Modelling Power Generation Strategy in the Context of Regulatory Compliance

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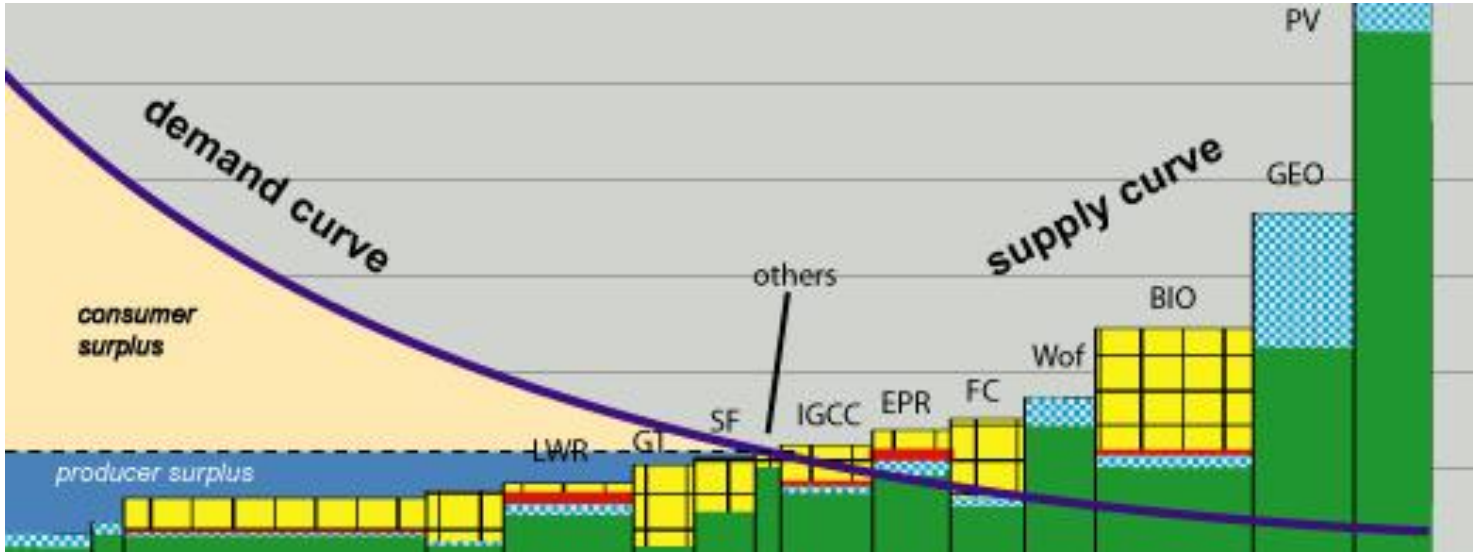


The European Union's Third Energy Package

Goal:

- to ensure a secure, competitive and sustainable supply of energy to the economy and society;

Tasks:

- to accelerate investments in energy infrastructure, to enhance cross border trade and access to diversified sources of energy.

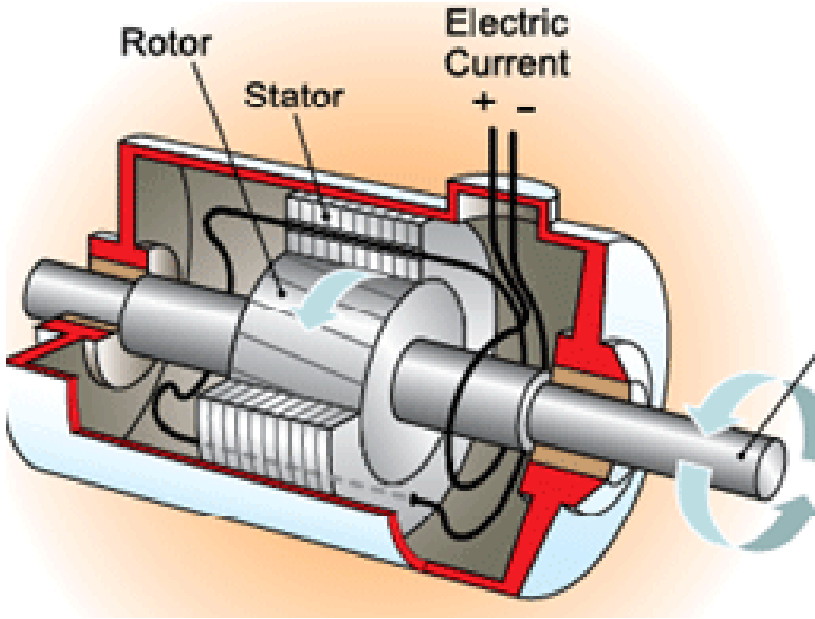
- A strong, competent and independent National Regulatory Authority is a key player for implementation of the package
- New strategic functions of the NRA, forecast is necessary

Security of supply

- Member States shall ensure the monitoring of security of supply issues;
- monitoring shall, in particular, cover the balance of supply and demand on the national market, the level of expected future demand and envisaged additional capacity being planned or under construction, and the quality and level of maintenance of the networks, as well as measures to cover peak demand and to deal with shortfalls of one or more suppliers;
- Member States may delegate the monitoring of security of supply issues to the NRAs.

New generation capacity

The NRA shall:



- monitore investment in generation capacities in relation to security of supply;
- receive and analyse TSO annual reports on power generation and supply capacity for the period up to 10 years;
- organise, monitore and control the tendering procedure referred to the new generation capacity.

Ten-year network development plan

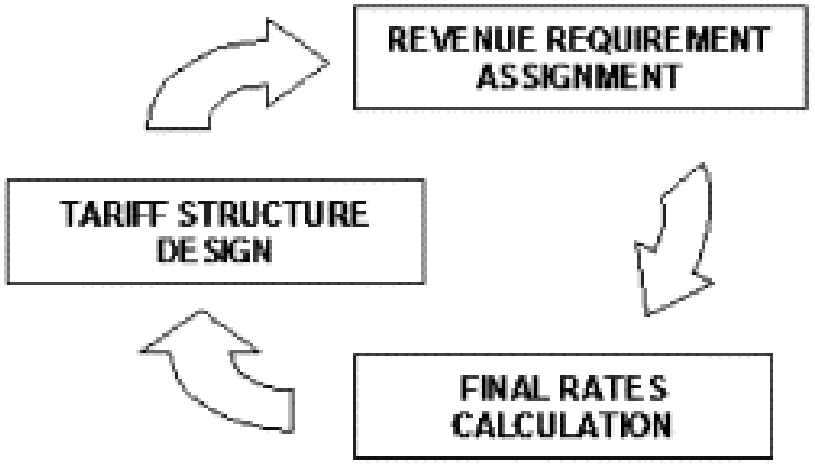
Every year TSO shall submit to the NRA a ten-year network development plan based on existing and forecast supply and demand; the plan shall contain assumptions about the evolution of the generation, supply, consumption and exchanges with other countries, as well efficient measures in order to guarantee the adequacy of the system and the security of supply taking into account investment plans for regional and Community-wide networks.

The NRA shall:

- examine the plan, including coverage of all investment needs and consistency with the non-binding Community-wide ten-year network development plan;
- approve the investments planning and the plan;
- monitor and evaluate the implementation of the plan.

Methodologies and tariffs

The NRA shall fix or approve:



- transmission or distribution tariffs, or the methodologies underlying the calculation of the tariffs; tariffs have to be non-discriminatory and cost-reflective, taking account of the long-term, marginal, avoided network costs;
- sufficiently in advance of their entry into force at least the methodologies used to calculate or establish the terms and conditions for:
  - the provision of balancing services which shall be performed in the most economic manner possible;
  - access to cross-border infrastructures, including the procedures for the allocation of capacity and congestion management.

