Results of the simulation runs

Claus Huber, Thomas Faber, Gustav Resch
Energy Economics Group (EEG)

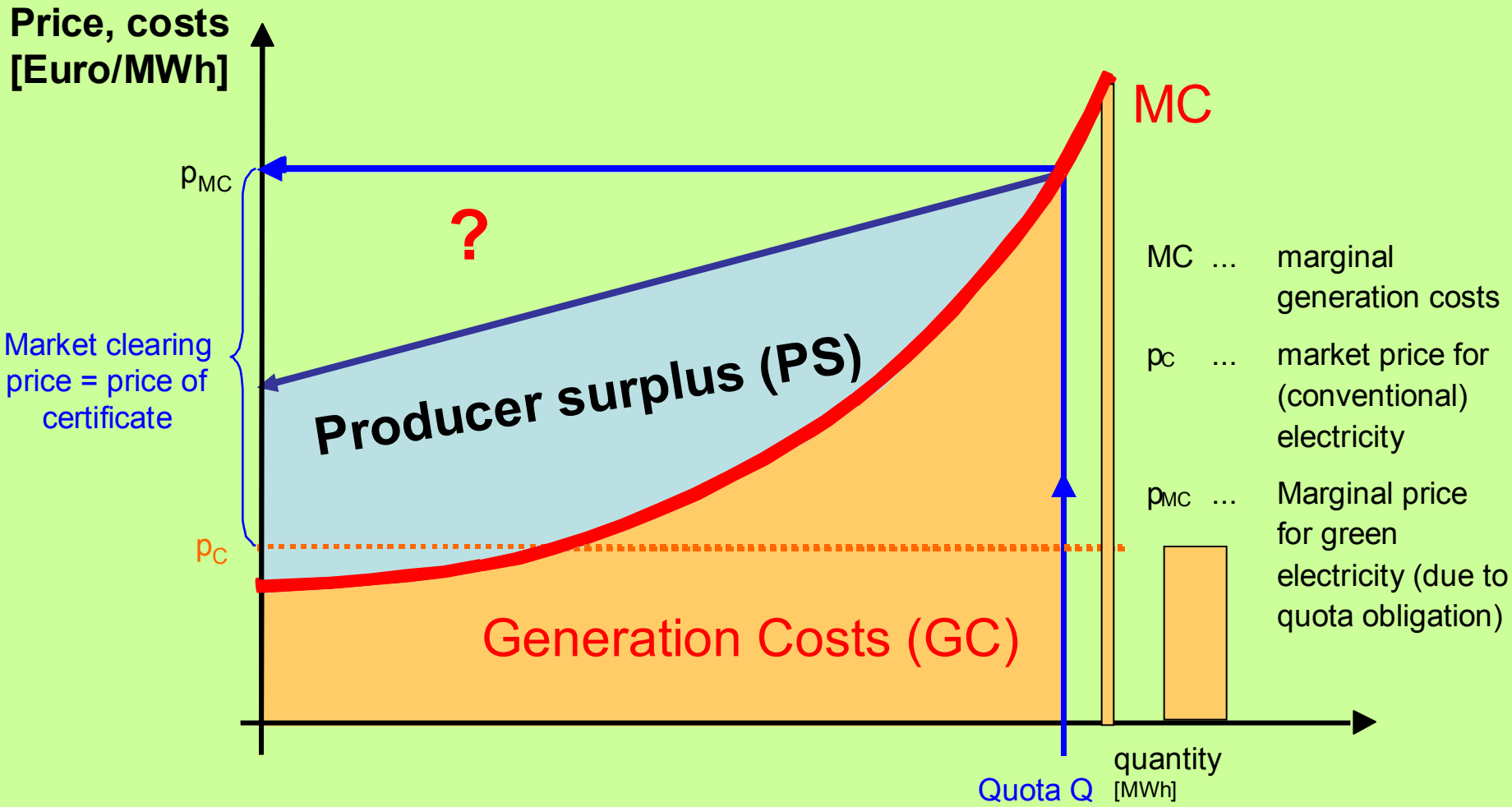
Overview

- Introduction
- Method of approach
- The toolbox ***Green*-X**
- General assumptions
- Investigated scenarios
- Results

Introduction

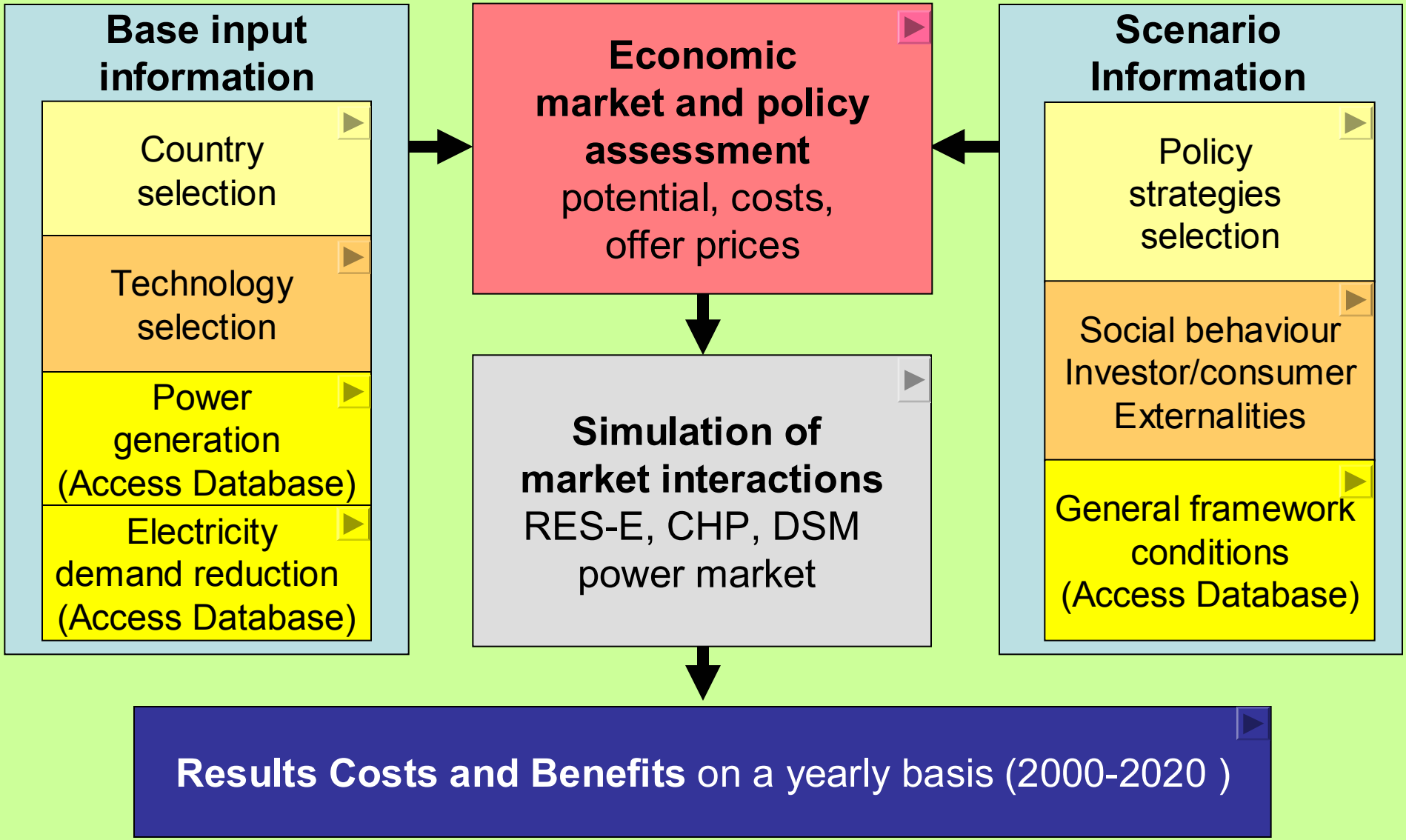
- Will be currently developed within the EU-project „Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market - Green-X“
- Objective of ***Green*-X**:
  - To facilitate a significant increased RES-E generation in a liberalised electricity market with minimal costs to European citizen.
  - To find a set of efficient, sustainable and integrated strategies for RES-E, conventional electricity production (incl. CHP), DSM activities and GHG-reduction
- Independent software tool under Microsoft Windows

