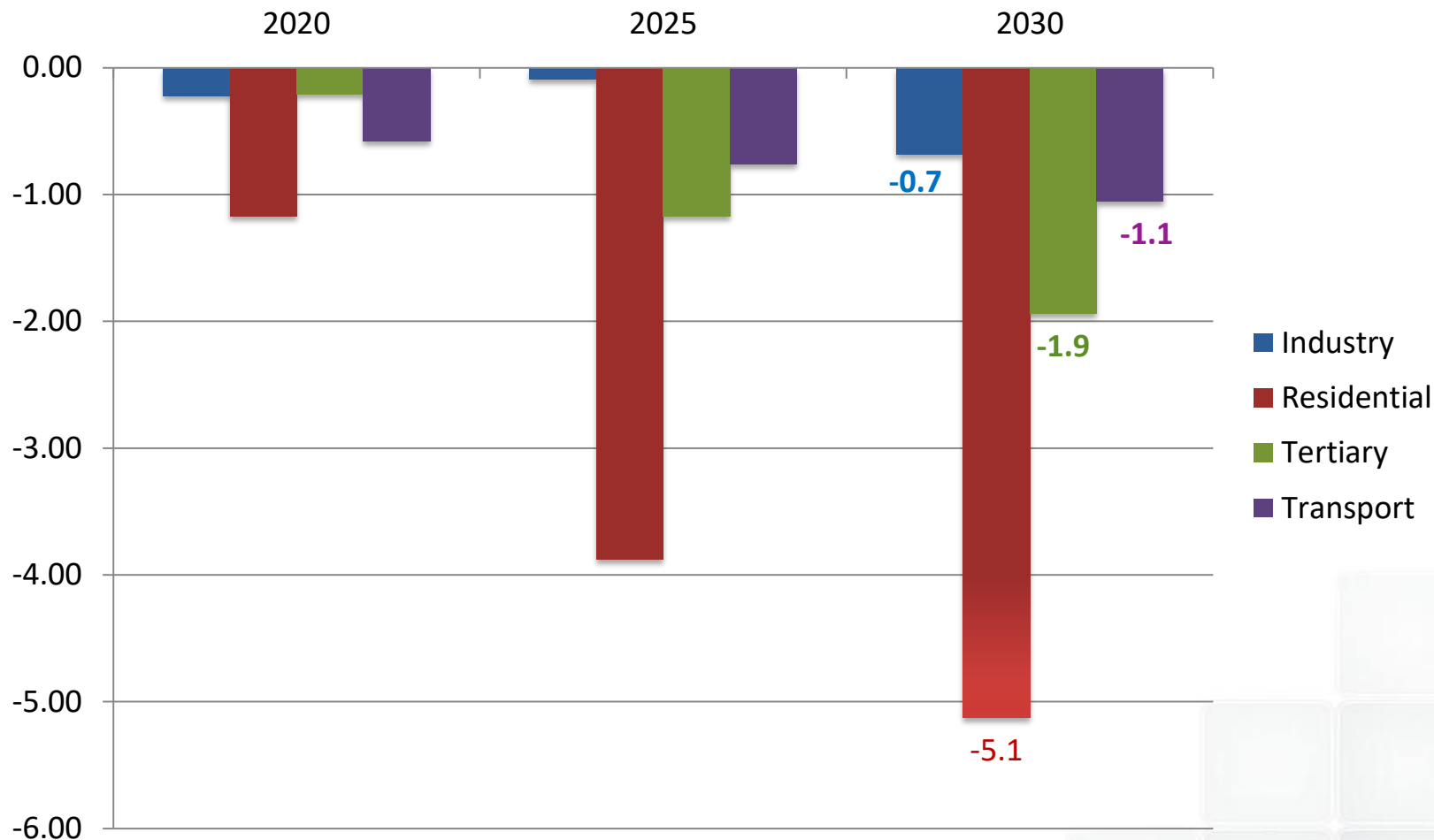
- 1) GHG Emission reduction in the non-ETS sectors (-32% w.r. to 2005 ) as in the EUCO30 scenario.
  - An overall CO<sub>2</sub> cap imposed for residential, services, industry and transport
  - Non-energy GHG emissions equal those of the EUCO30 scenario for Italy
- 2) 1.5% /yr reduction of final energy use in 2020-30 as in proposed new EED (COM(2016)761 final). Meeting minimum efficiency requirements leads to a final energy consumption of **109.9 Mtoe**
  - In the Base case the ETS sector meets the 2030 target vs 2005), so no further constraint imposed and CO<sub>2</sub> price assumed same.
  - Removed constraints on capacity potential for onshore wind and PV that increase to **16 GW (+0.5 GW off-shore)** **40 GW** respectively.
  - Contrary to the EUCO30 scenario, no renewables target on gross final energy consumption or emission targets to 2050 is assumed.