Energy system analyses tools in Latvia

- **Not continuity in Latvia (just in one case study)**
  - MESSAGE – a systems engineering optimization model used for medium to long-term energy system planning, energy policy analysis
  - BALMOREL – optimization model for analyzing the power&DH sector in an international perspective
  - MESAP (Modular Energy System Analysis and Planning Environment) - PlaNet – Linear network module (Simulation model)
- **EFOM (Energy Flow Optimization Model) – multi-period linear programming optimization model describing the total energy system of a country**
  - Used from 1994 – 2000
  - Research projects with focus to electricity and district heat (energy system is partly represented)
- **Since 1995 MARKAL is used for energy and environment system analyses in Latvia**

MARKAL
IEA-ETSAP, www.iea-etsap.org

- MARKAL (TIMES) is developed by Energy Technology Systems Analysis Programme (ETSAP) (an Implementing Agreement of the International Energy Agency, the first established in 1976)
- Model generator written in the General Algebraic Model System (GAMS)
- User interfaces for managing input data, running model generator, examining results
- Used in a non-research environment since 1980 and now in use at more than 200 institutions in nearly 70 countries
- Widely used, proven and continually evolving model for assessing a wide range of energy and environmental planning and policy issues
- Has a well-developed support network around the world through ETSAP
- Analytic framework is ideally suited for assessing the role of technology in achieving environmental and policy goals

Insight into MARKAL use in Latvia

- **Implemented by IFE (Norway) support in 1995**
- **Emission projections for energy sector**

– Projections of GHG emissions for
  - National use
  - UNFCCC National Communications (from 2nd NC)
  - Monitoring EU GHG emissions (Commission Decisions 280/2004/EC and 2005/166/EC)

– Projections for other gases SO_2, VOC, NO_x, PM2.5, NH_3 for
  - National use
  - Convention on Long-Range Transboundary Air Pollution

- **Projections of energy use**

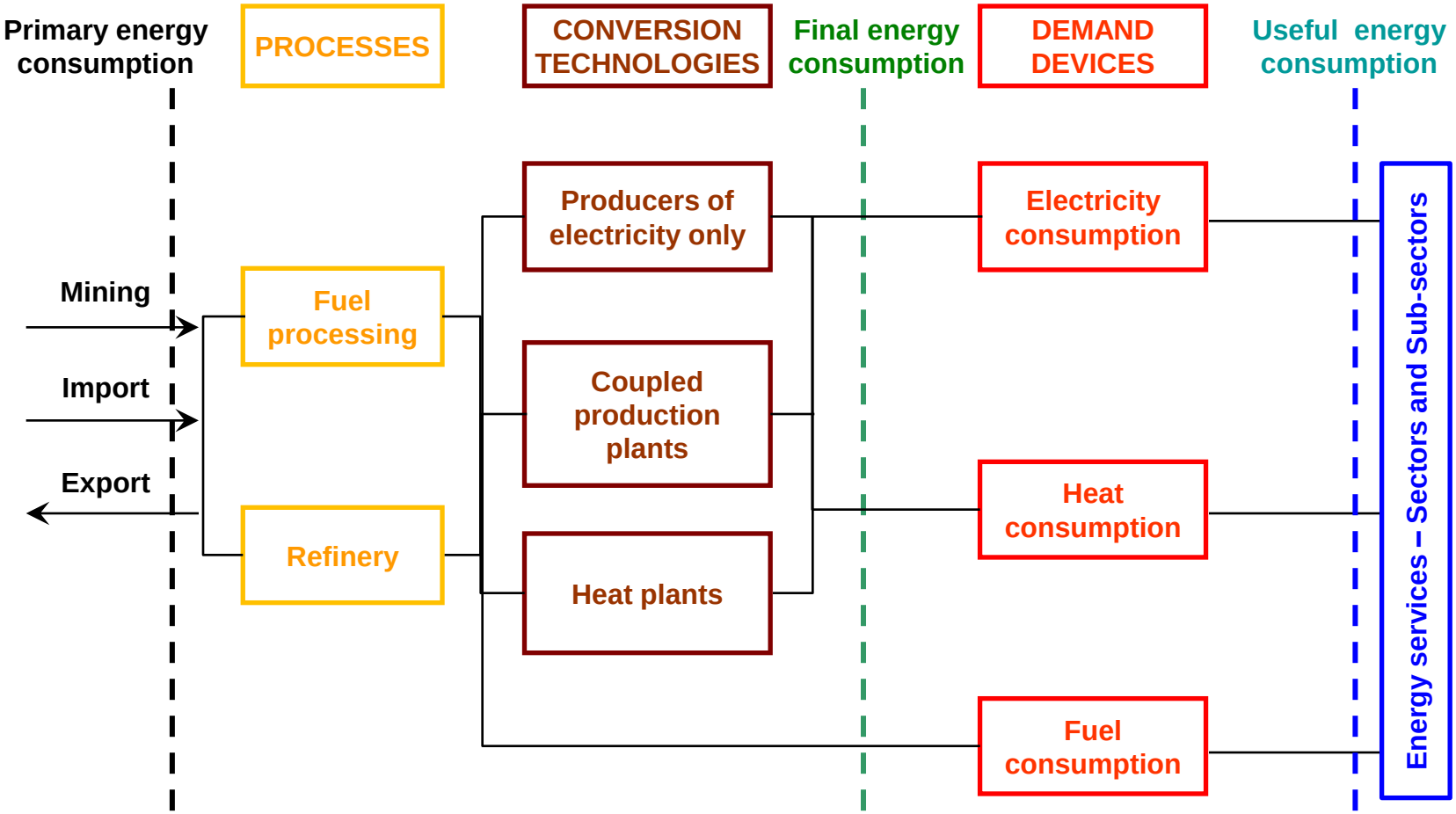
– Mainly use for research projects
  - Identifying least-cost solutions for energy system planning
  - Evaluation of impact of introduction of energy&emissions taxes

– Seldom direct use for national strategies
  - Evaluation of impact of introduction of different RES and energy efficiency targets

Modeling approach

- **Bottom-up technology rich optimization model**
- **Covers all energy system from resource extraction through to end-use as represented by a Reference Energy System (RES) network**
- **Spread of action between supply and demand**
- **Emissions taxes and constraints**
- Identifies most cost-effective pattern and mix of resource use and technology deployment over time under varying constraints and alternate futures by optimizing system costs. Also provides estimates of eq.:
  - energy prices
  - demand activity
  - GHG and other emission levels
  - mitigation costs
- **Scenario approach: establishes baselines and the implications of alternative futures**
- **Sensitivity analyses**
  - Possibility to deal with uncertainty with stochastic analyzes

MARKAL Building Blocks



An energy technology is any device that produces, transforms, transmit, distribute or uses energy

Useful demands / Energy services – Sectors and Sub-sectors

- **Agriculture, forestry, fishery**
  - AGR Electricity
  - AGR Energy Carriers (excl. ELC)
- **Services**
  - COM Air Conditioning
  - COM Cooking
  - COM Space Heating & Hot Water
  - COM Lighting
  - COM Electric Equipments
  - COM Refrigerators and freezers
- **Industry and construction**
  - ICH Chemical
  - ICO Construction
  - IES Energy Sector
  - IFB Food; Beverage and Tobacco
  - IIS Iron & Steel&Non-ferrous Metals
  - ILP Pulp&Paper and Printing
  - INM Non-metallic Minerals
  - IWP Wood and Wood Products
  - IOI Other
- **Residential**
  - RES Air Conditioning
  - RES Clothes Drying
  - RES Cooking
  - RES Clothes Washing
  - RES Dishwashing
  - RES Electric Equipments
  - RES Space Heating & Hot Water MF
  - RES Space Heating & Hot Water SF
  - RES Lighting
  - RES Refrigerators and freezers
- **Transport**
  - TRA Domestic Aviation
  - TRA International Aviation
  - TRA Pipeline Transport
  - TRA Road – Buses
  - TRA Road - Trucks (Heavy Duty Trucks, Light Duty Vehicles)
  - TRA Road - Car (Cars, Mopeds, Motorcycles)
  - TRA Railway
  - TRA Domestic Navigation
  - TRA International Navigation (Bunkers)