Method of approach



Transfer costs for consumer (additional costs for society) = PS + GC – p_C * Q

The toolbox Green-X



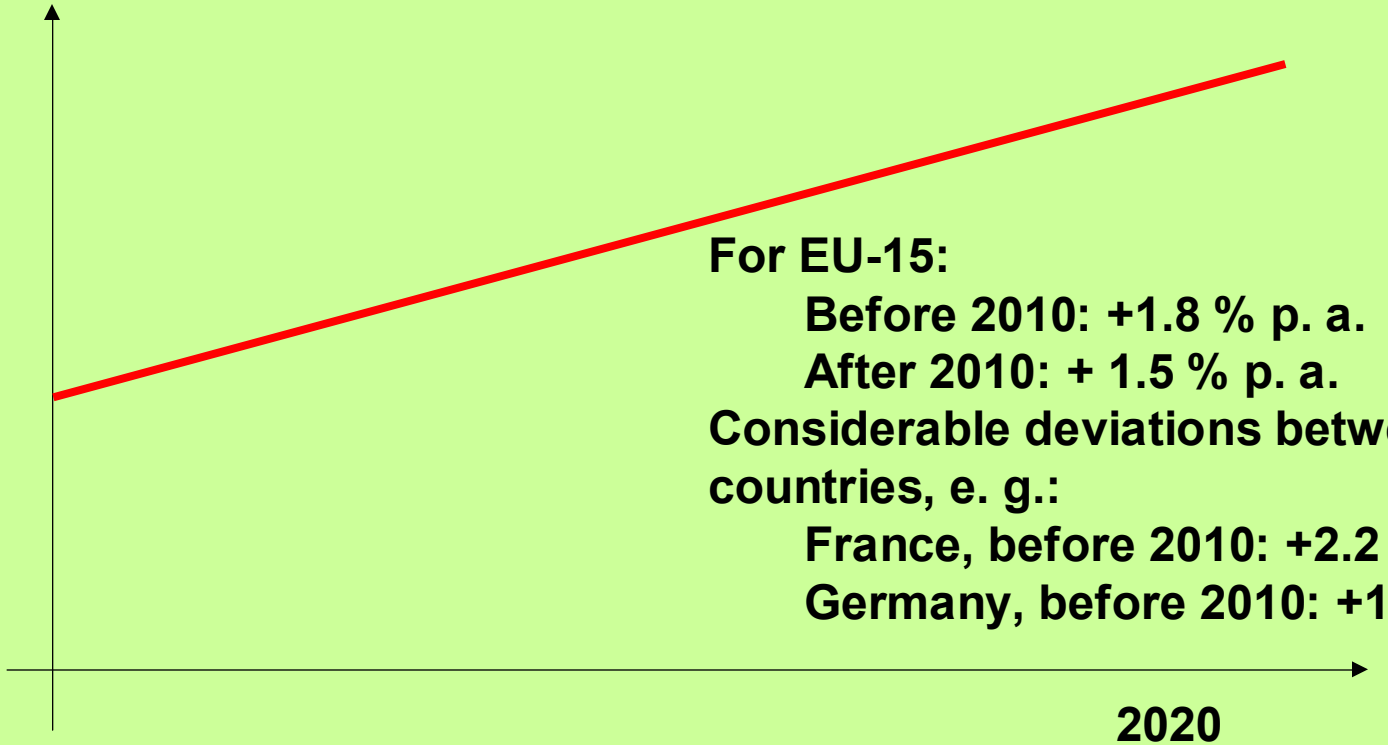
Results computer model Green-X

- The following results can be derived on country and technology level on a yearly basis till 2020:
  - Total electricity generation (RES-E and conventional)
  - Electricity production by each technology
  - CO_2-emissions
  - Average costs of electricity generation on technology level
  - Import / export balances RES-E and conventional power
  - Influence of energy policy setting on
    - total generation costs and benefits for investors / utilities
    - costs and benefit for consumer / society

General scenario assumptions (1/7)

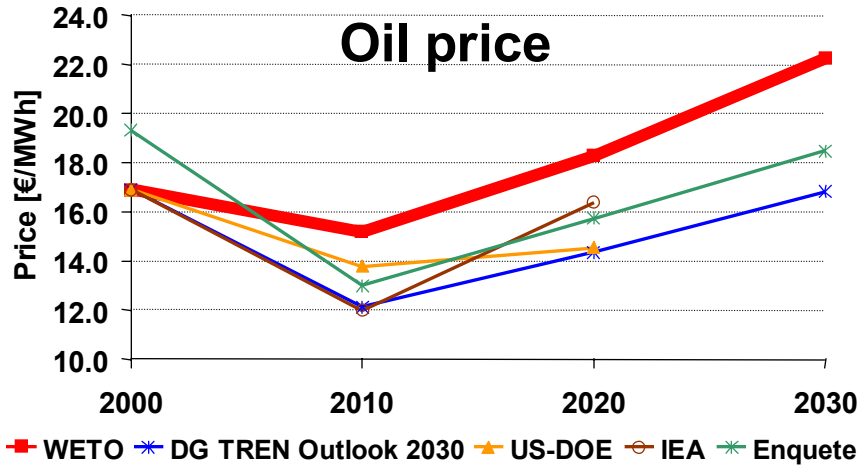
- Electricity demand

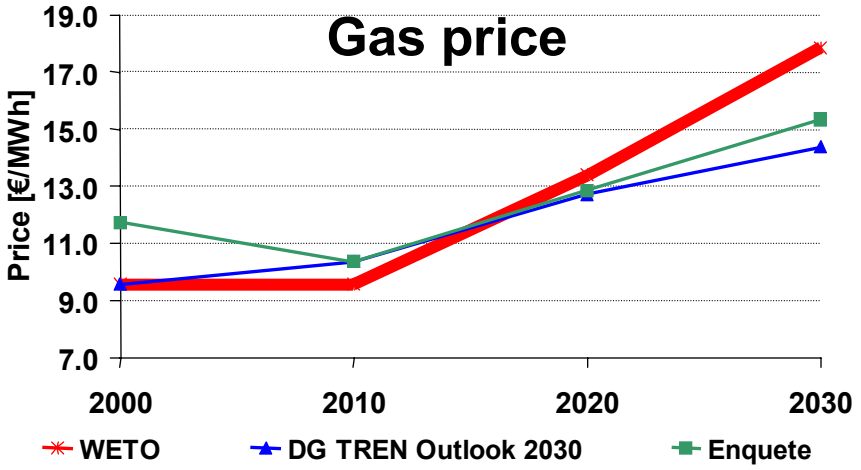
  according to DG TREN Outlook 2030: European Energy and Transport Trends to 2030 Outlook (Mantzos et. al 2003) – Baseline forecast

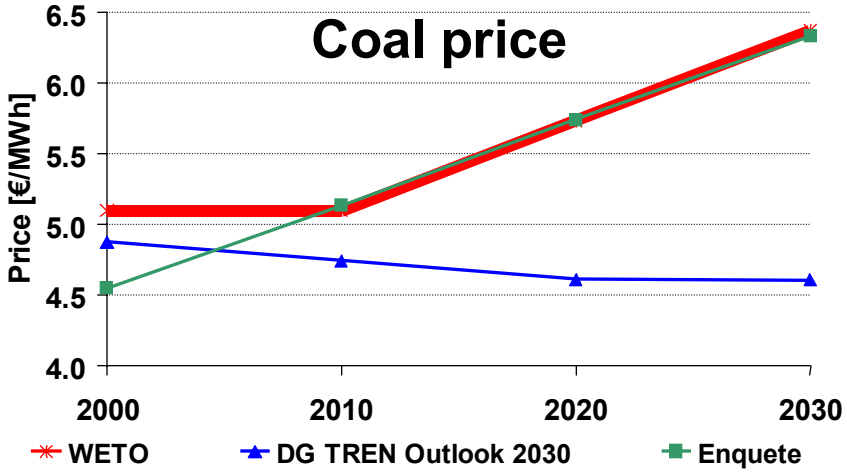


General scenario assumptions (2/7)

- Primary energy prices –fossil energy







WETO: World Energy, Techonology and Climate Policy Outlook by ENERDATA et al. on behalf of DG Research (2003)

DG TREN Outlook 2030: European Energy and Transport Trends to 2030 by Mantzos et al. (2003)

