ODYSSEE indicators and policies

EPE-GIZ training on indicators

EPE, Rio de Janeiro , September 17-19 2012

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1. **How ODYSSEE indicators are used to support policy making?**
2. How indicators can be used to evaluate policies
   1. Introduction
   2. Diffusion indicators and policies
   3. Indicators from ODYSSEE and MURE
   4. Case study: solar heaters in France (EMEEES)
   5. Case study: measuring the impact of ETS with ODYSSEE indicators

How energy efficiency indicators can be used to support policy making ?

- Indicators can first of all be used to monitor the results achieved in terms of energy savings or according to the way the targets are stated:
  - To check that the country is on track compared to its targets ("distance to target")
  - To conform to reporting requirements of the parliament or other institutions (e.g. EU Commission for EU member countries)
- To understand why the targets are not met so as to identify corrective policy measures: which sectors, end-uses, drivers are responsible for deviation (e.g. lifestyle, structural changes...)

Monitoring of EU target on energy efficiency : EU Energy Service Directive Directive (ESD)

- Target of 9% energy savings in 2016 compared to 2008 for each EU member country, with reporting obligation imposed to each EU member on actions undertaken and energy savings achieved, with harmonised calculation model using combination of top-down and bottom-up methods

- For second reporting in June 2011 , ~ ¾ of EU countries used Top-Down methods (i.e. indicators) to report their energy savings over 2008-2010

- These Top-Down methods are based on the same indicators as used in ODYSSEE.

Example of calculation of energy savings derived from energy efficiency indicators: officail submsion to EU Commsion nin NEEAP 2012

Transport sector 2000 - 2007

Energy savings achieved in the transport sector based on energy efficiency indicators	2000 Indicator	2007 Indicator	00-07 variation	2007 Activity	2007 savings ktoe	2007 Savings GWh
M_5 - Energy consumption of road vehicles in toe per car equivalent	1,07	0,99	-0,08	4,2	344	3999
M_6 - Energy consumption of rail transport in koe per gross ton-km	8,6	8,5	-0,07	12	0,87	10
M_7 - Energy consumption of inland waterways transport in koe per ton-km	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
P_8 - Energy consumption of cars per passenger km	43	41	-1,85	55	101	1179
A_1 for P_8 - Energy consumption of car in l per 100 km	7,07	6,78	-0,29	40771	97	1125
P_9 - Energy consumption of trucks and light vehicles per ton-km	54	81	26,59	21	-557	-6481
A_2 for P_9 - Energy consumption of trucks and light vehicles per vehicle (toe/veh)	4,03	3,73	-0,31	0,45	140	1630
P_{10} - Share of public transport in total land passenger transport (%)	20,1%	20,1%		69	-0,1	-1
P_{11} - Share of rail, inland waterways transport in total freight transport (%)	4,6%	2,6%		22	-25	-292

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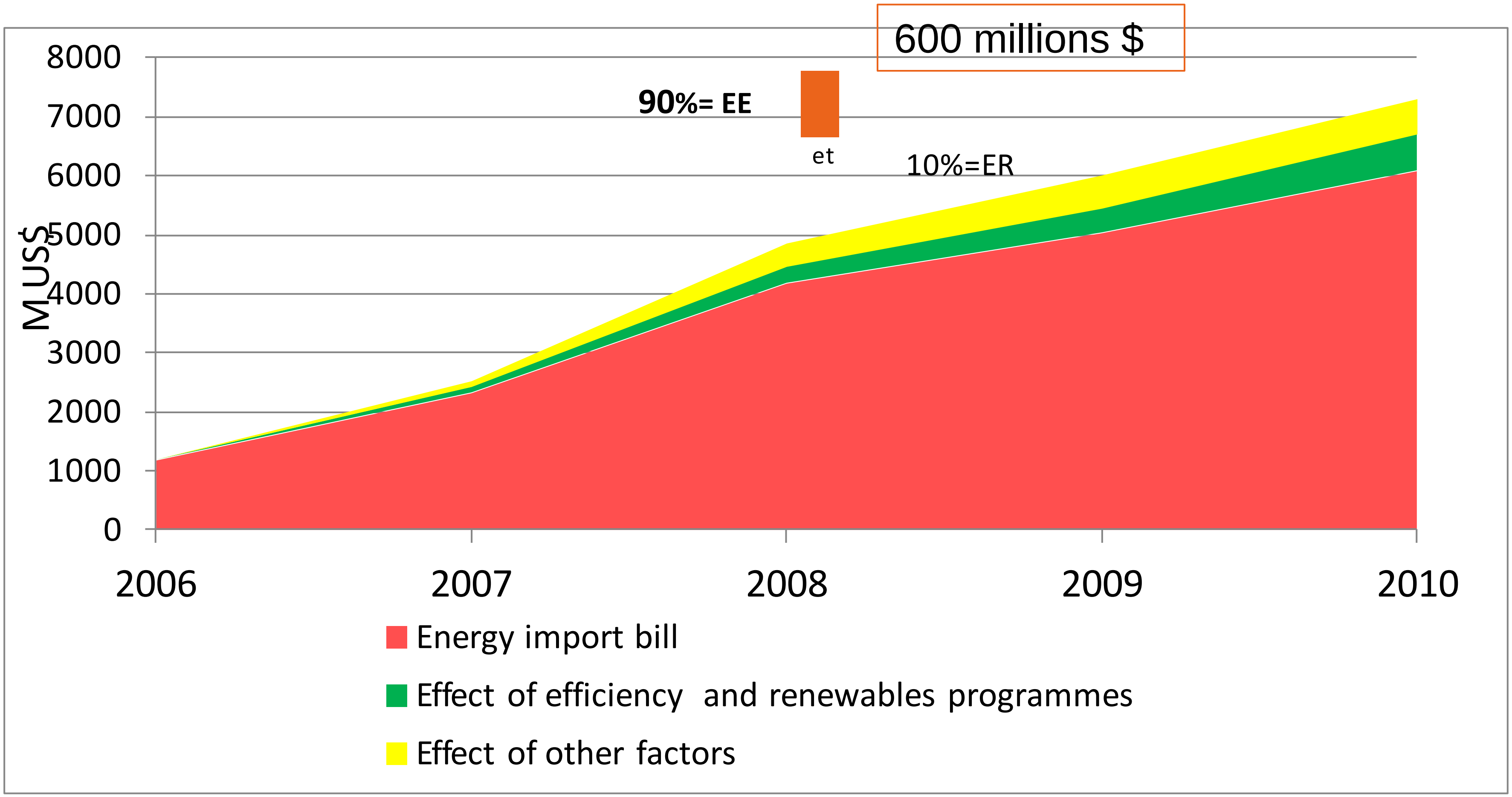
How energy efficiency indicators can be used to support policy making ? (cont'd)

- To benchmark the countries progress and performance with respect to specific countries (e.g. France with Germany for appliances; France with The Netherlands for heating) or group of countries (e.g. Denmark with main EU countries for heating), etc...

- To justify the public budget spent on energy efficiency programmes and to give arguments to policy makers to maintain or even increase the public budget on energy efficiency → need of innovative indicators that are meaningful for Economic of Finances Ministries (e.g. foreign currencies saved for importing counties, subsides saved from public budget for countries with price subsidies

Justification of the public budget spent

Impact of energy efficiency (EE) and renewables (ER) on import bill in Tunisia



Source ANME, 2012

Main policy users of ODYSSEE indicators

- DG-ENER:
  - EMOS database (Energy Market Observatory)
  - Explicit reference in the Energy Service Directive to ODEX indicator
  - Basis to measure energy savings with top-down methods for the monitoring of the ESD Directive ;

- IEA: to complete its indicators for European countries.