# Results: Gross Inland Consumption, Mtoe

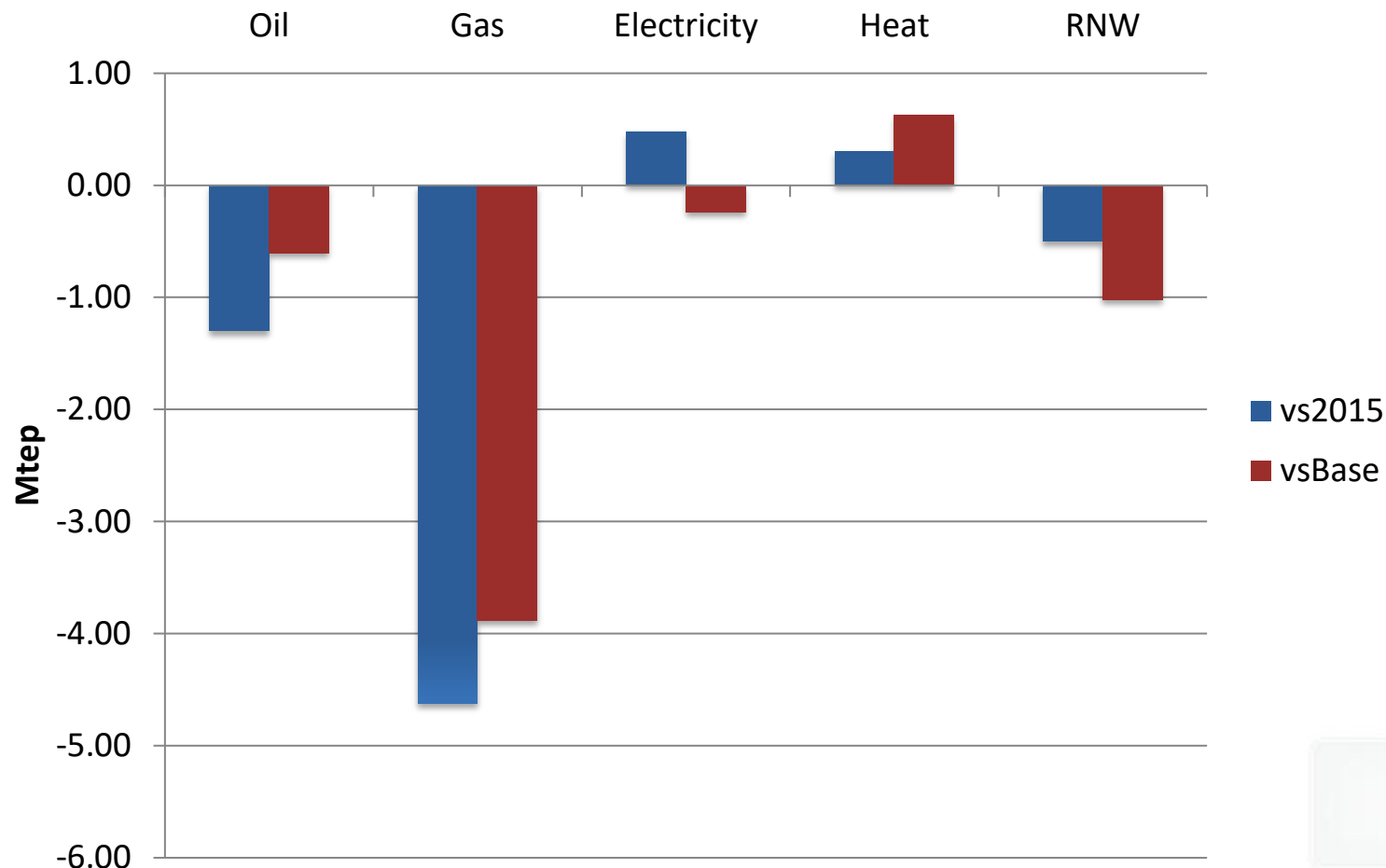


**Base scenario reproduces rather closely the EU Ref2016 scenario for Italy: some differences for industry, residential, transport**