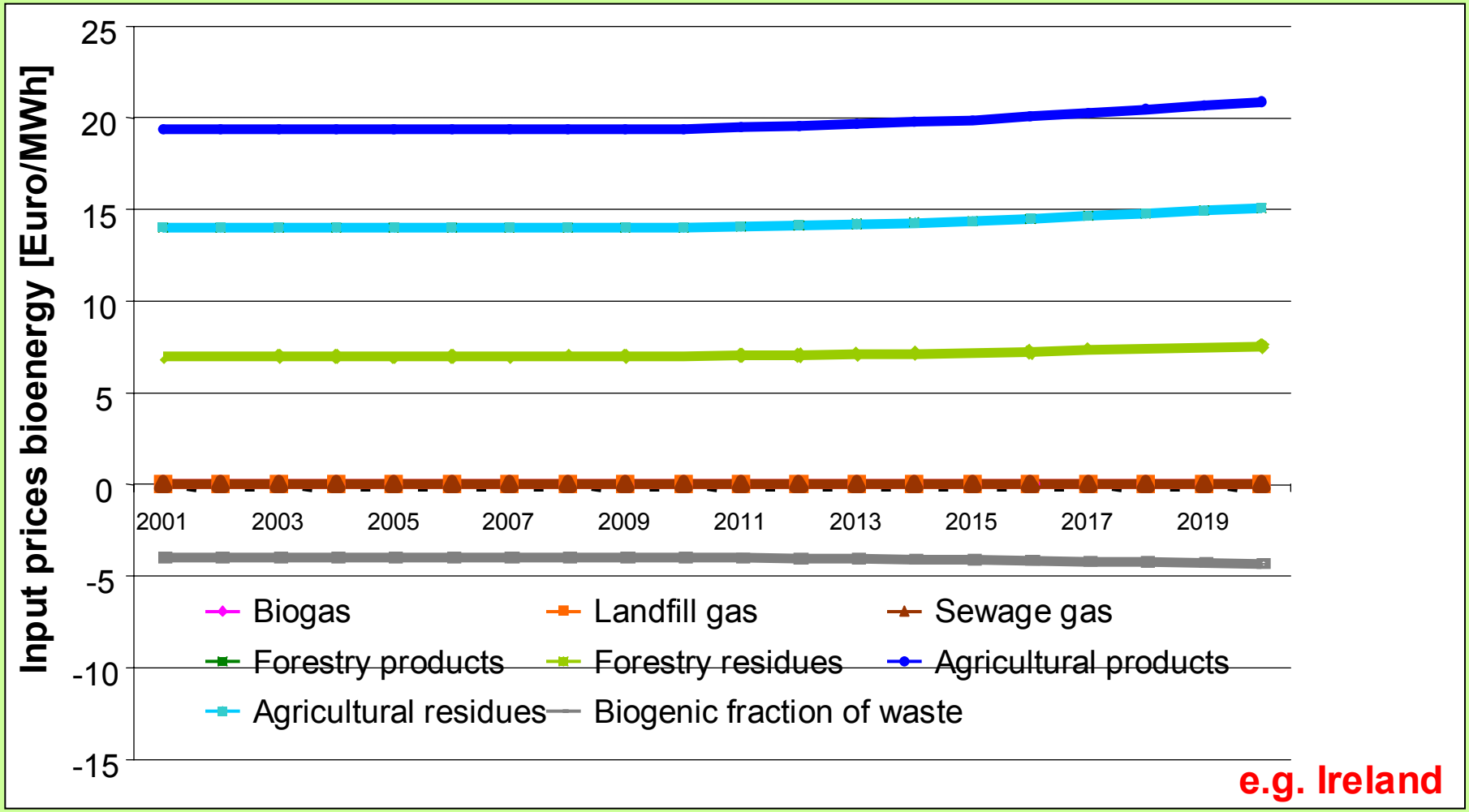
US-DOE: International Energy Outlook 2002, Reference Case projection

IEA: World Energy Outlook to 2020 (2002)

Enquete: Analysis grid for the German Enquete Commission on Sustainable Energy Policy (2002)

General scenario assumptions (3/7)

- Primary energy prices bioenergy: country-specific prices



General scenario assumptions (4/7)

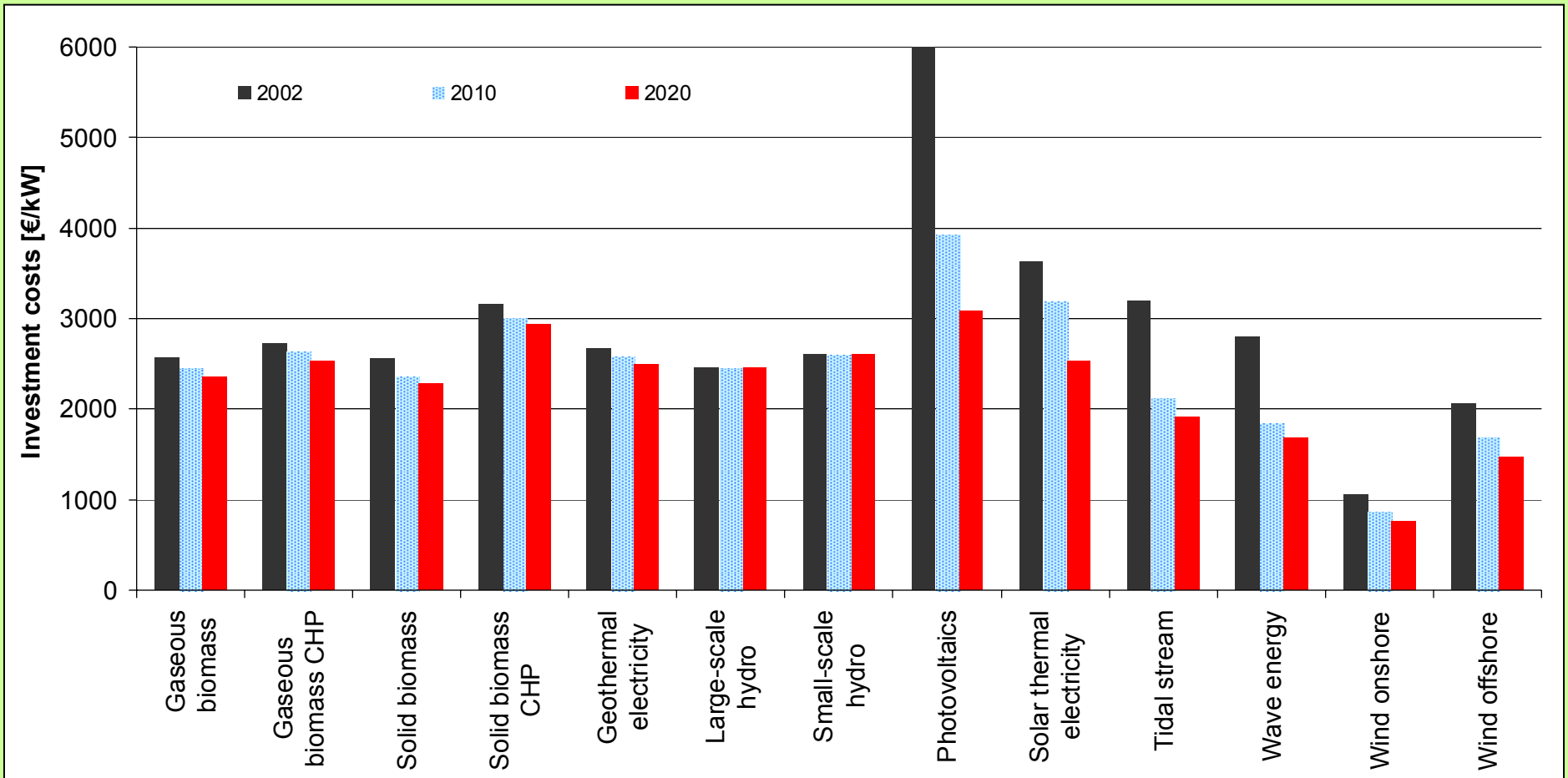
- Weighted average costs of capital (WACC)

$$WACC = gd \bullet rd + ge \bullet re = gd \bullet [rfd + rpd] + ge \bullet [rfe + b \bullet rpe] \bullet (1 + rt)$$

	Abbreviation / calculation	Default risk assessment		Higher risk assessment	
		Dept (d)	Equity (e)	Dept (d)	Equity (e)
Share equity / debt	g	75.0%	25.0%	70.0%	30.0%
Nominal risk free rate	r_n	4.1%	4.1%	4.1%	4.1%
Inflation rate	i	1.9%	1.9%	1.9%	1.9%
Real risk free rate	$r_f = r_n - i$	2.2%	2.2%	2.2%	2.2%
Expected market rate of return	r_m	4.7%	7.5%	4.7%	10.7%
Risk premium	$r_p = r_m - r_f$	2.5%	5.3%	2.5%	8.5%
Equity beta	β		1.59		1.59
Tax rate (corporation tax)	r_t		12.5%		12.5%
Post-tax cost	r_{pt}	4.7%	10.6%	4.7%	15.7%
Real cost	$r = r_{pt} * (1+r_t)$	4.7%	12.0%	4.7%	17.7%
Weighted average cost of capital	*WACC*	6.5%		8.6%	

General scenario assumptions (5/7)

- Future cost projections – technological learning



E.g. Results from BAU scenario

General scenario assumptions (6/7)

For all investigated it has been assumed:

- Stable planning horizon, i.e. investors have knowledge about applied policy mechanism in the future
- Continuous RES-E policy / long term RES-E targets
- Clear and well predefined tariff structure / yearly quota
- Reduced investment costs over time (technological learning)
- Reduction in barriers and high public acceptance in the long term (depending on the target)

General scenario assumptions (7/7)

For all investigated with the exception of BAU, it has been assumed:

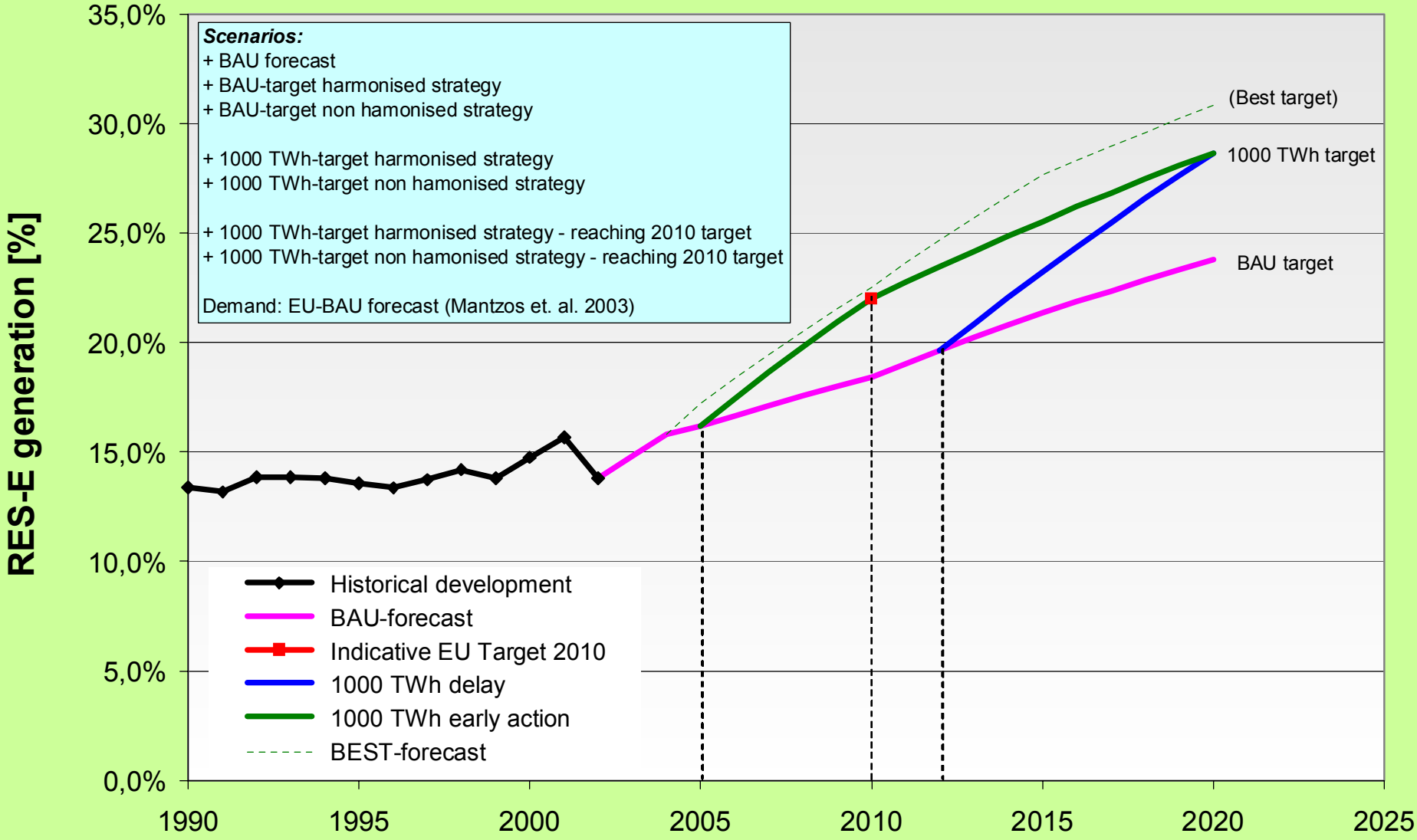
- New support mechanism refer to new capacity only;
  This means already supported RES-E technology remains in their support instrument
- For new support mechanism:
  Restriction of the duration in which investors can receive the (additional) financial support

Investigated cases (1/3)

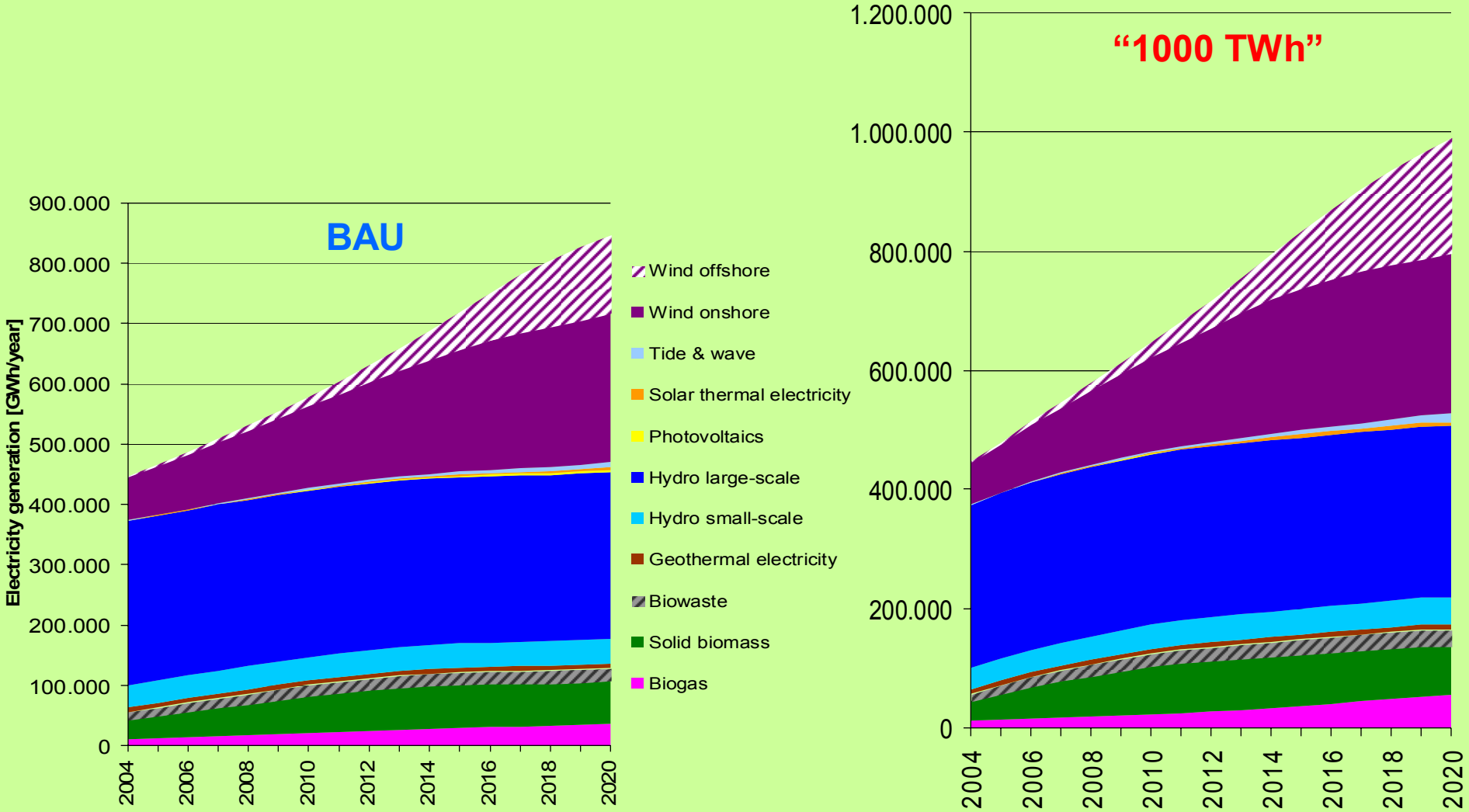
National Support Schemes and EU Community Framework

Taking account of the wide diversity of promotion schemes between Member States, the Directive states that it is too early to set a Community-wide framework regarding support schemes. By 10/27/2005, the Commission should present a report on the experience gained with the application and coexistence of different support schemes in the Member States. The report may be accompanied by a proposal for a Community framework for RES support schemes (art.4.2). However, the directive also stipulates that such a proposal for a harmonised support framework should allow a transition period of at least 7 years (thereafter) in order to maintain investors' confidence and avoid stranded costs.