- EEA (European Environmental Agency):
  - Indicators factsheets
  - Annual TERM report;
  - Annual report "State and Outlook of the Environnement »

- National agencies and administrations (eg NEEAP evaluation)

*TERM monitors indicators tracking transport and environment integration in the EU

Conclusion: indicators and policies

- Policy makers need data and indicators to monitor the impact of their actions, to prepare new policy measures and to assess long– term energy savings potentials

- Data needed are not just merely the usual energy statistics from the energy balance but more detailed data by end-use

- Strategies have to be defined to collect such data ... in a permanent and cost-effective way:
    - by combining detailed surveys every 2 to 3 years with modelling or lighter surveys in between the survey years
    - by imposing reporting requirements to utilities, equipment manufacturers , utilities➔ exchange of international experience is very useful in that matter

Conclusion: indicators and policies

- Greater use of indicators by policy makers increases the quality and quantity of data and indicators ;

- Indicators need to be permanently adapted to meet policy requirements (e.g. in EU countries the increasing use of biomass and power production of households);

- Indicators should be easy to understand by policy makers...
  - This does not mean that they should be too simple, but that
  - Communication is important

- Indicators should be well updated to be useful for policy makers
  - This is somehow contradictory with the use of detailed indicators, that require detailed data produced with some delays, but means that
  - Updating procedures should be developed to provide preliminary detailed indicators (e.g. on energy savings) by mid year t for year t-1 ➔ under development for ODYSSEE.

Conclusion :multiple use of energy efficiency indicators

- Beyond a monitoring of the energy savings and progress achieved these indicators can be also used :
  - ✓ To understand why the targets are not met so as to identify corrective measures
  - ✓ To compare/benchmark the countries progress and performance with respect to energy efficiency performances and assess potential for improvement
  - ✓ Finally to assess the long term potential for energy efficiency improvement so as to see what new measures could be implemented ➔ indicators are the main input variables of the end-use models to be used for such assessments (e.g. MEDEE, MAED, LEAP)

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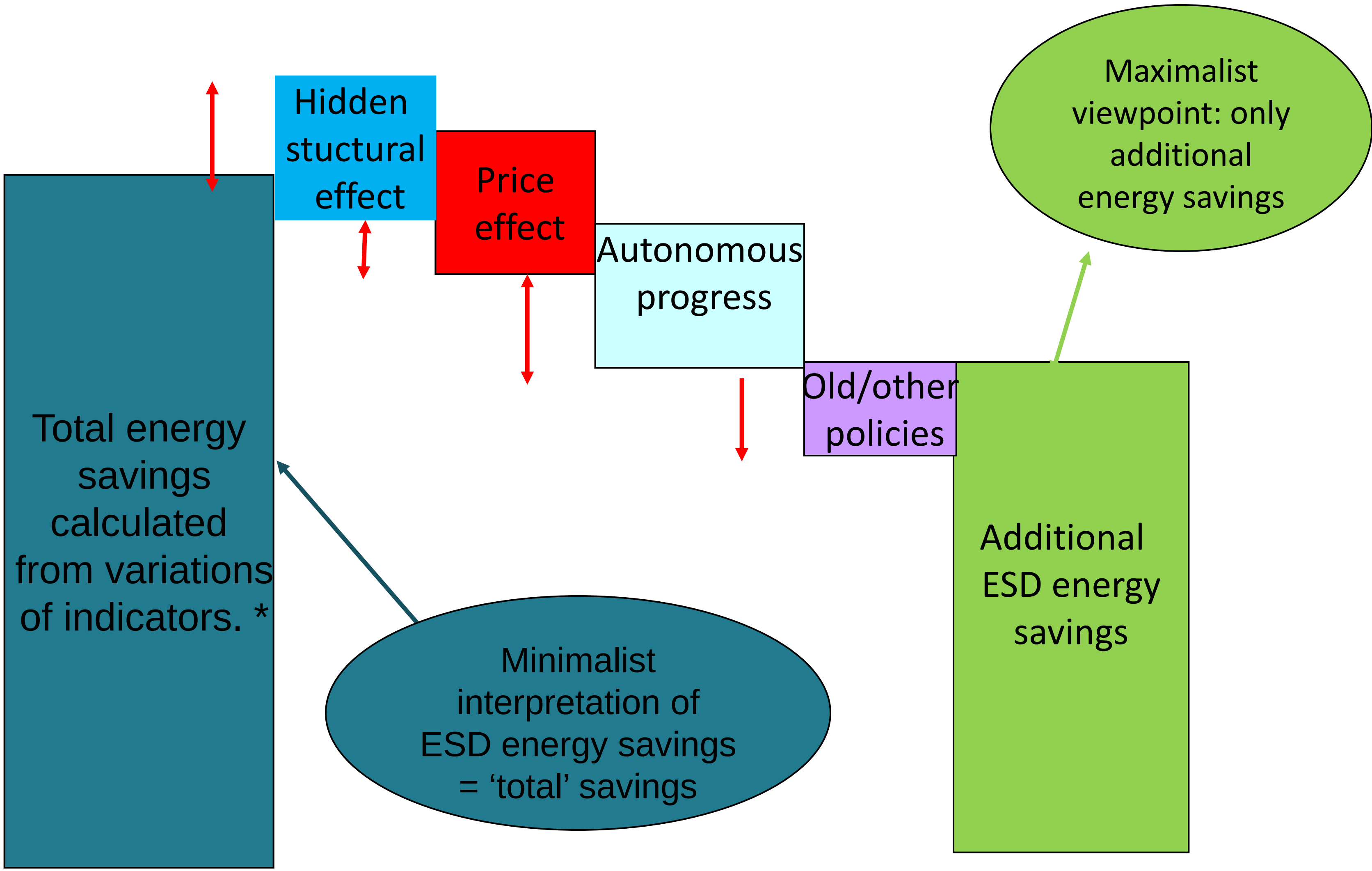
Introduction

- Countries are implementing monitoring systems with indicators to measure the progress achieved and calculate the energy savings (e.g. ODYSSEE)
- Most often the results of these evaluations only correspond to total energy savings, including the effect of policies but also energy prices and autonomous trend that would have happened even without policies .
- The question for policy makers is to relate these savings to policy and possibly to isolate the part of energy savings linked to the policies implemented, the so called "additional savings".