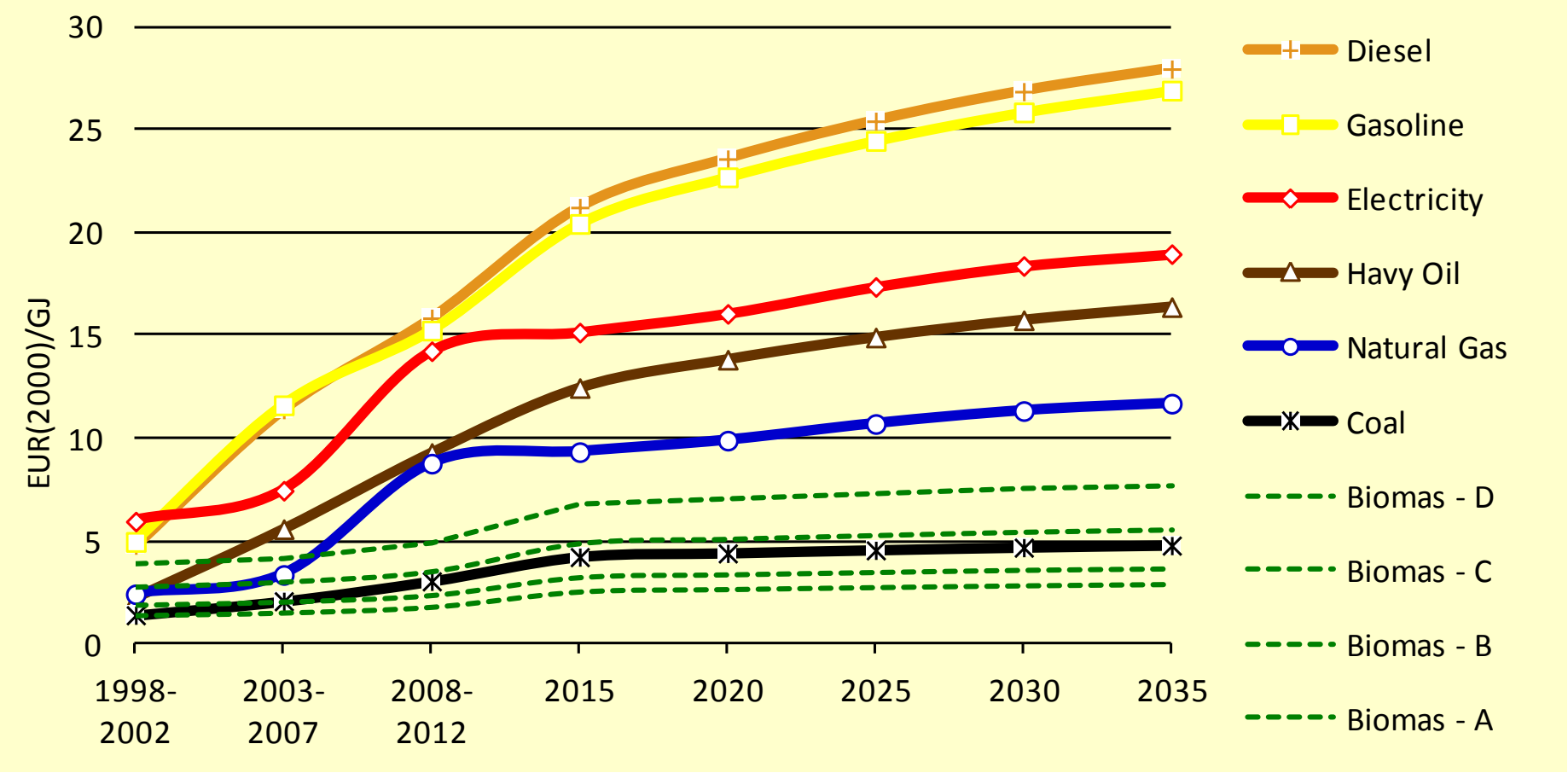
Security of supply issues insight modeling case study

- Diversification of primary energy resources;
- Self-sufficiency with electricity and generation capacity;
- Deployment of RES;
- Impact of Energy efficiency to an energy demand projections (Demand-supply balance);
- Support for development of new generation capacities;
- Sustainable development - climate policy targets.

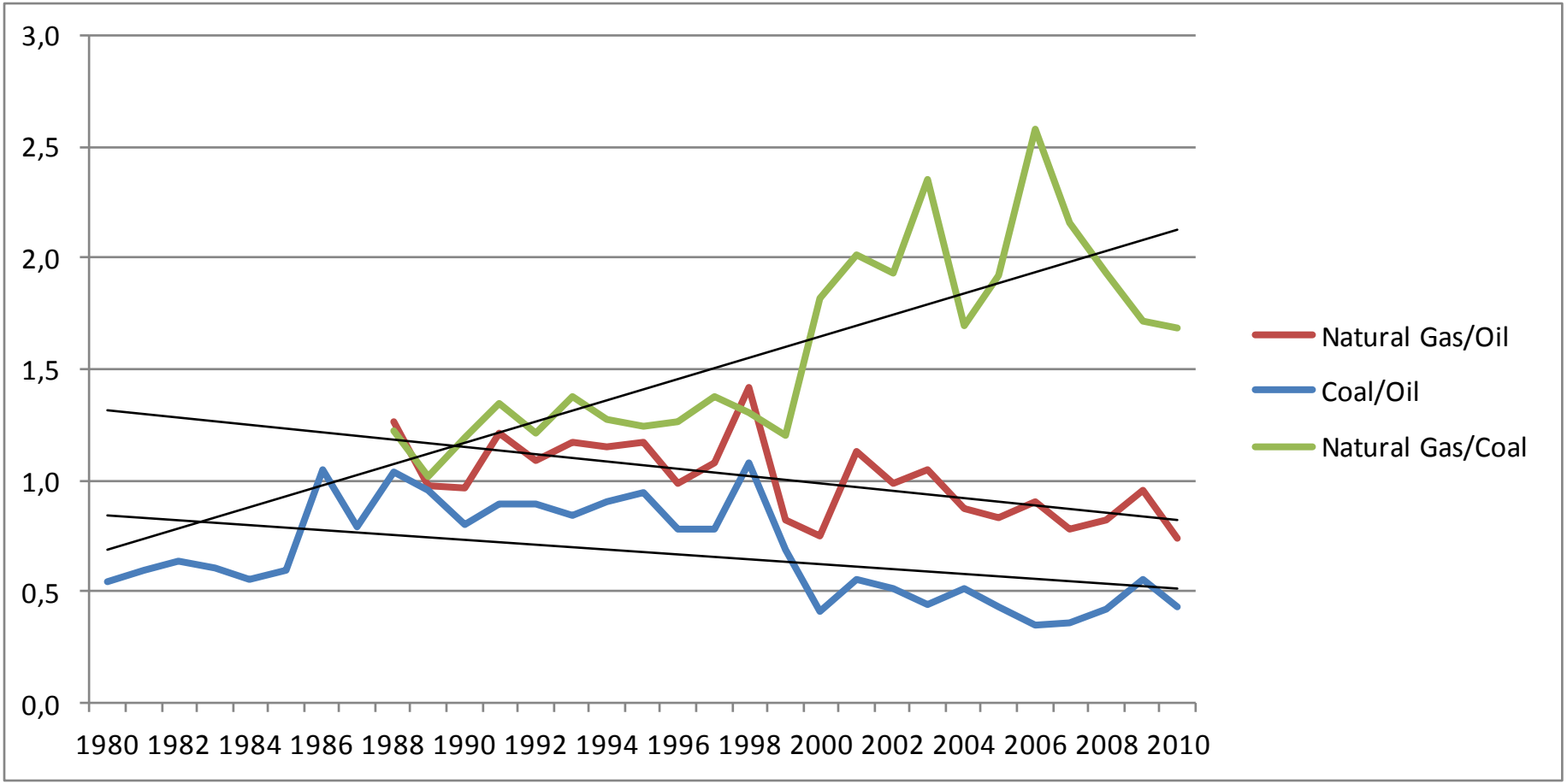
Definitions of scenarios

- **BASE** with Existing policies and plans
- **BASE_EFF (efficiency SC)** - BASE + EE measures in residential houses
- **BASE_RES2020** - BASE + RES 40% from 2020 (RES-F – 10%)
- **BASE_SUB (existing subsidy scheme)** – BASE + subsidies for CHP and RES and capacity payment
- **BASE_SEG-UP (GHG emission cup SC)** - BASE + GHG emission cup from 2020
- **Energy strategy** – additional EE+ RES 50% from 2030