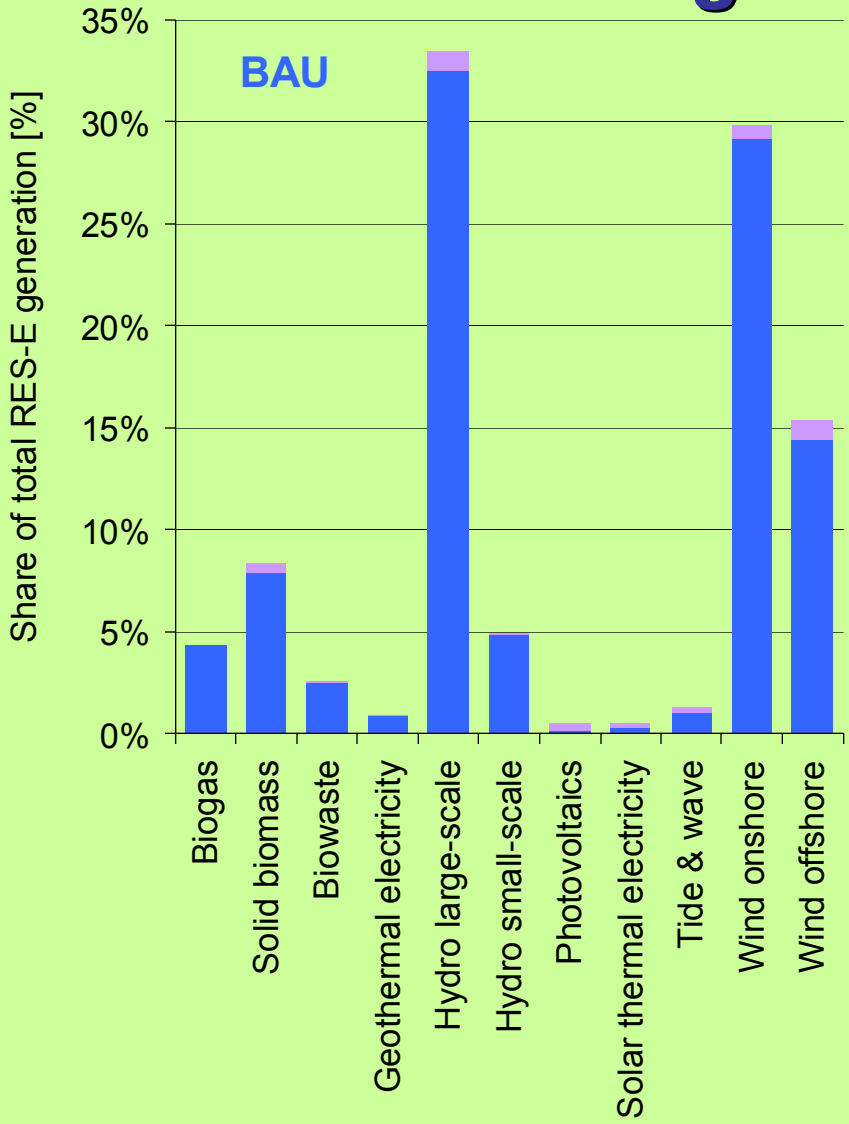
Investigated cases (2/3)