Policy related energy savings versus total savings as measured with with top-down methods: theoretical principle



*already corrected for main structural effects

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Introduction

- Different methods have been tried to relate savings from TD indicators to policies :
  1. The easiest one is to work with diffusion indicators and to relate changes in their market diffusion to the policy measures.
  2. A second one is to aggregate measures into one indicator measuring the policy intensiveness (e.g. relating ODYSSEE indicators and MURE indicators.
  3. The third one, developed within EMEEES is to evaluate these savings through econometric modelling
  4. The fourth one is to evaluate one policy by measuring the changes in different indicators affected by the measure (e.g. done recently for the EU Emission Trading Scheme (ETS)

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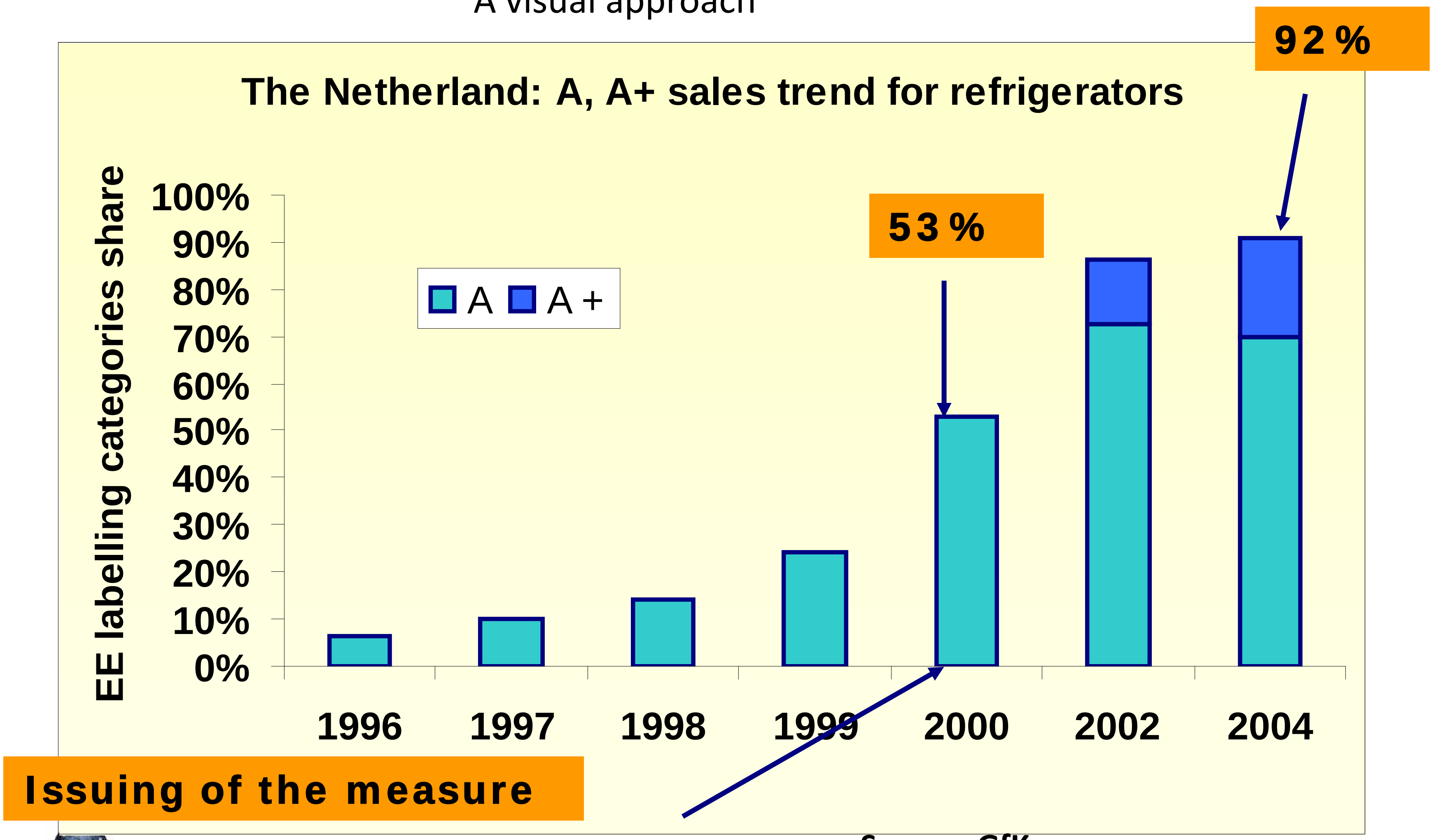
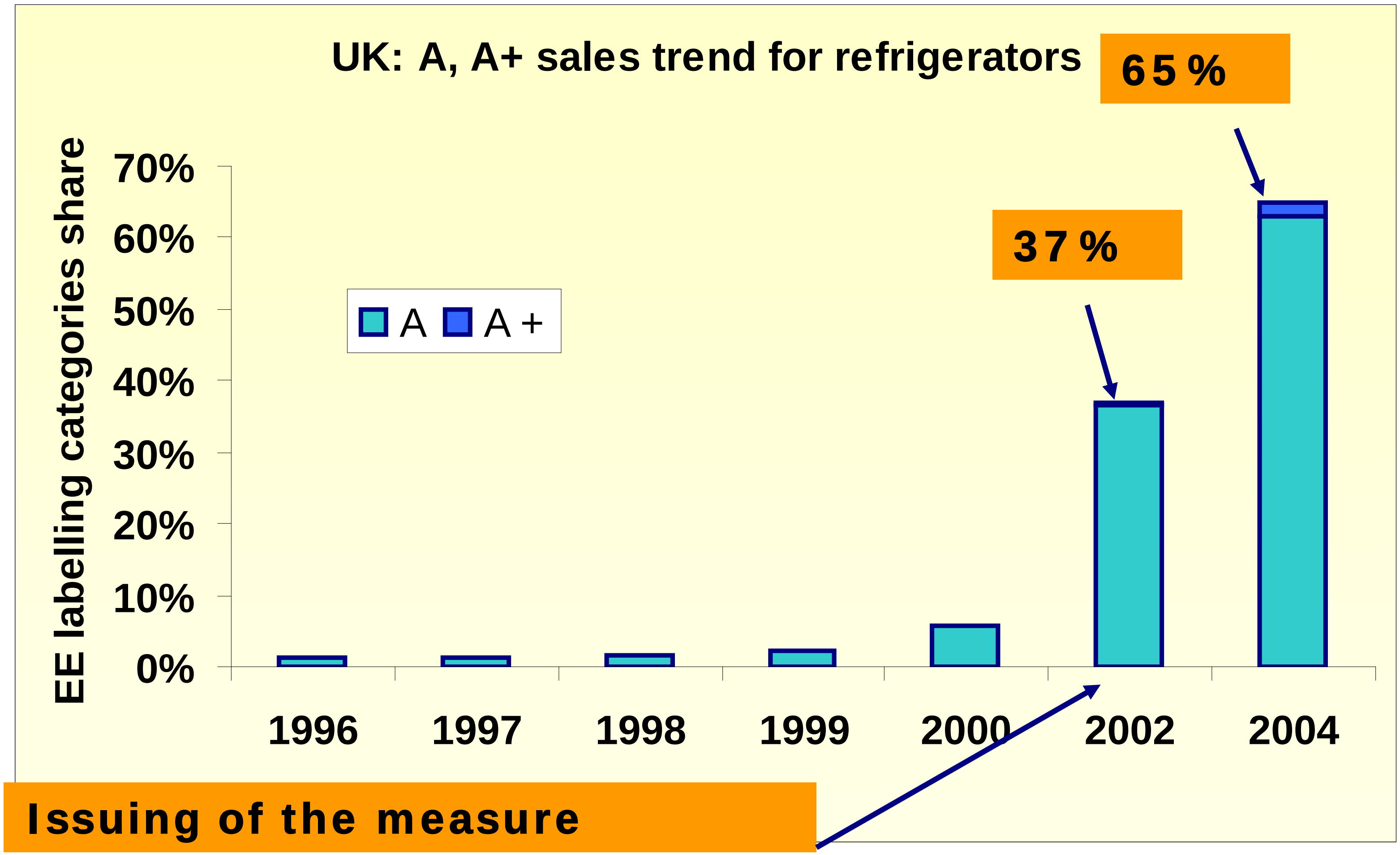
Diffusion indicators and policies: case of cold appliances in The Netherlands