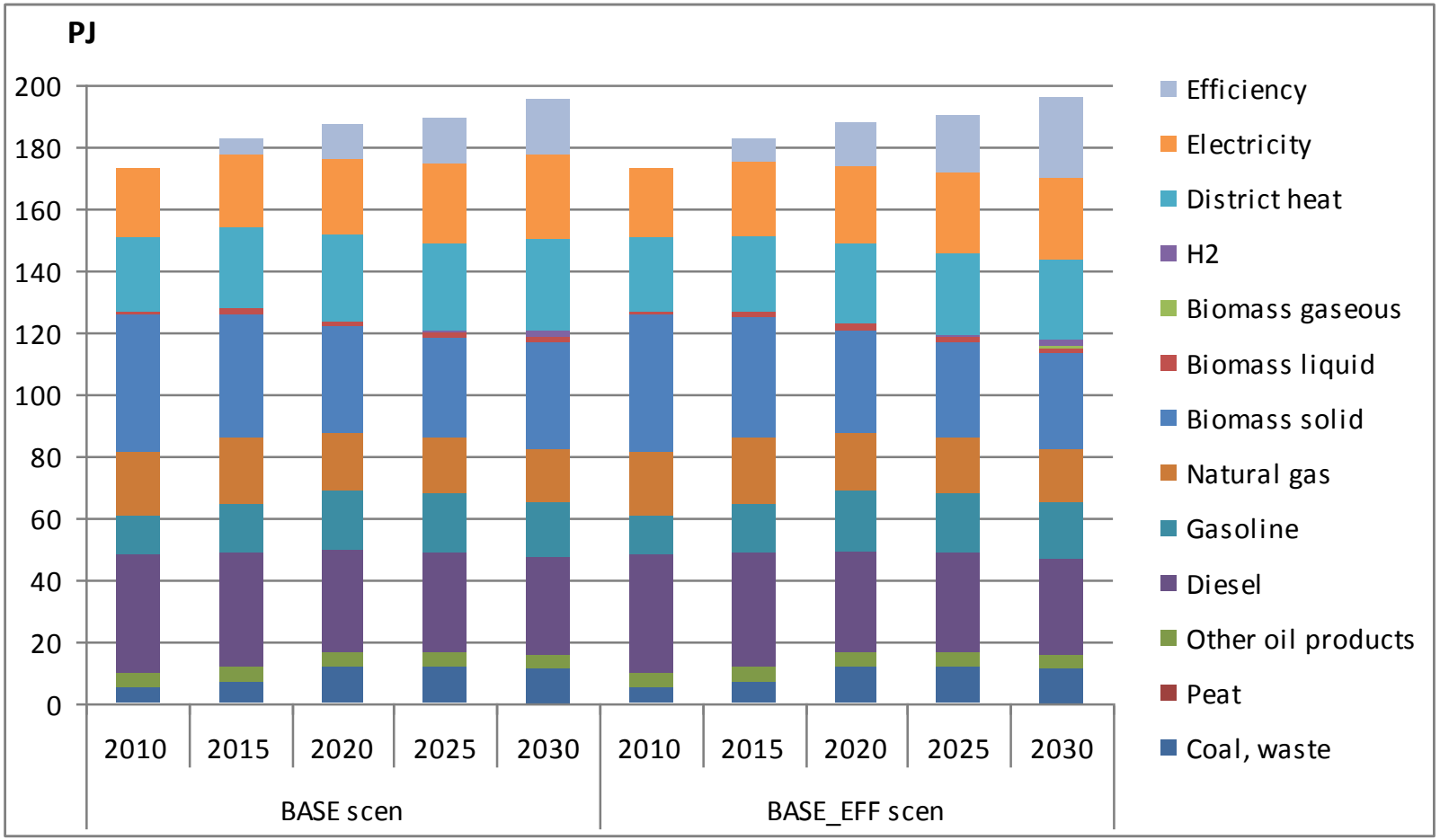
Projections of energy prices for modeling of developed scenarios