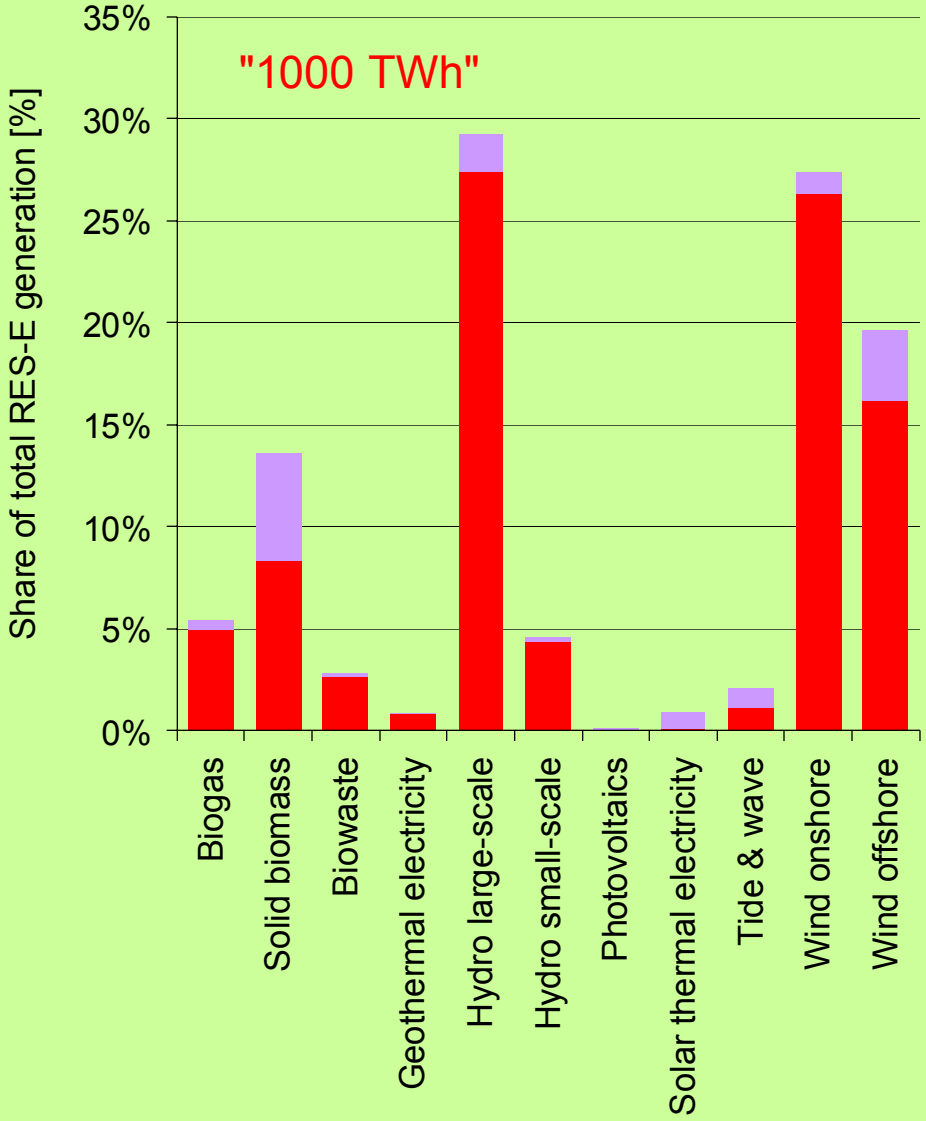


RES-E deployment over time EU-15

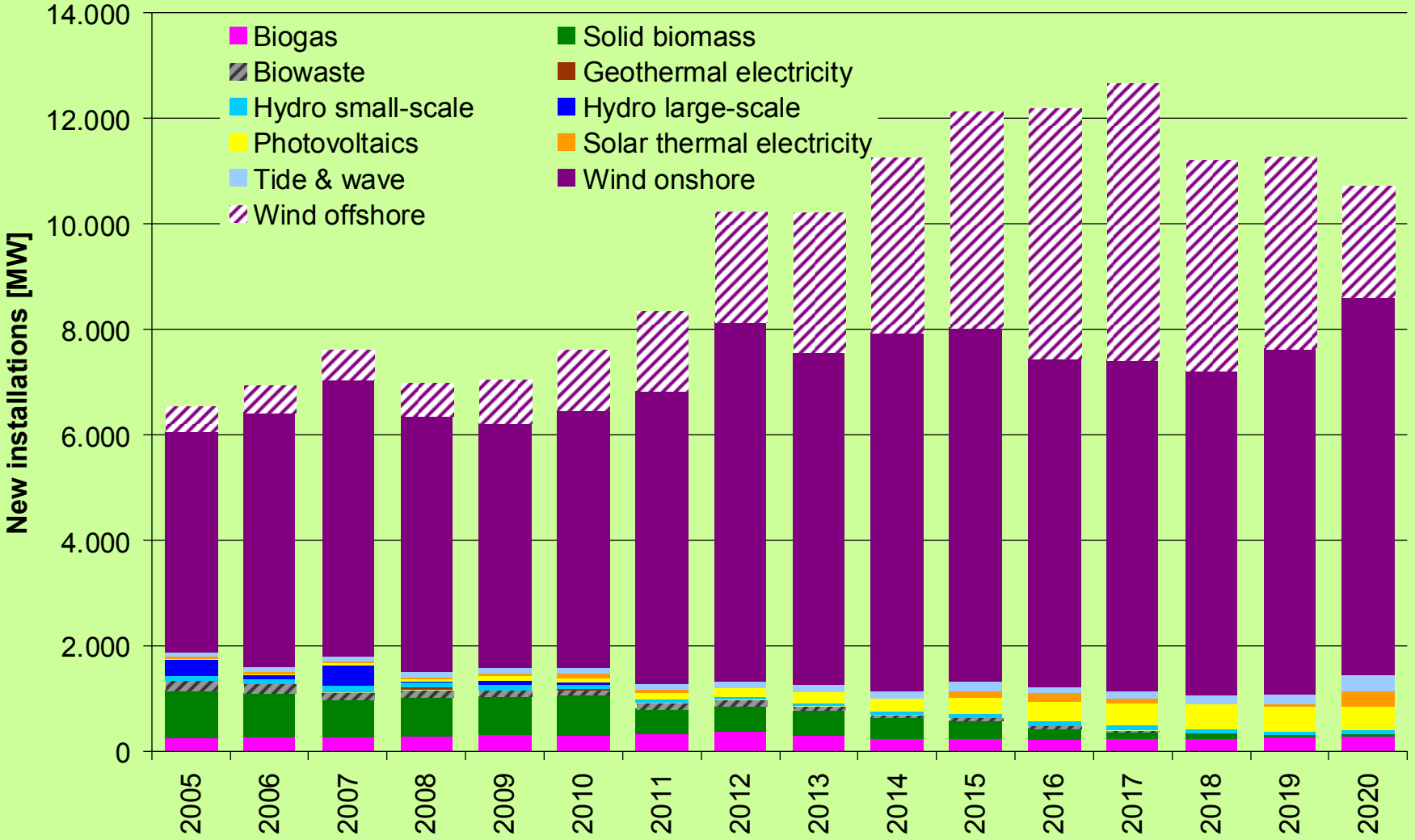


Total RES-E generation EU-15 in 2020



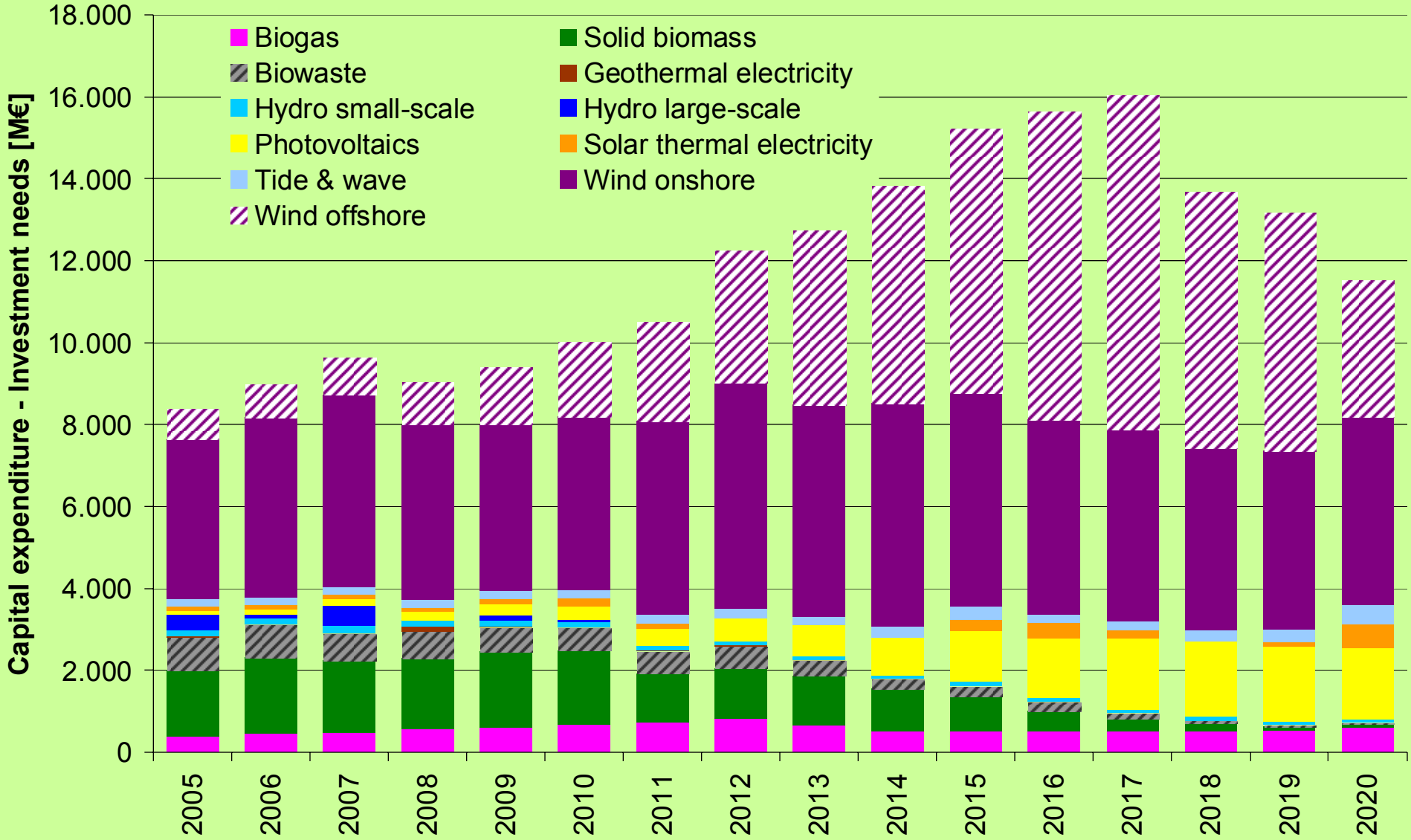


New RES-E installations up to 2020 BAU