# Results: Final energy consumption by sector, change Policy vs Base. Mtoe

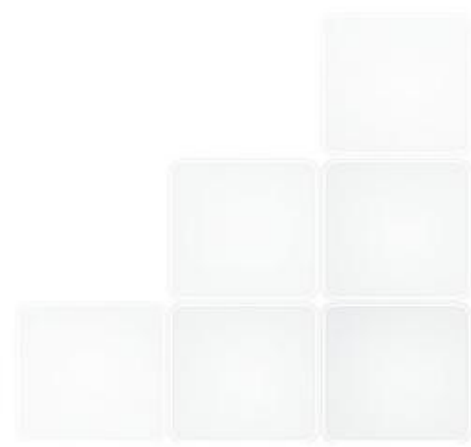


## Energy consumption reduction by source in 2030 vs 2030 Base e vs 2015



\* RNW= Renewables

# Efficiency scenarios

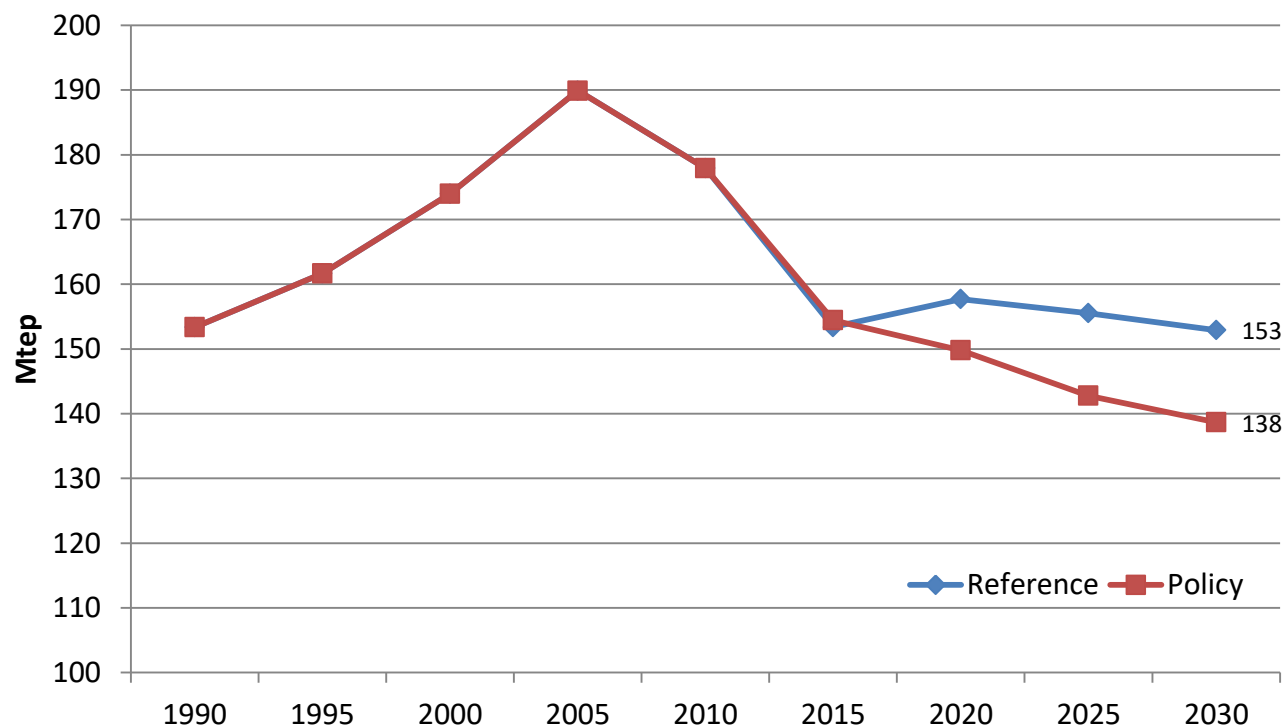


## Assumptions

- 1) Differentiated emission constraint according to European objectives for the Energy and climate plans to 2030:
  - -43% CO<sub>2</sub> emissions for ETS sectors
  - -33% CO<sub>2</sub> emissions for non-ETS sectors
- 2) The TIMES-Italy model does not compute GHG emissions but only CO<sub>2</sub>.
- 3) Same macroeconomic drivers and demand projections as in the EU Reference scenario 2016.