Price ratios between fuels are important

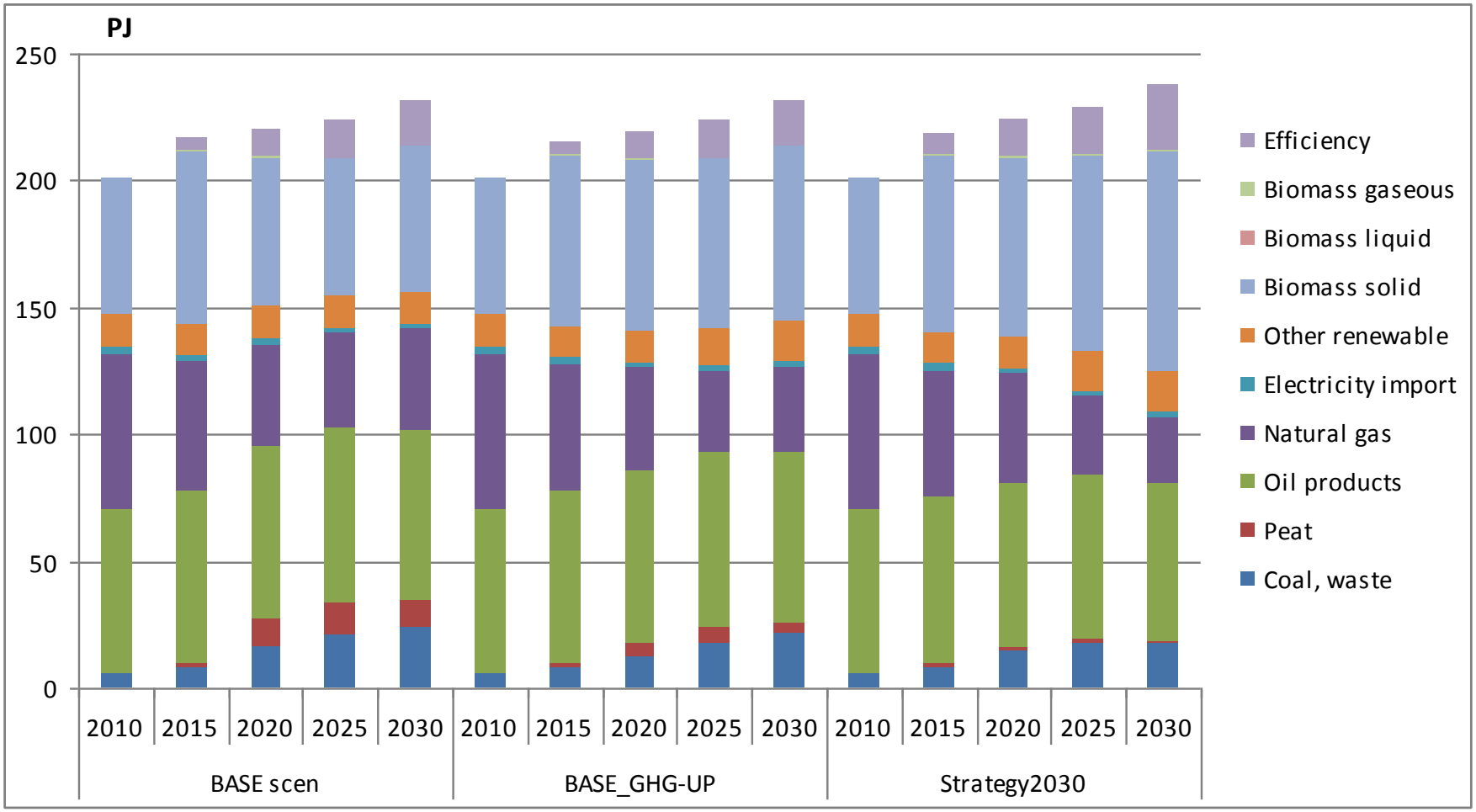


Final energy demand, PJ



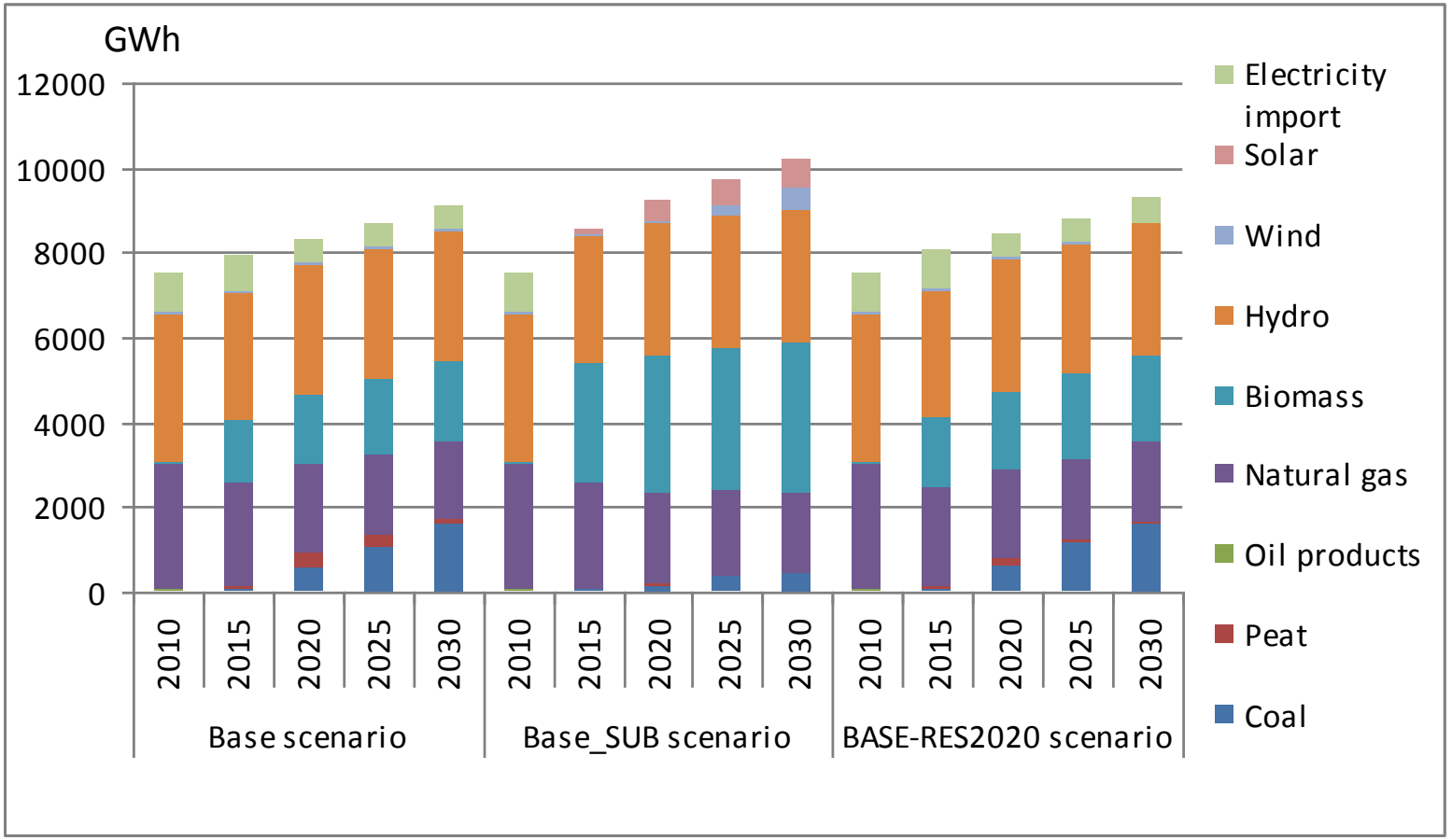
Implementation of existing EE policy could save up to 9% of energy; additional policy in residential sector could add 4%

Primary energy, PJ

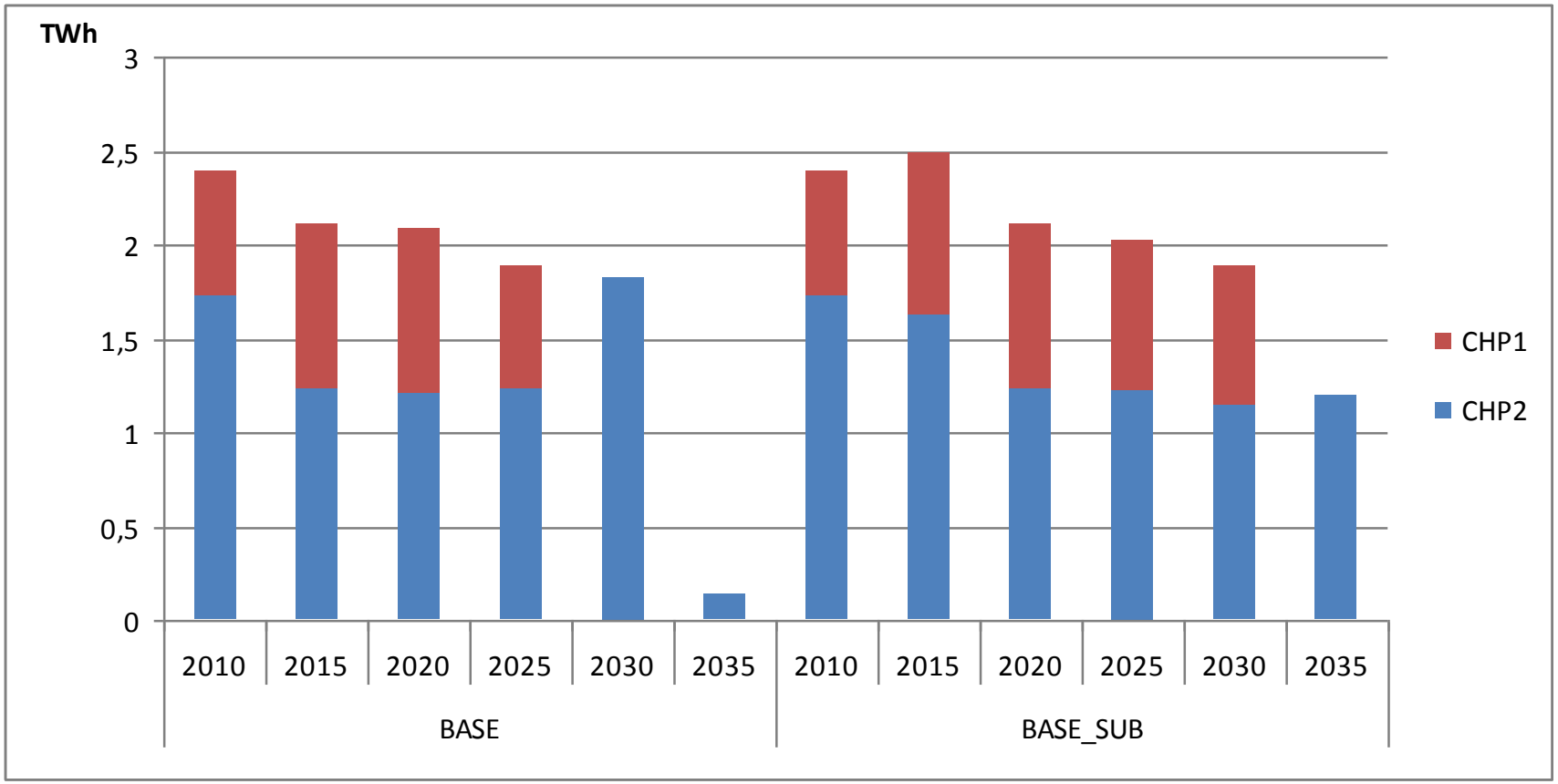


Coal and solid biomass are competitive resources to make diversification from natural gas

Impact of measures to ensure self-sufficiency with energy and generation capacity



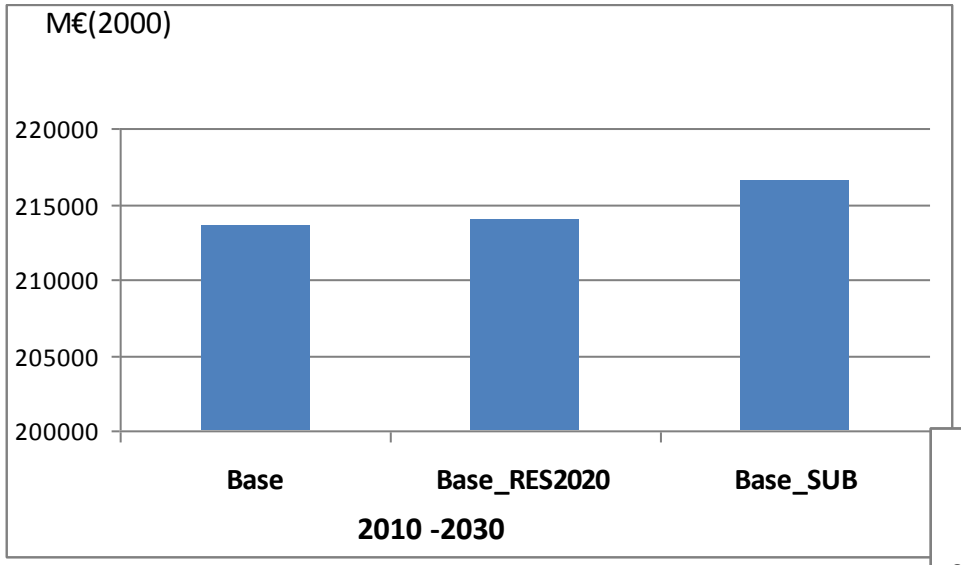
Electricity generation by existing CHP capacities (modeling results)