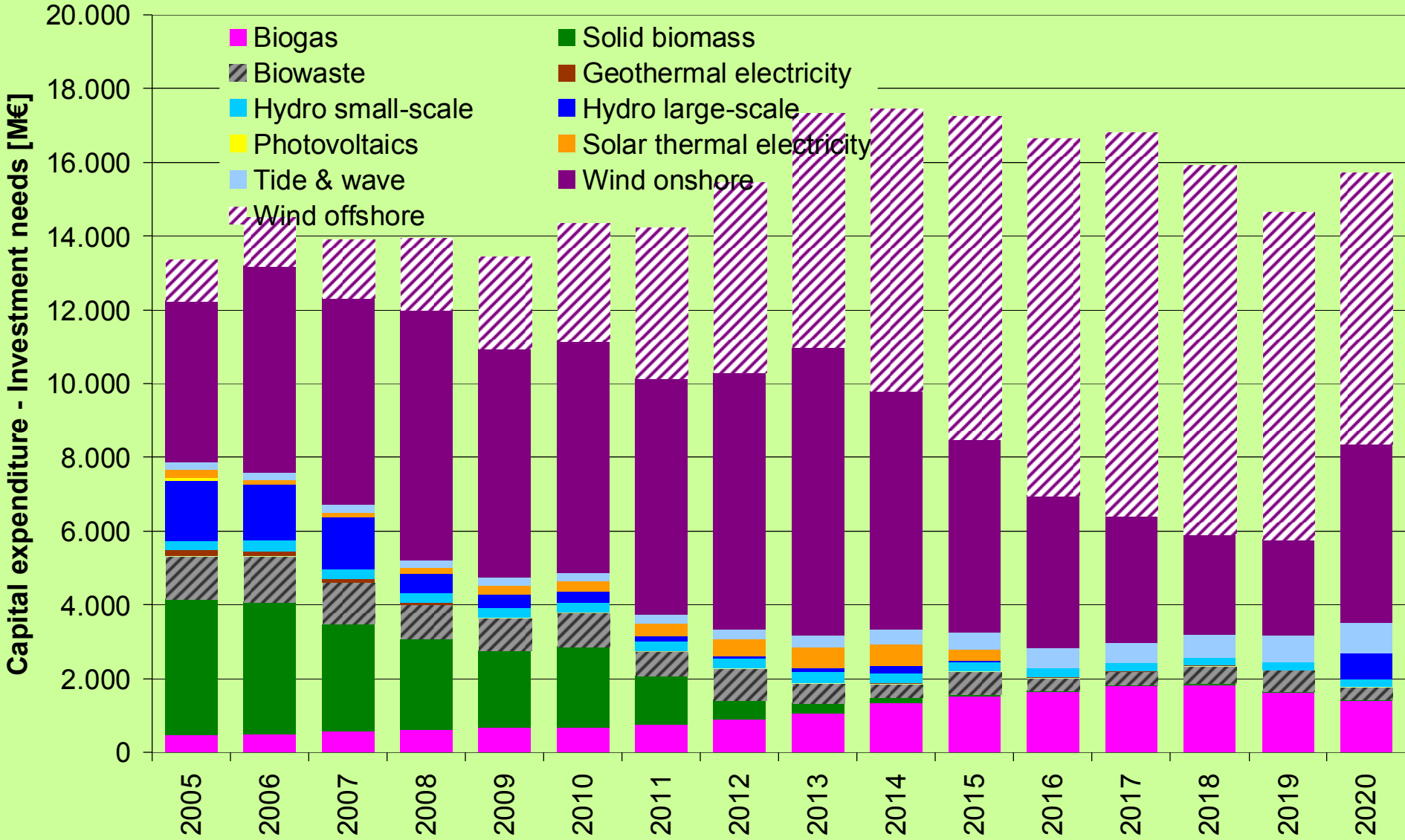
Investment needs up to 2020

BAU

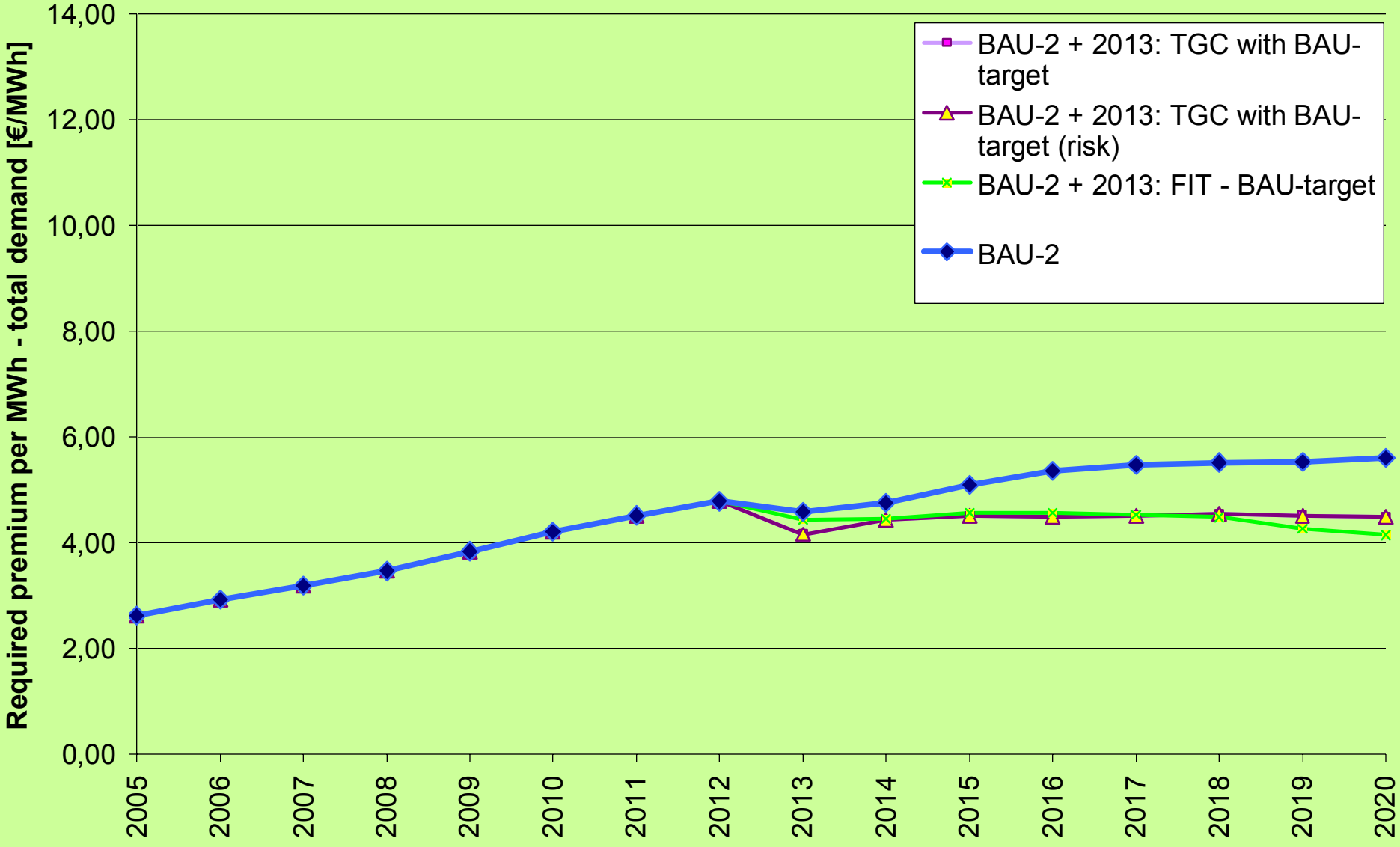


Investment needs up to 2020

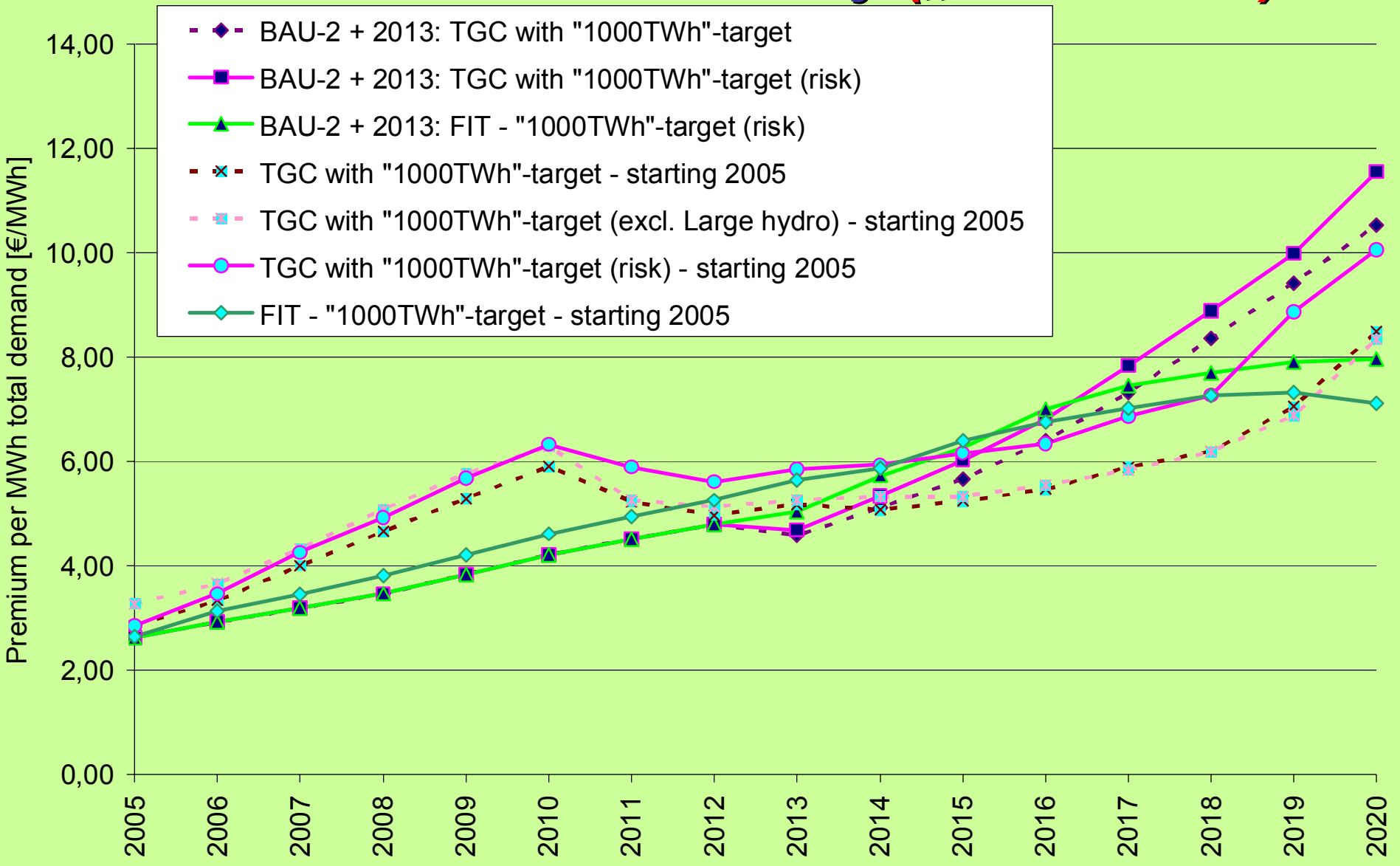
"1000 TWh"



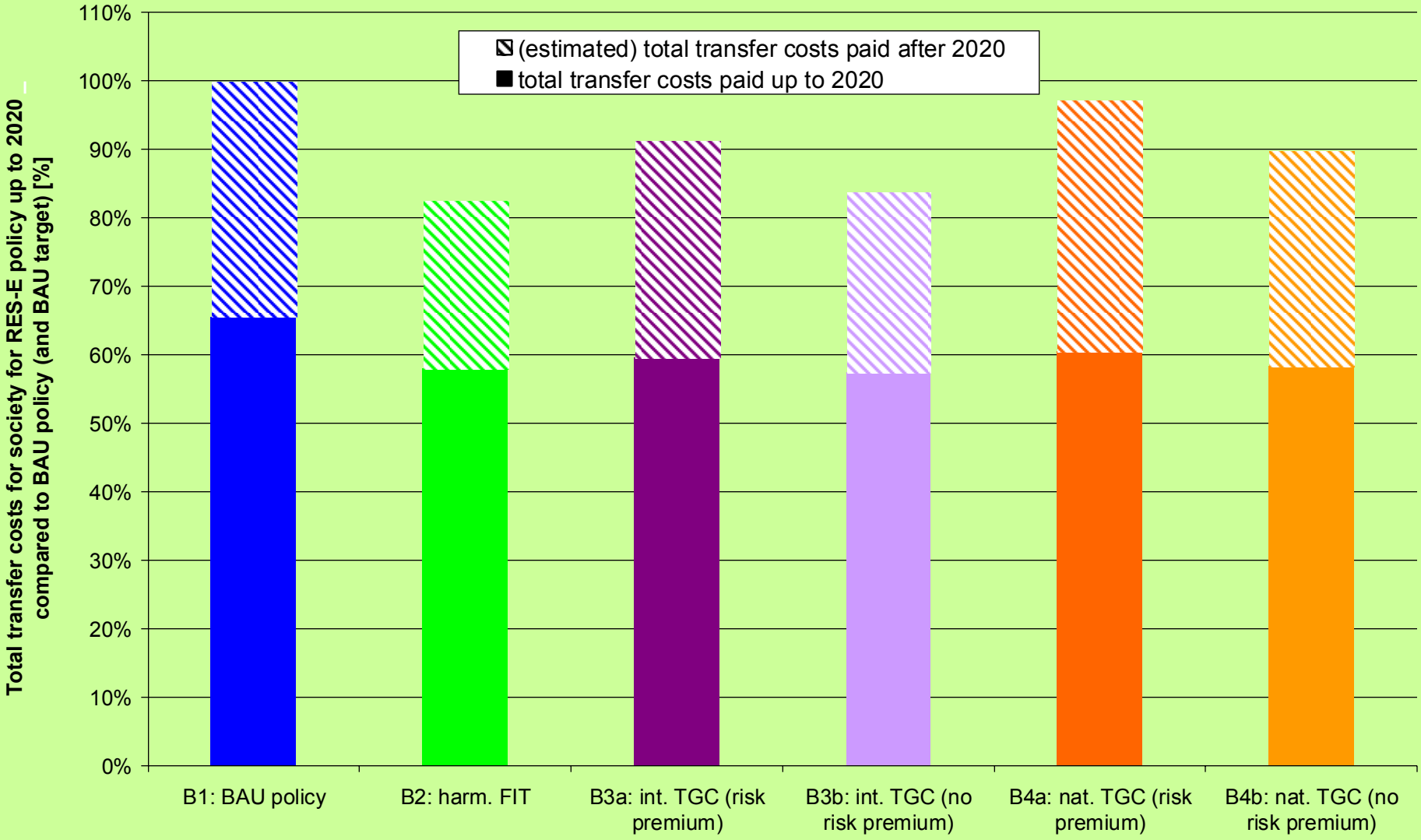
Transfer costs for society (BAU)