A visual approach



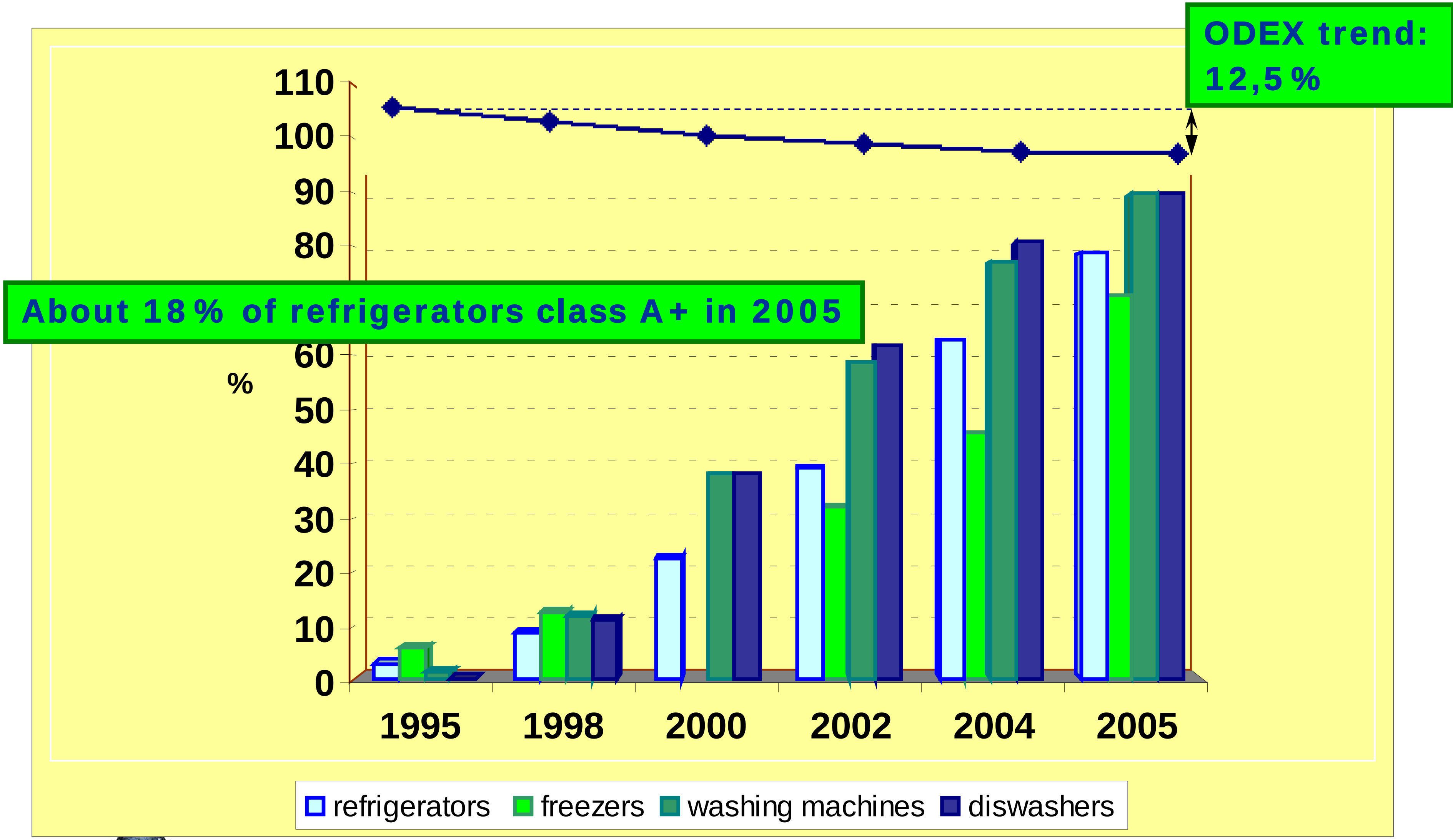
Source: GfK

Diffusion indicators and policies: case of cold appliances in UK

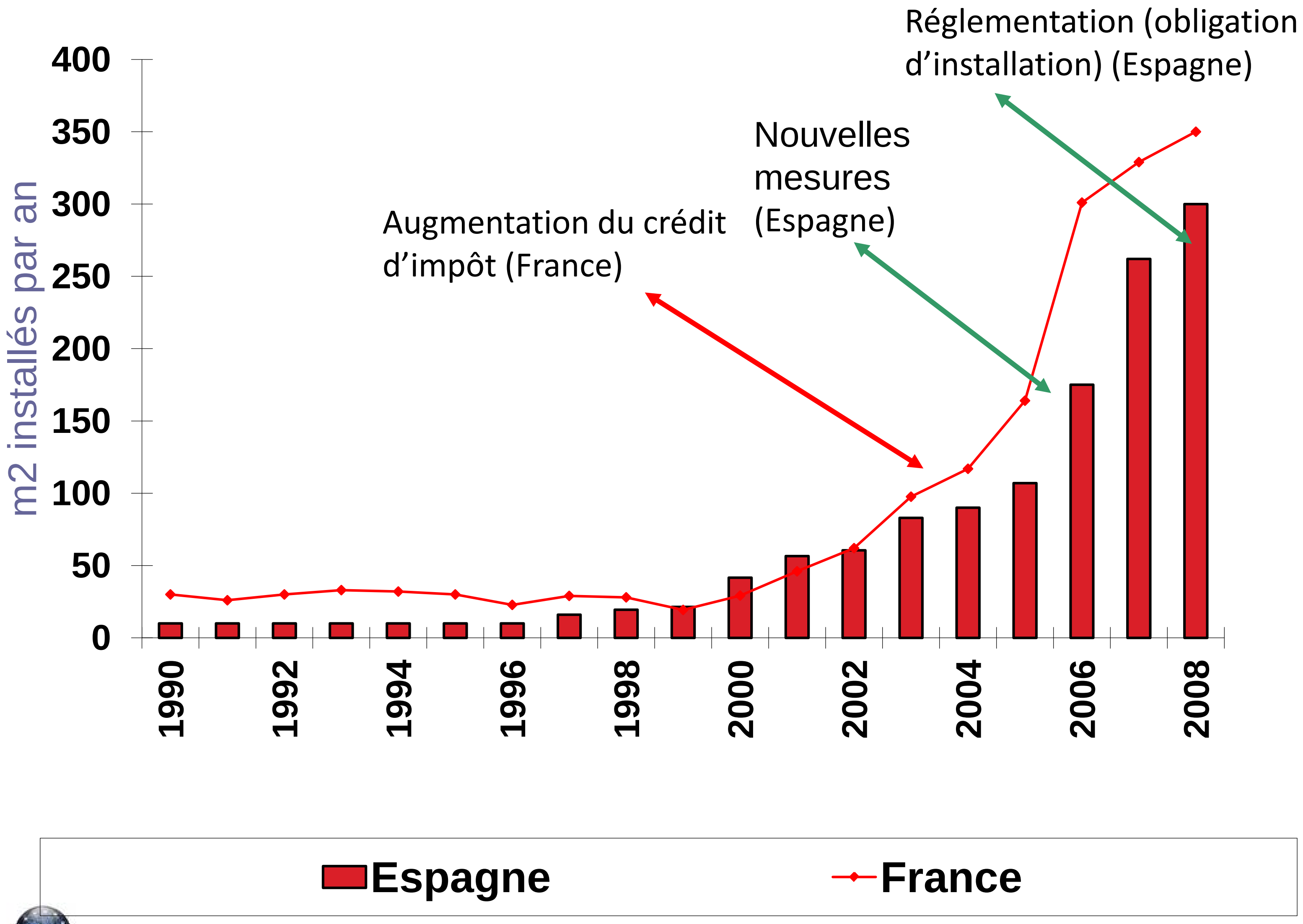


Source: GfK

Impact of measures at EU level: market share of label A and A+ for cold and washing appliances and trend in large appliances ODEX