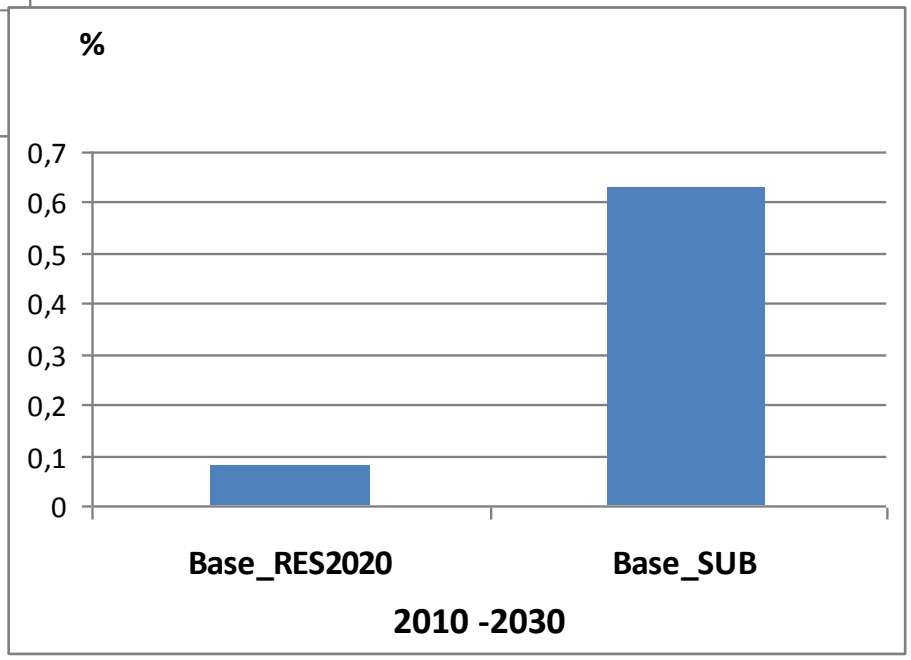


Capacity payment support generation in existing CHP capacities

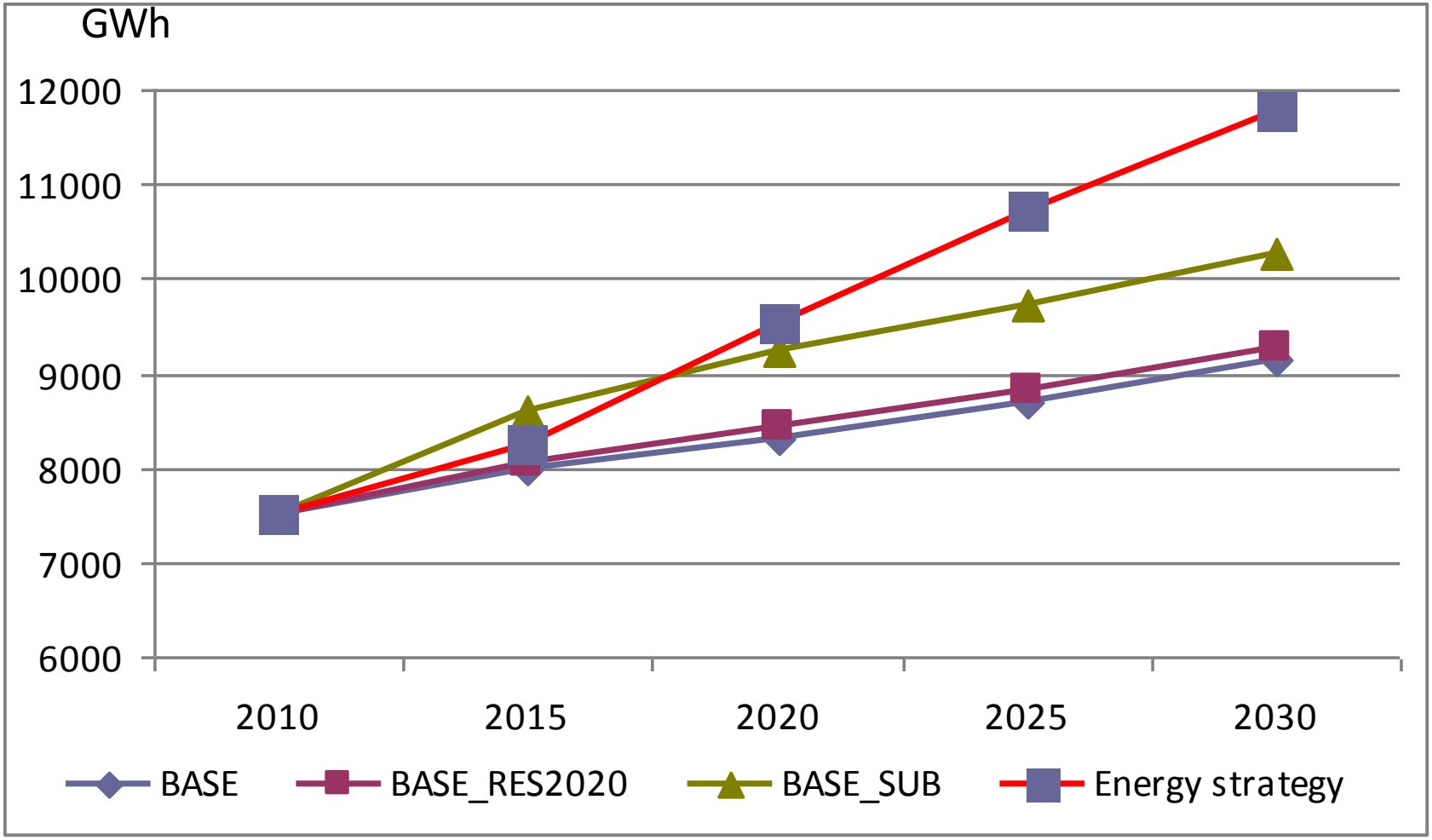
Changes of Total system cost and related to GDP

%=(BASEsc-Xsc)/GDP

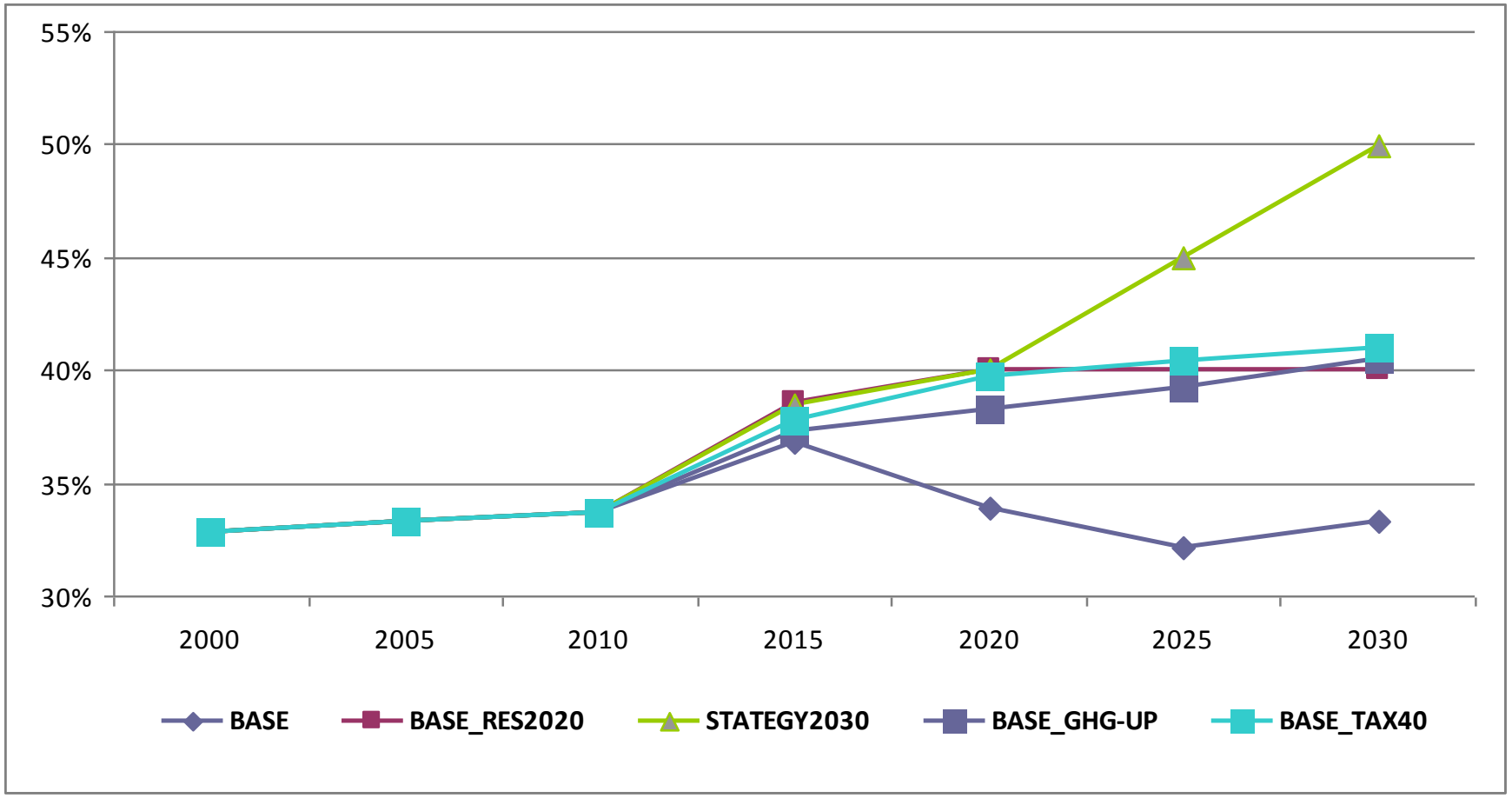




Electricity demand projections (EE measures and demand overestimation)