# Efficiency scenarios

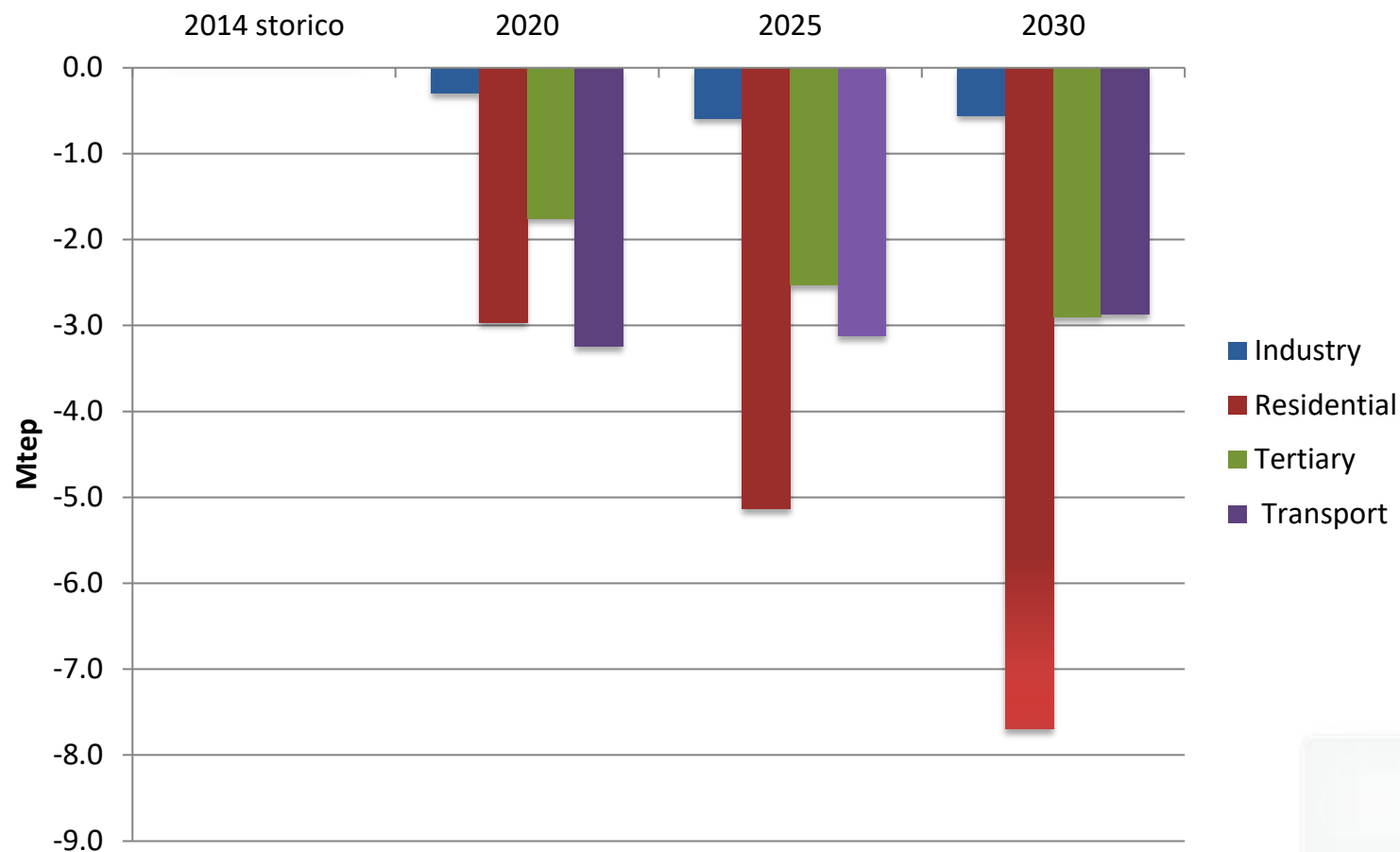
## Primary energy consumption



Fonte: Elaborazioni ENEA