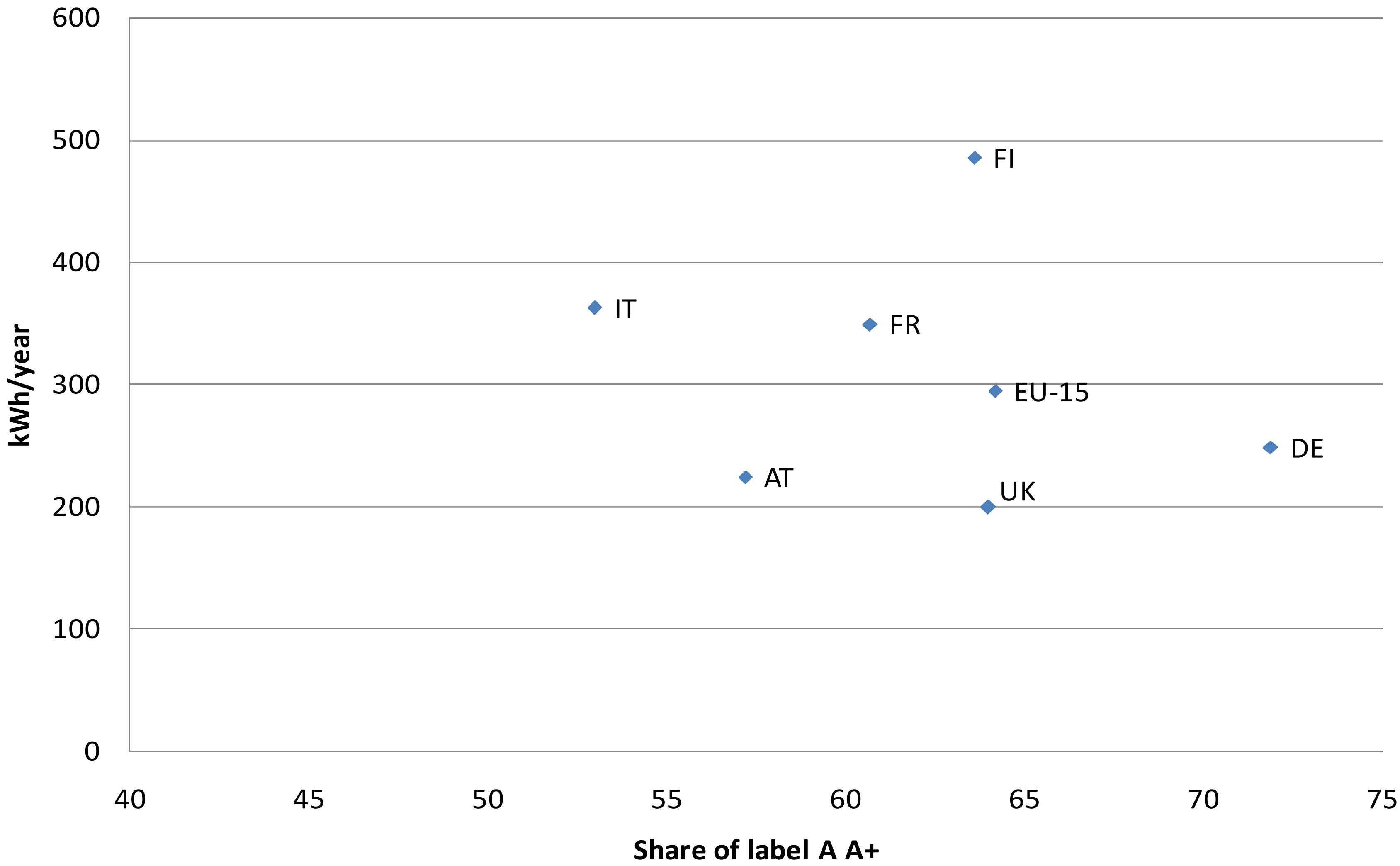


Impact of policies on the solar market: France and Spain



Source: élaboration Enerdata d'après données ObservER

Benchmarking of efficiency level and policies: case of refrigerators and specific consumption (2004)