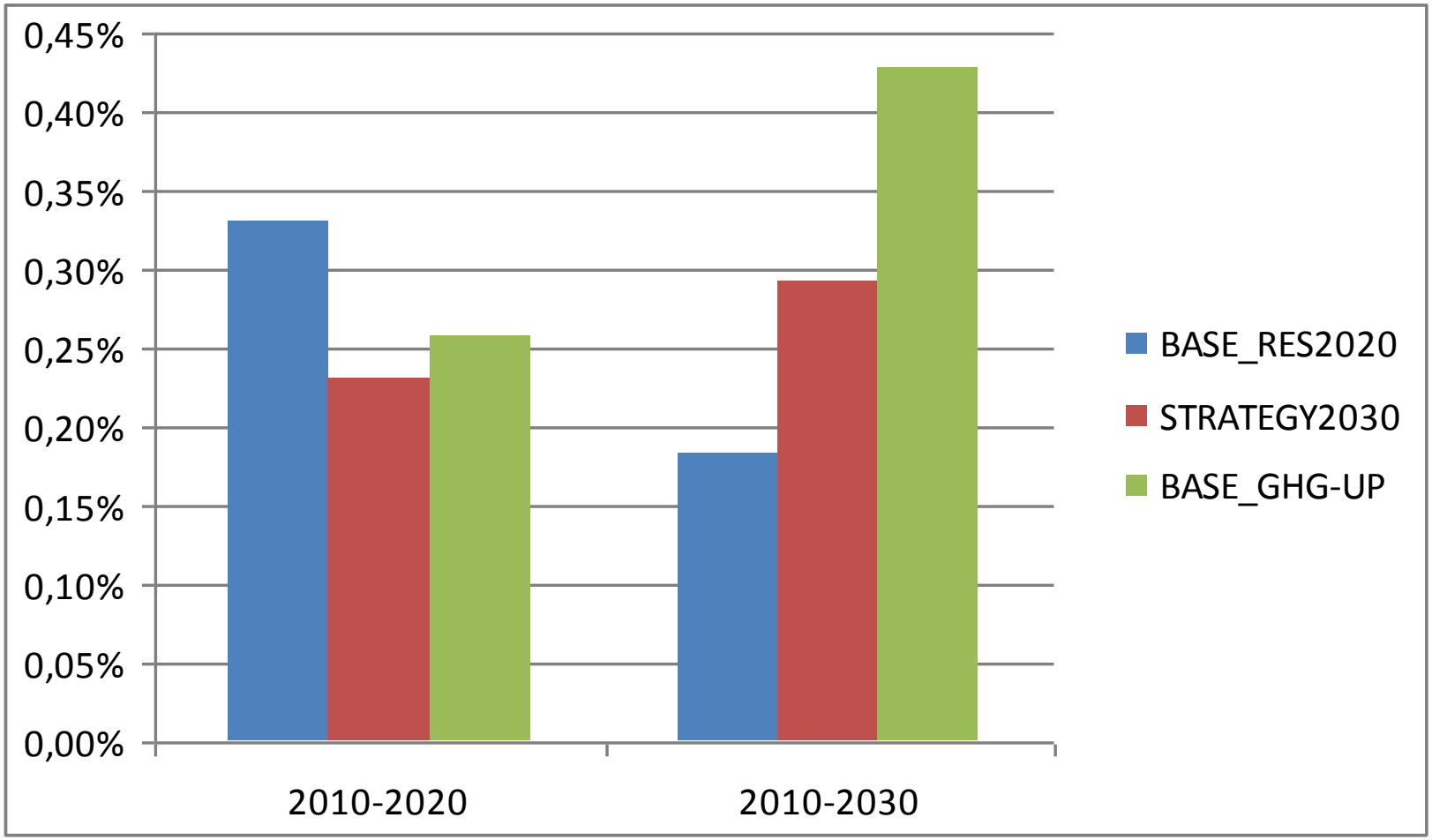
Role of Renewable energy to increase security of supply



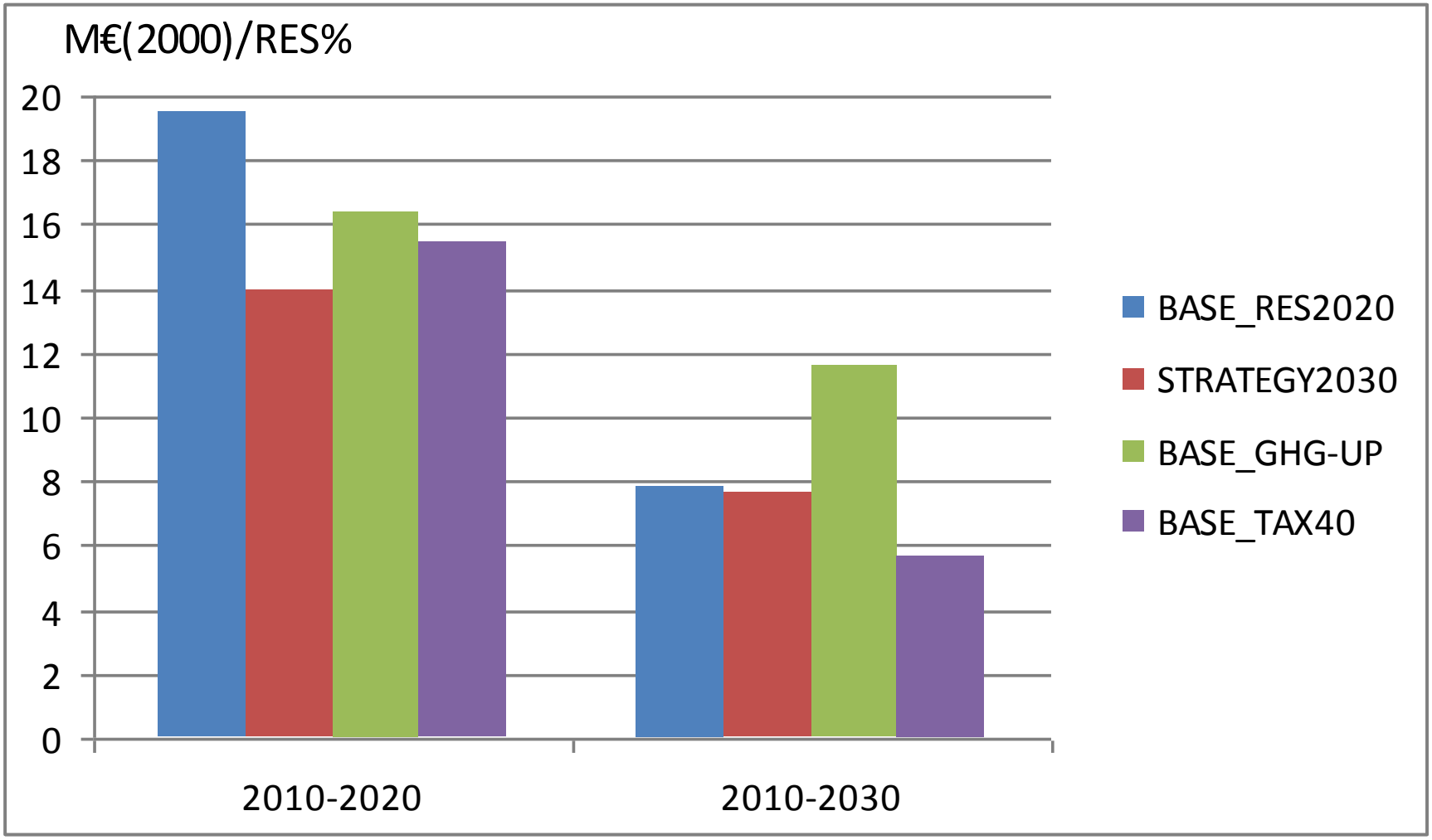
RES share in gross final consumption of energy