# Efficiency scenarios

## Final energy consumption: reduction vs Reference, by sector

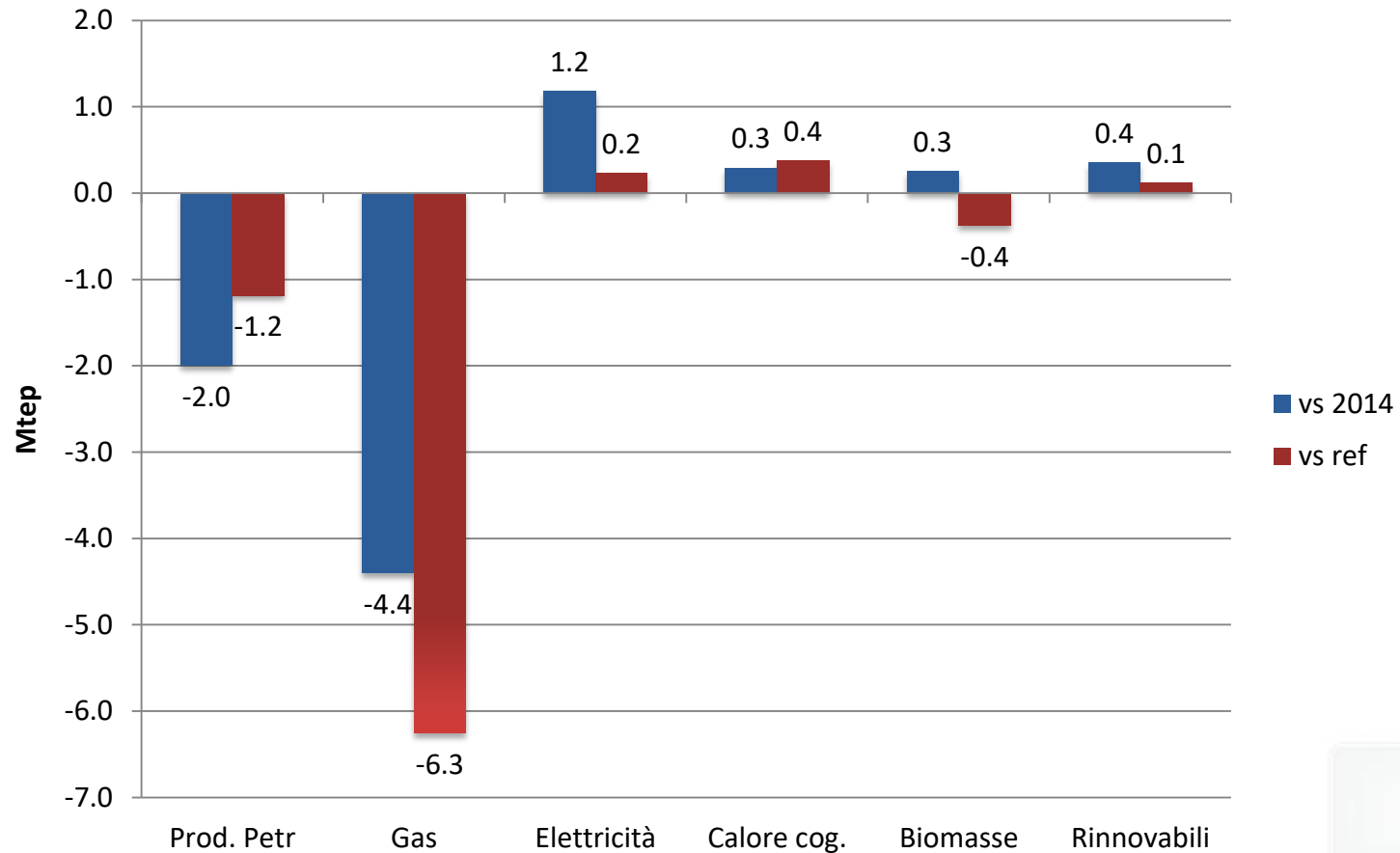


Fonte: Elaborazioni ENEA