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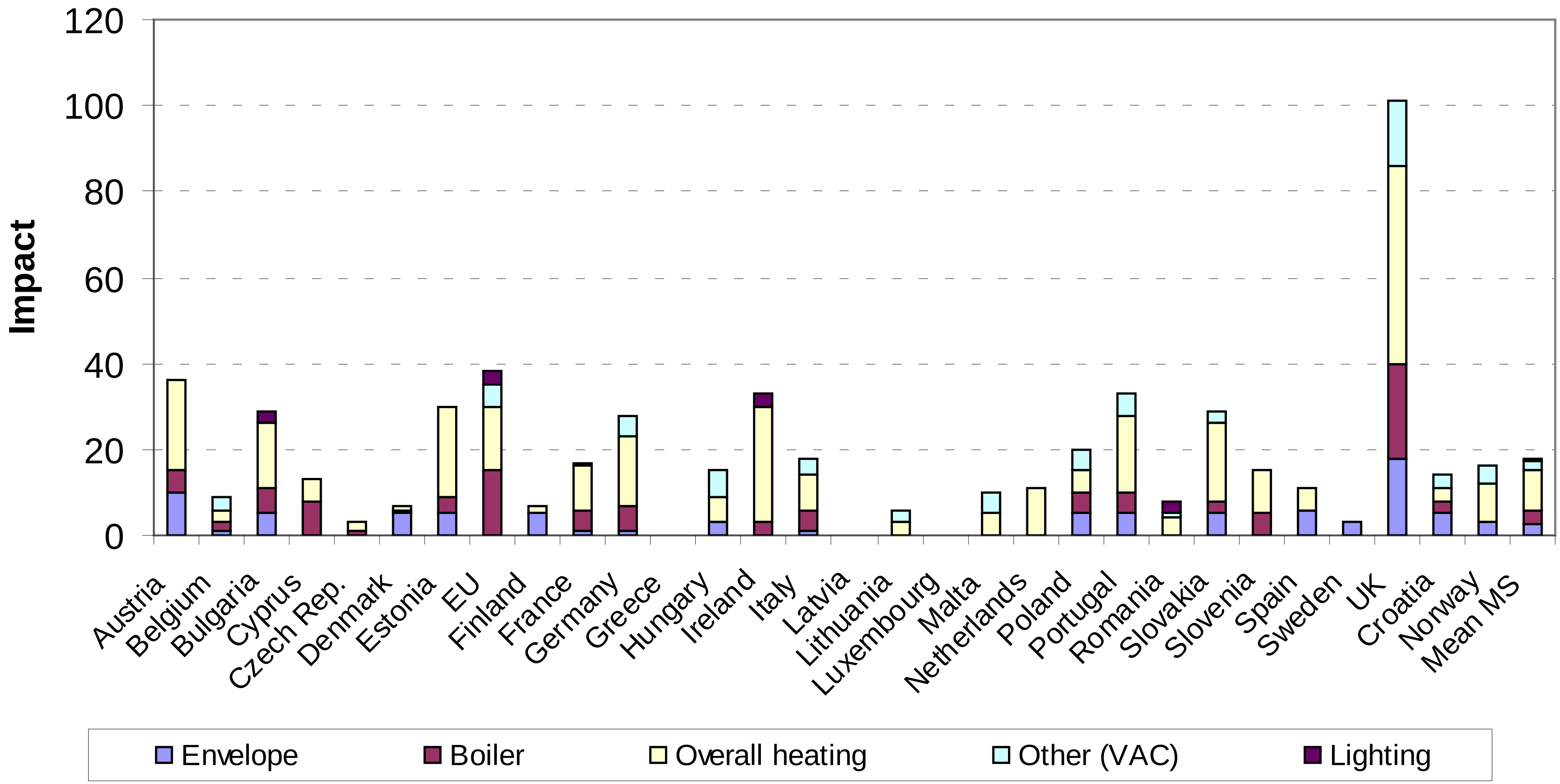
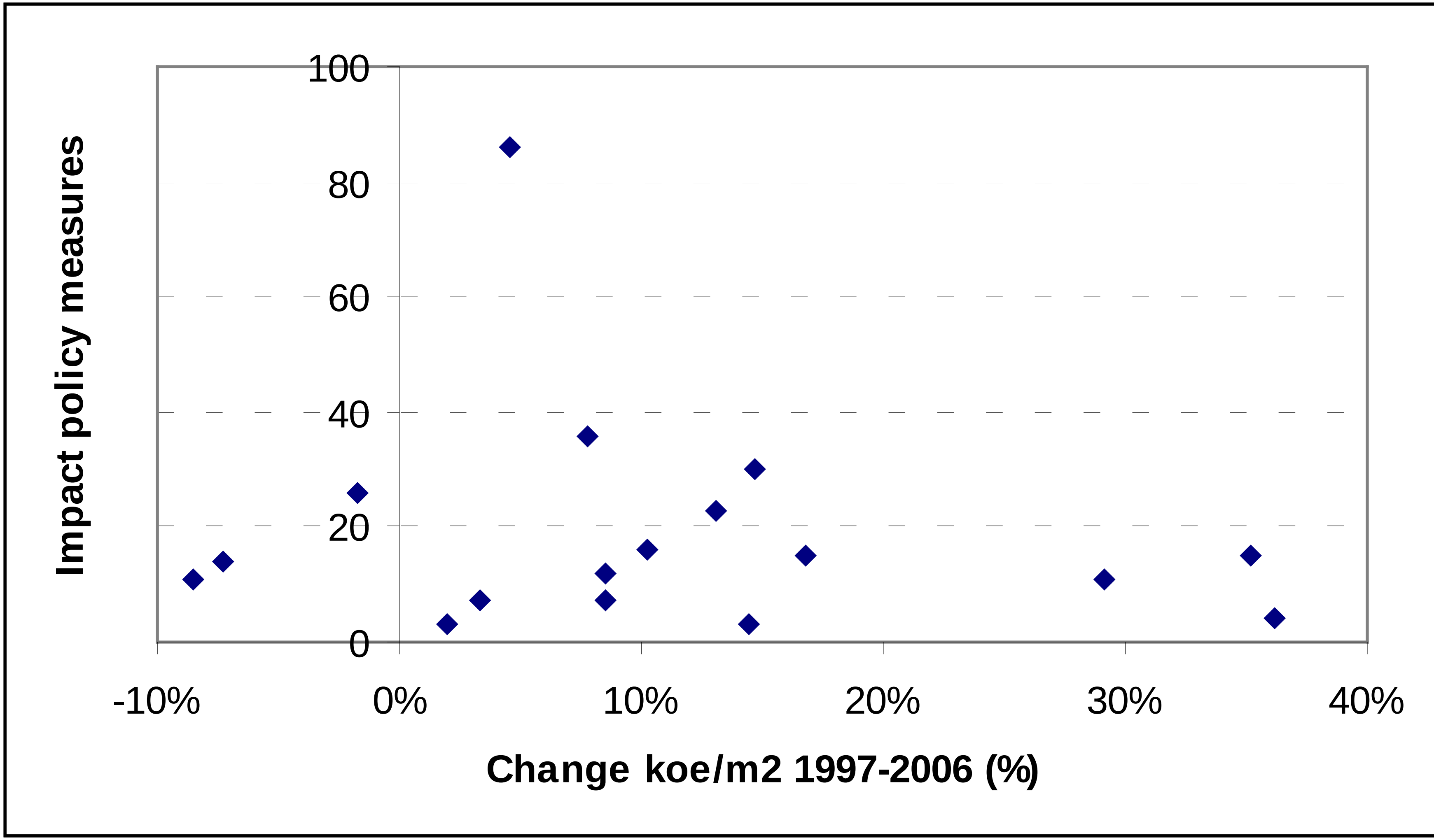
Impact of policy measures in MURE: indicator of policy intensity

- Method: Qualitative estimate per measure
  - High if savings > 1,5% of total energy use
  - Medium 0,5 – 1,5%
  - Low < 0,5%
- Calculation of total policy intensity
  - Policy measures on targeted energy use
  - Weight 5 (high), 3 (medium) or 1 (low)