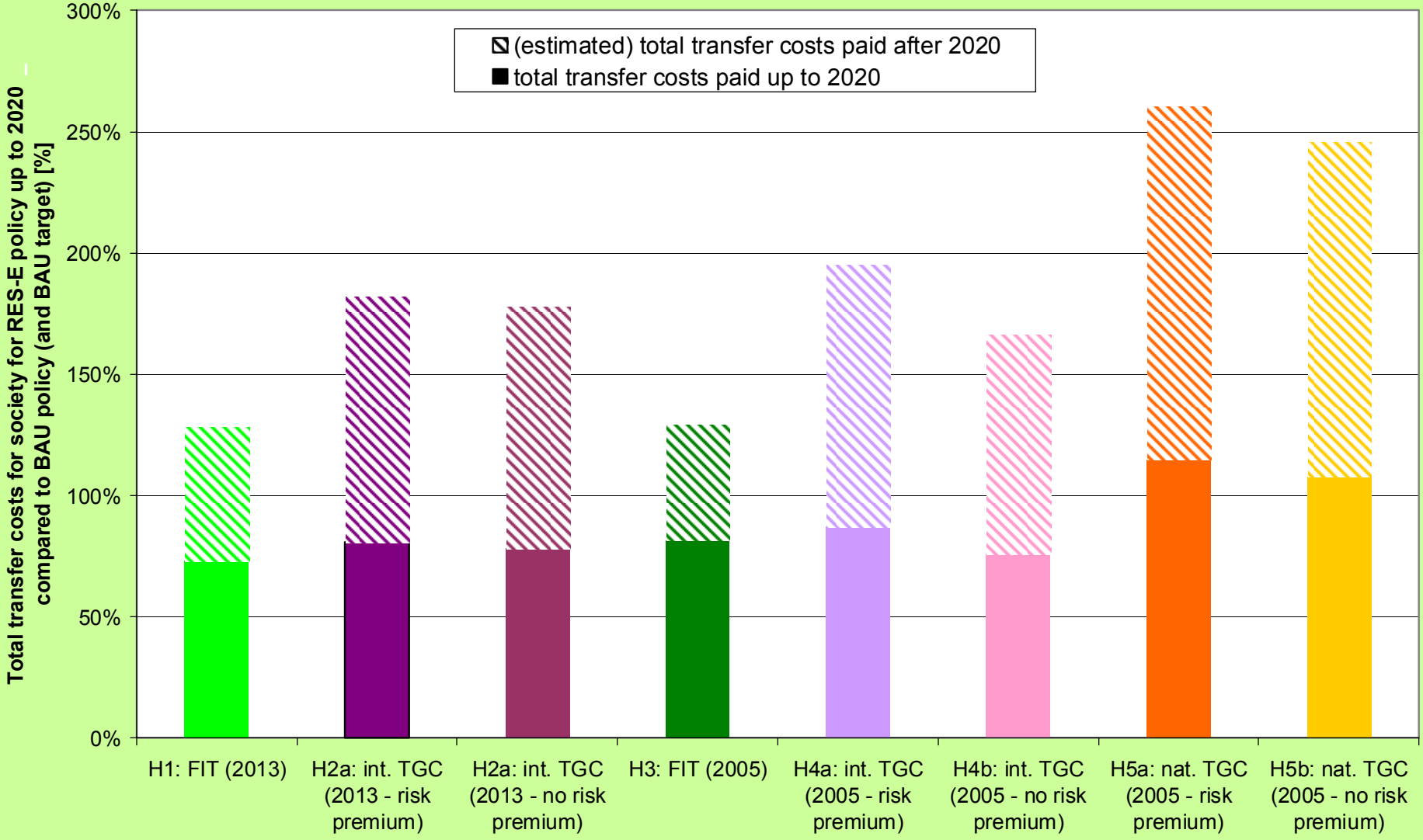
Transfer costs for society („1000TWh“)



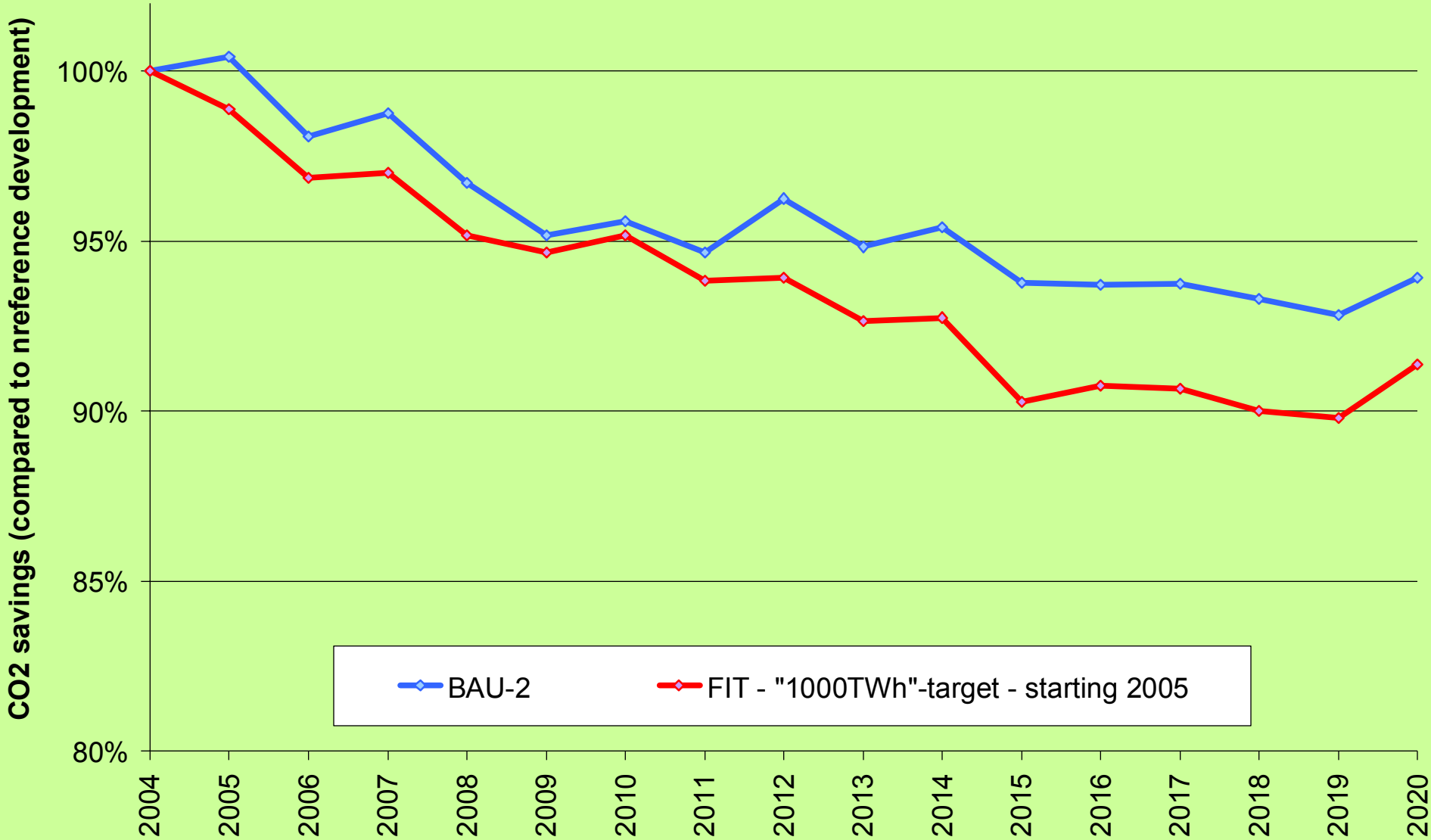
Transfer costs for society – Comparison all cases



Transfer costs for society – Comparison all cases



Impact on electricity prices



Impact on GHG emissions