# Efficiency scenarios

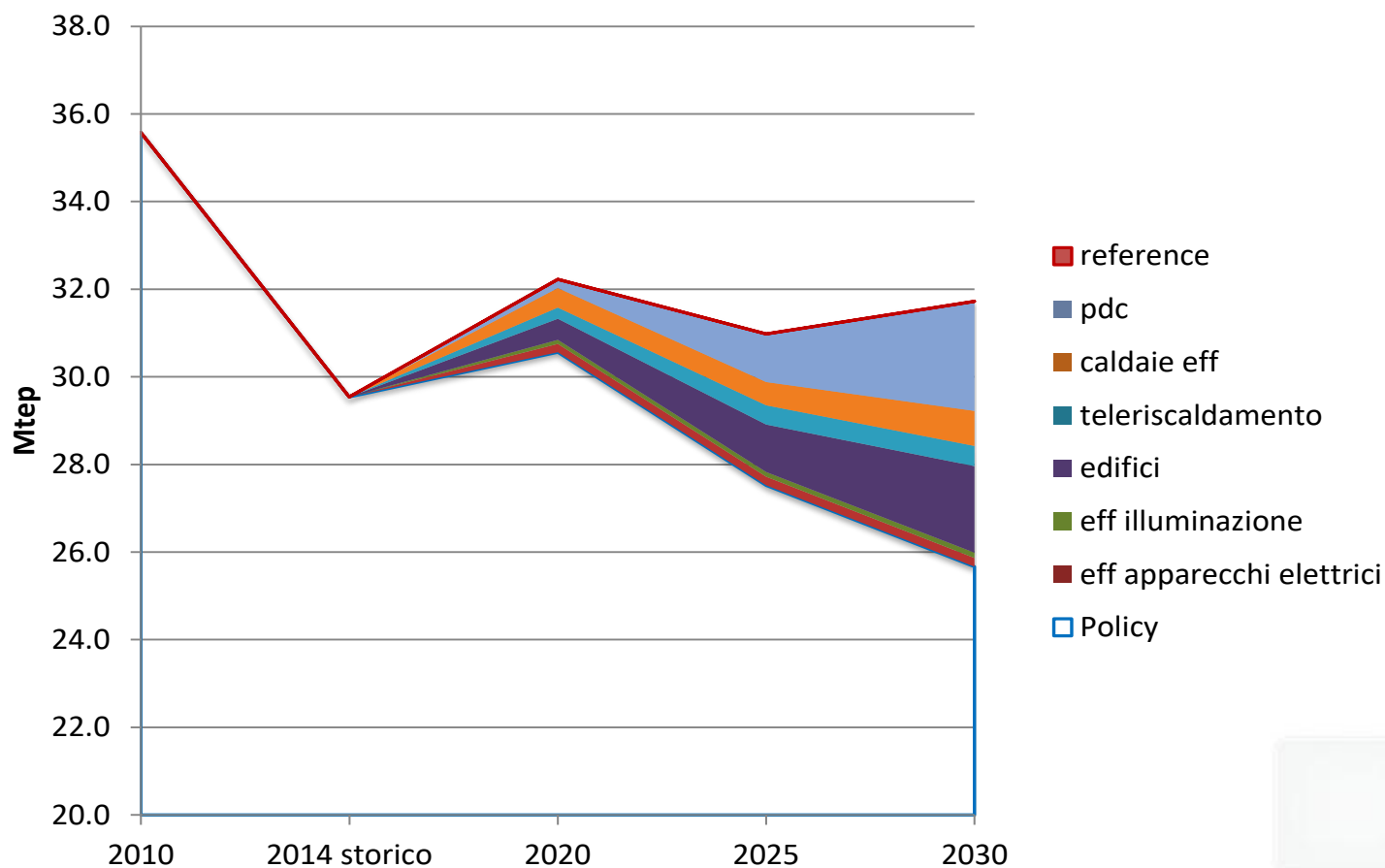
## Residential sector 2030: consumption reduction by source vs reference and vs 2014