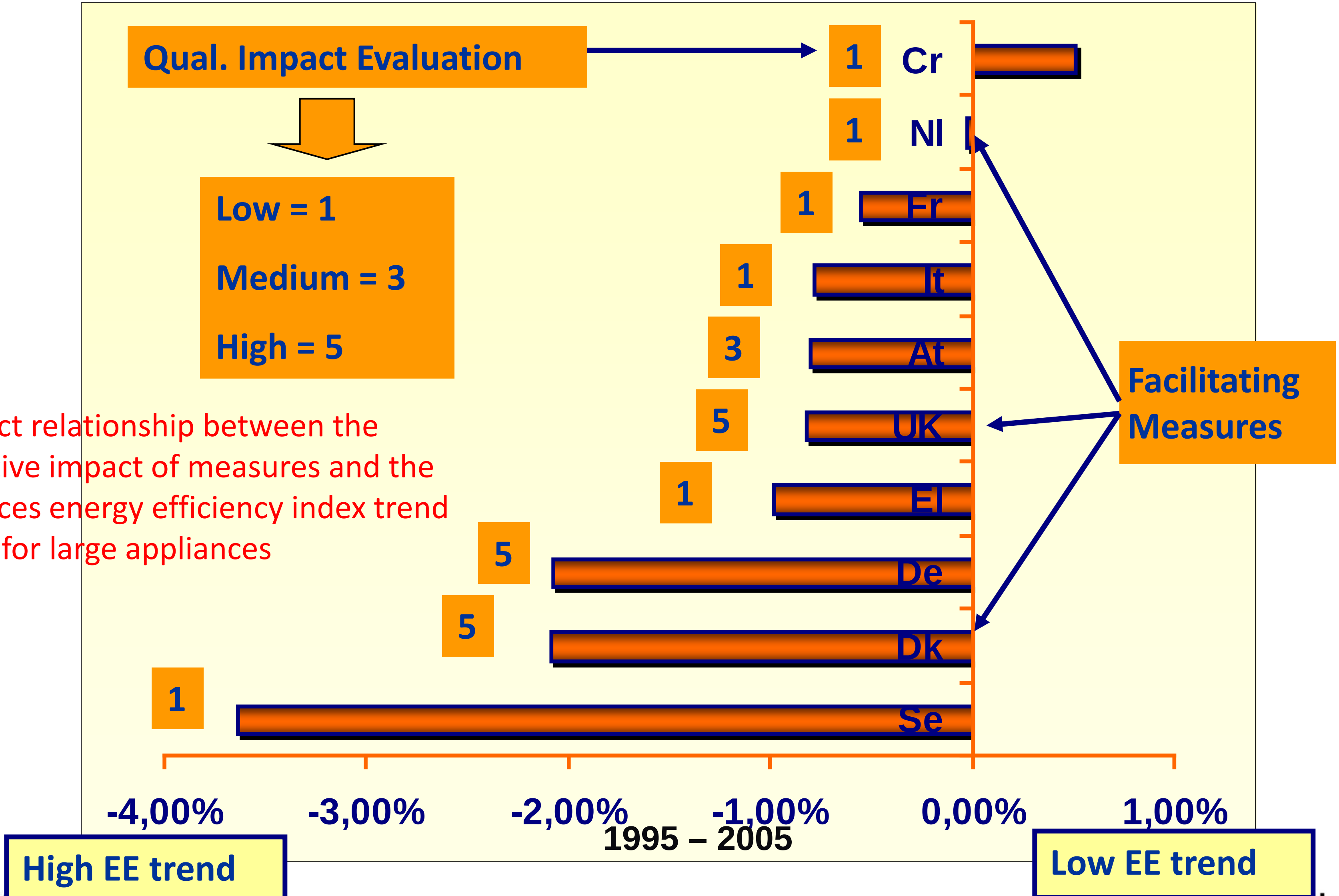
Impact of policy measures in MURE: indicator of total policy intensity for households



Impact of policy measures versus efficiency increase for space heating in Households



Relationship between energy efficiency trend and qualitative impact of measures



No direct relationship between the qualitative impact of measures and the appliances energy efficiency index trend (ODEX) for large appliances

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Harmonised Methods for Evaluating Energy End-Use Efficiency and Energy Services: EMEEES project

- Context : the ESD Directive required member countries to report on the energy savings related to the policies implemented, the so called “additional savings”
- Objective of the project was to propose to the EU Commission and Member Countries methodologies to measure policy related savings
- Three approaches followed:
  - Bottom-up (BU)
  - Top-down with indicators (TD)
  - Mix of BU and TD
- The outcome of the project were used after simplification to reach a political consensus and get the methodology recommended by the EU commission
- Enerdata was in charge of developing the TD methodology
- The methodology is briefly presented in the following slides below
- More information at http://www.evaluate-energy-savings.eu/emeees

Corrections to calculate additional energy savings in EMEEES case studies

- EMEEES has focussed on two possible corrections : autonomous trend and market price;
- The project has outlined the pros and cons of doing such corrections and proposed a method in case such corrections were decided;
- Simple econometric methods were used to quantify the impact of autonomous trend and market prices, on purpose :
  - ✓ in view of a possibility of harmonisation and the easiness of their understanding
  - ✓ and taking into account data limitations for additional explanatory variables (e.g. price/tax on cars, cost of equipment);
- Generally results of the econometric analysis were not very robust as data series used often too short

Methods to define corrections of total energy savings in EMEEES case studies

$$\ln ES = a + b\,T + c \ln P + d \ln A + e \ln ES_{-1} + K$$

with:

ES : energy saving indicator ; b: trend, T: time,

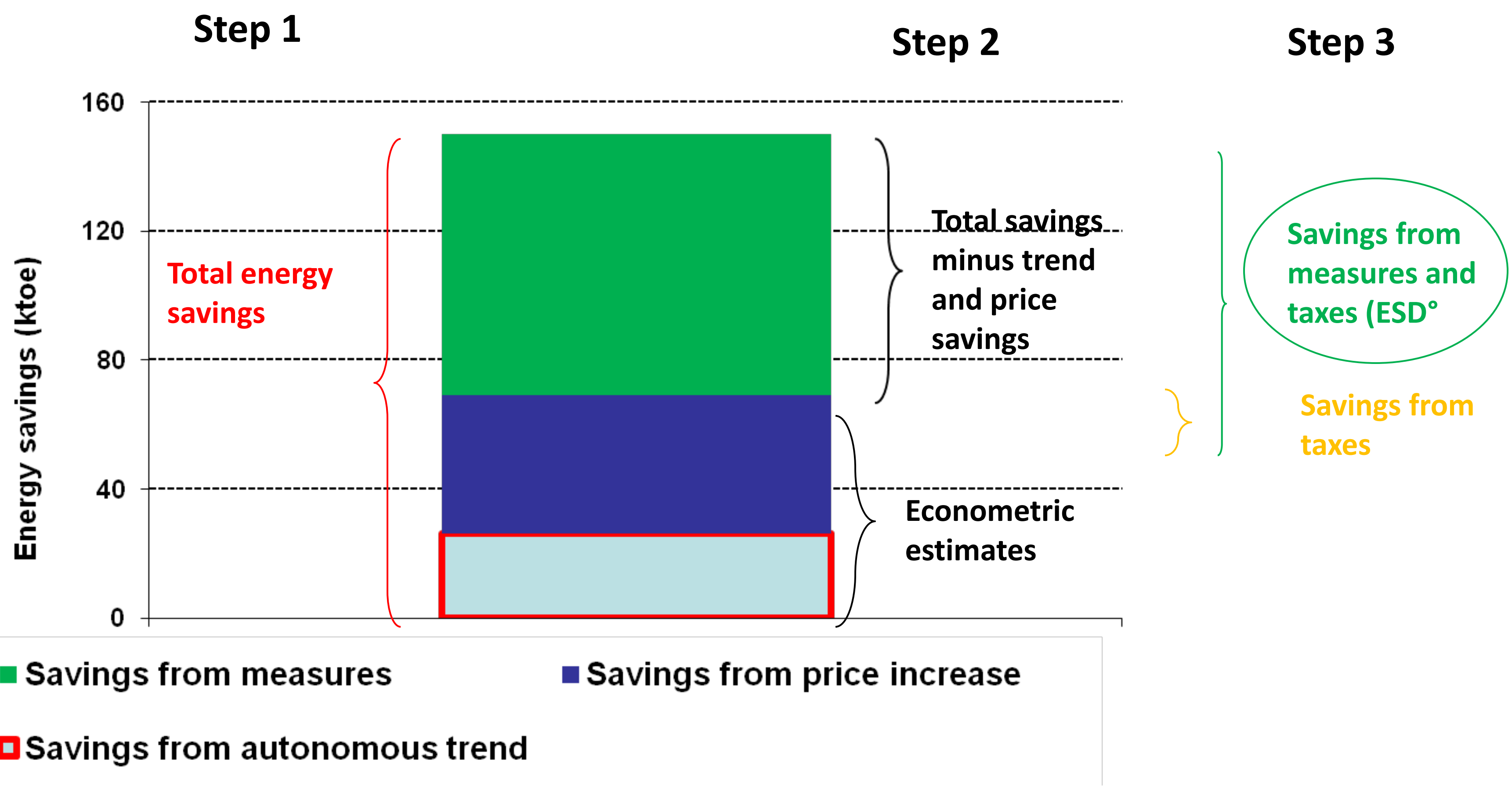
c : price elasticity, P: energy price (2 components: ex-tax (market) price and tax),

d: elasticity to macro economic variable A (e.g. GDP) to capture the impact of business cycles

Too simple …or too complex?