Changes of Total system cost of GDP

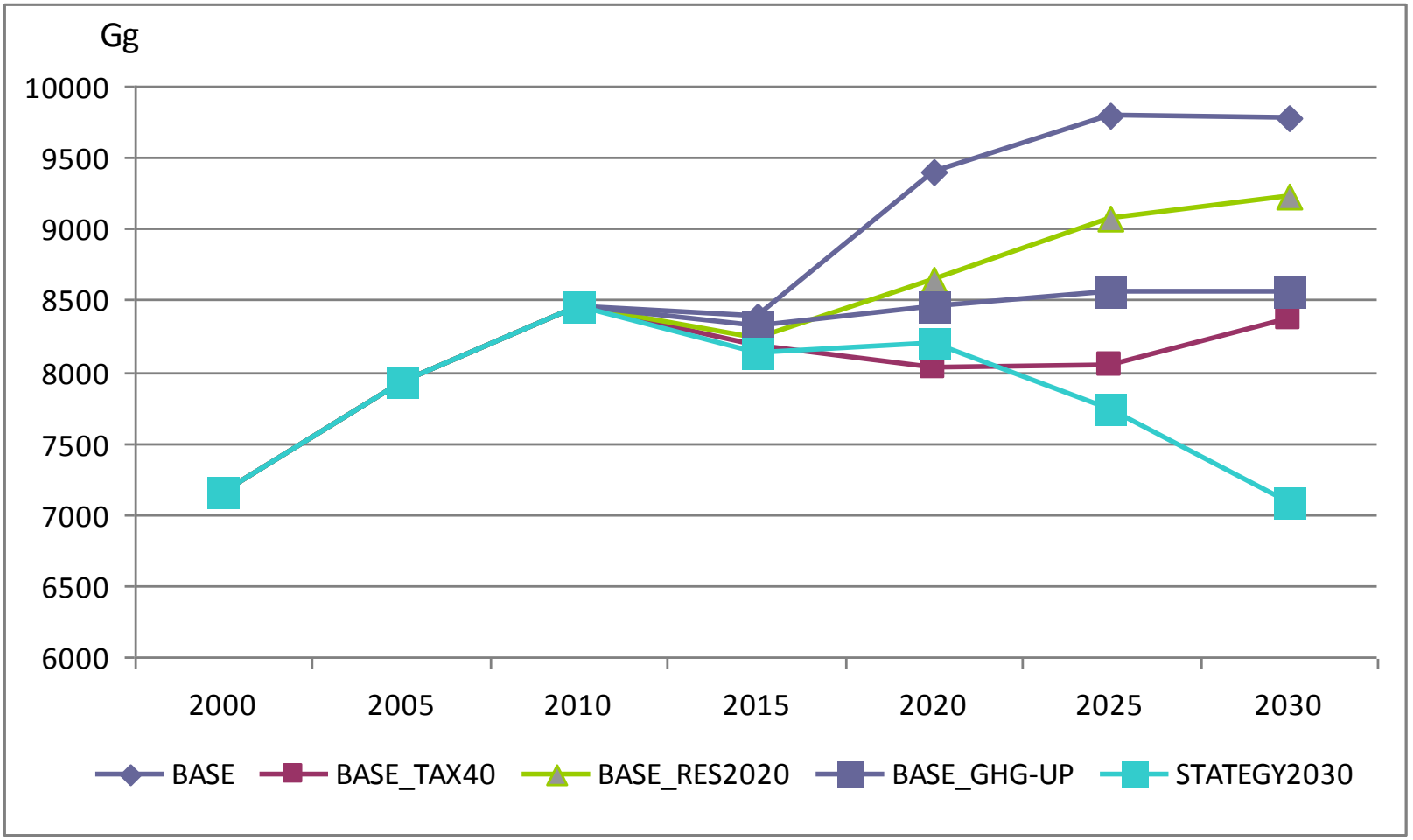
%=(BASEsc-Xsc)/GDP



How much costs one percentage point of additional RES

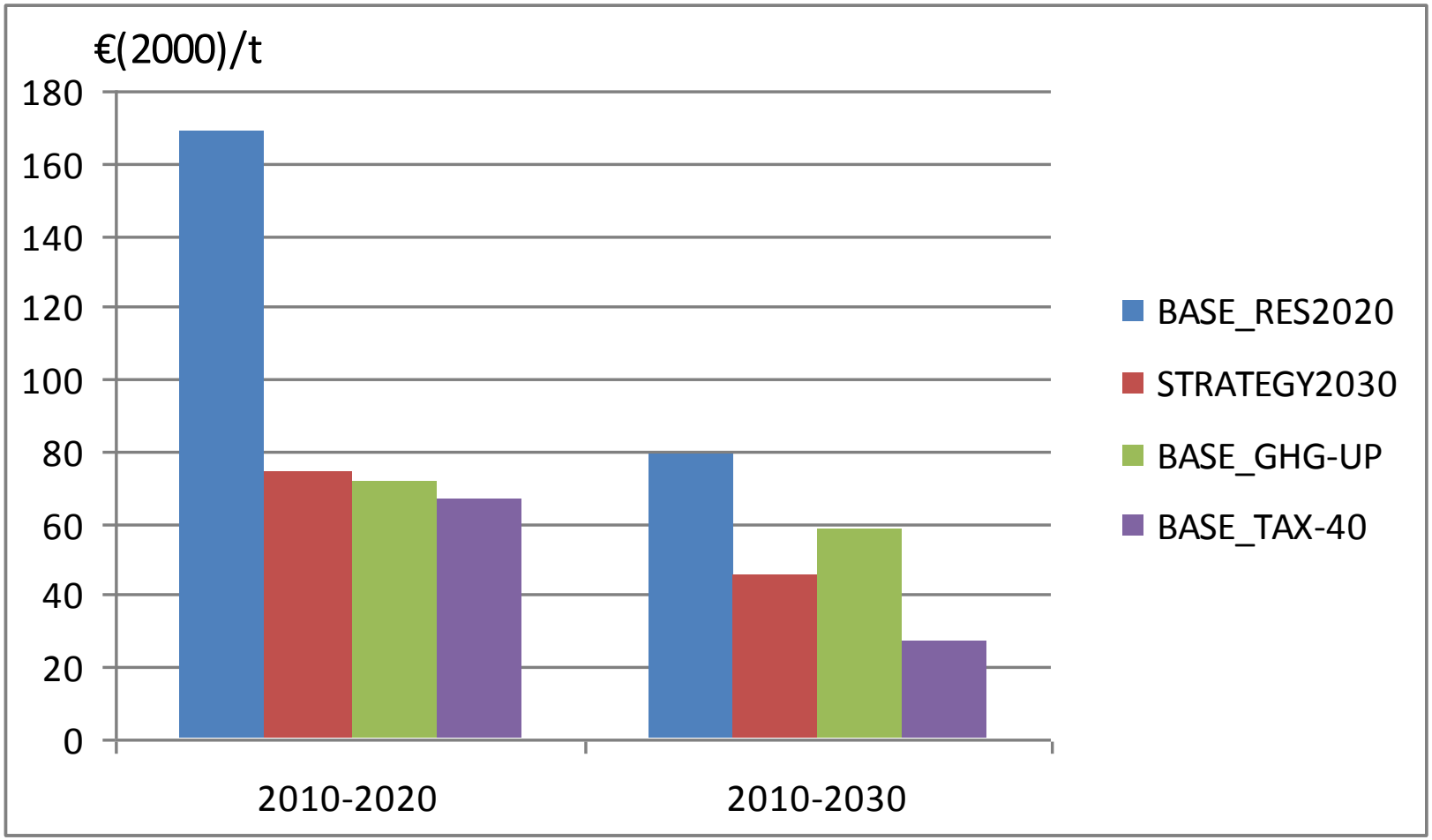


GHG emissions, Gg



Only scenarios with EE measures and RES deployment ensure sustainable development in long term

CO_2 reduction cost



THANK YOU FOR ATTENTION!