Fonte: Elaborazioni ENEA

# Efficiency scenarios

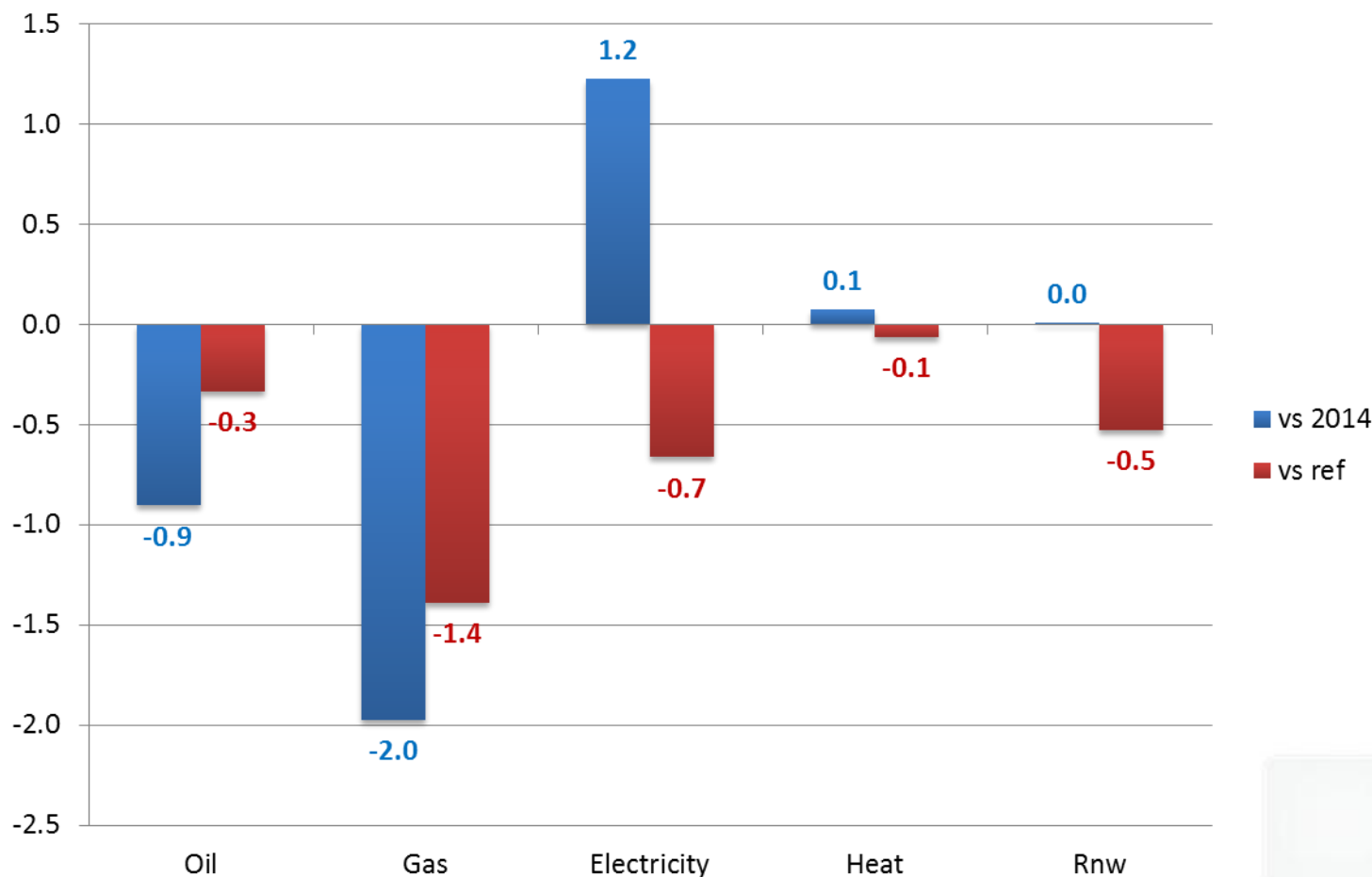
## Residential sector : consumption reduction by type of intervention



Fonte: Elaborazioni ENEA

# Efficiency scenarios

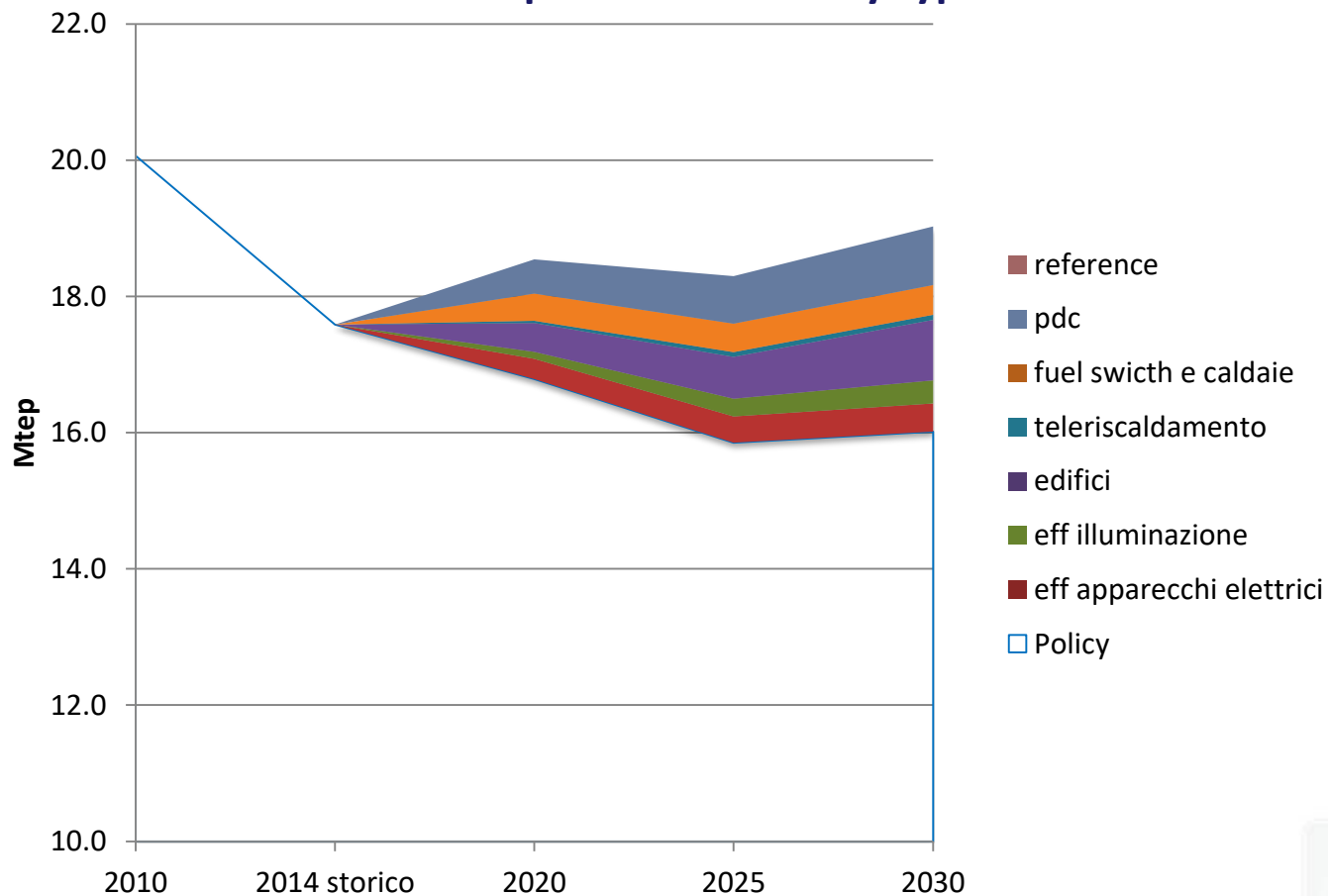
## Services sector: consumption reduction by energy source



Fonte: Elaborazioni ENEA

# Efficiency scenarios

## Services sector : consumption reduction by type of intervention



# Thanks!

## Contacts

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