Methods to remove other factors from total top-down energy savings – example)

Estimation of energy savings in year t (e.g. 2012)



Indicators used to evaluate top-down energy savings in EMEEES case studies

1 Building shell & heating (households)	Heat consumption per m2
2 Household electricity uses	Specific consumption (kWh/dwelling)
3 Specific white goods (refrigerators)	Specific consumption (kWh/dwelling
4 Solar thermal collectors	m2 installed
5 Building shell & heating in tertiary sector	Energy use per employee/m2
6 Electricity end-uses in tertiary sector	Electricity use per employee/m2
7 Industrial thermal energy use	Energy use per output
8 Industrial electricity consumption	Electricity use per output
9 Industrial CHP	Share of electricity cogenerated
10 New cars	Specific consumption (l/100 km)
11 Car, bus and truck stock improvement	Specific consumption (l/100 km)
11 Modal shift in passenger transport	Share of public transport
13 Modal shift in goods transport	Share of rail & water transport
14 Energy taxation	ODEX or final energy intensity

Case study on solar heaters

- Indicator used to measure savings: diffusion of solar water heaters in terms of installed stock in m2

- Modelling the diffusion of solar water heaters may be done with the following variables:
  - Autonomous trend
  - Energy price
  - Cost of solar water heaters
  - Energy policy measures (e.g. subsidies, tax credit) (After / before 1995)

- In practice, taking into account the data usually available, the diffusion of solar water heaters in the absence of policy measures (baseline) can be modelled with two main variables :
  - Time to capture the autonomous trend
  - Average price of energies used for water heating to measure the impact of prices

➔ The baseline diffusion is a function of an autonomous trend and a price effect; the energy savings from policies will be calculated from the difference between the actual diffusion and the baseline diffusion

Econometric analysis: case of France
Influence of energy prices not significant

- The price effect is generally not validated by statistics test. When it is the coefficient is positive instead of negative or the value of the coefficient (elasticity) is too high and finally not really relevant economically.

- Taking into account the cost of solar water heaters equipment would be better, but most of the evolution of the cost relate more to policies (subsidies) than to technical progress and scale effect . Moreover no historical data are available.

- Example of econometric analysis for France
  - Regression with autonomous trend and average price of energies used for water heating between 1990 and 2000

    Ln (IC) = 0.27 X ln (t) – 0.07 X ln (P) + 1.96

    t-stat (6.6) (0.2)

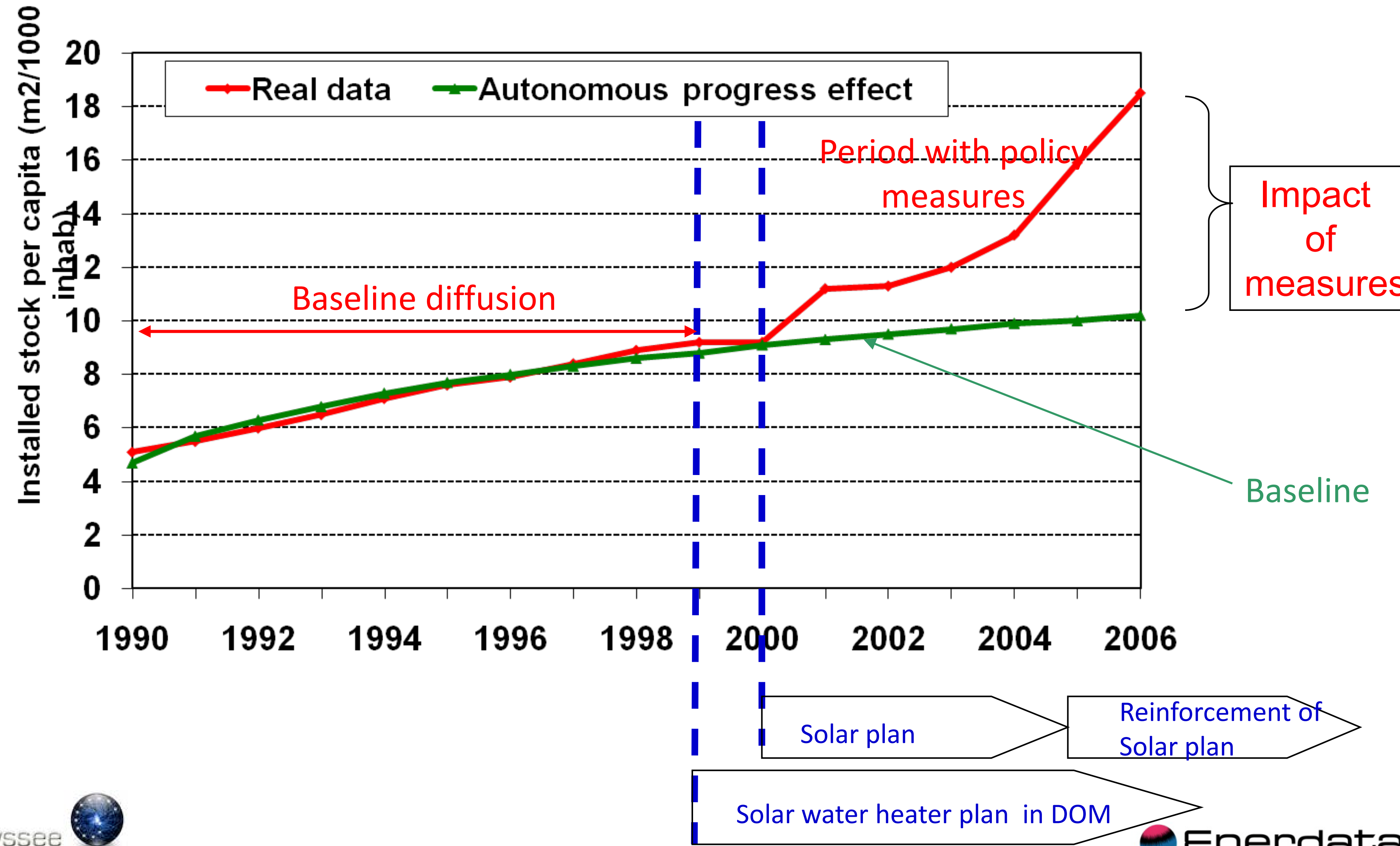
    R^2 = 0.96 => Good correlation (R^2 near 1) ; F-stat = 104 => regression is globally significant (F-statistic is > 4.5); T-stat > 1.9 for time but <1.9 for prices and negative elasticity=> price effect not significant
  - Regression with autonomous trend only between 1990 and 2000

    Ln(IC) = 0.28 X ln(t) + 1.54

    t-stat (15.2) , R^2 = 0.96, F-stat = 232 ➔ Good correlation, regression globally significant

Econometric analysis : case of France

Modelling the baseline



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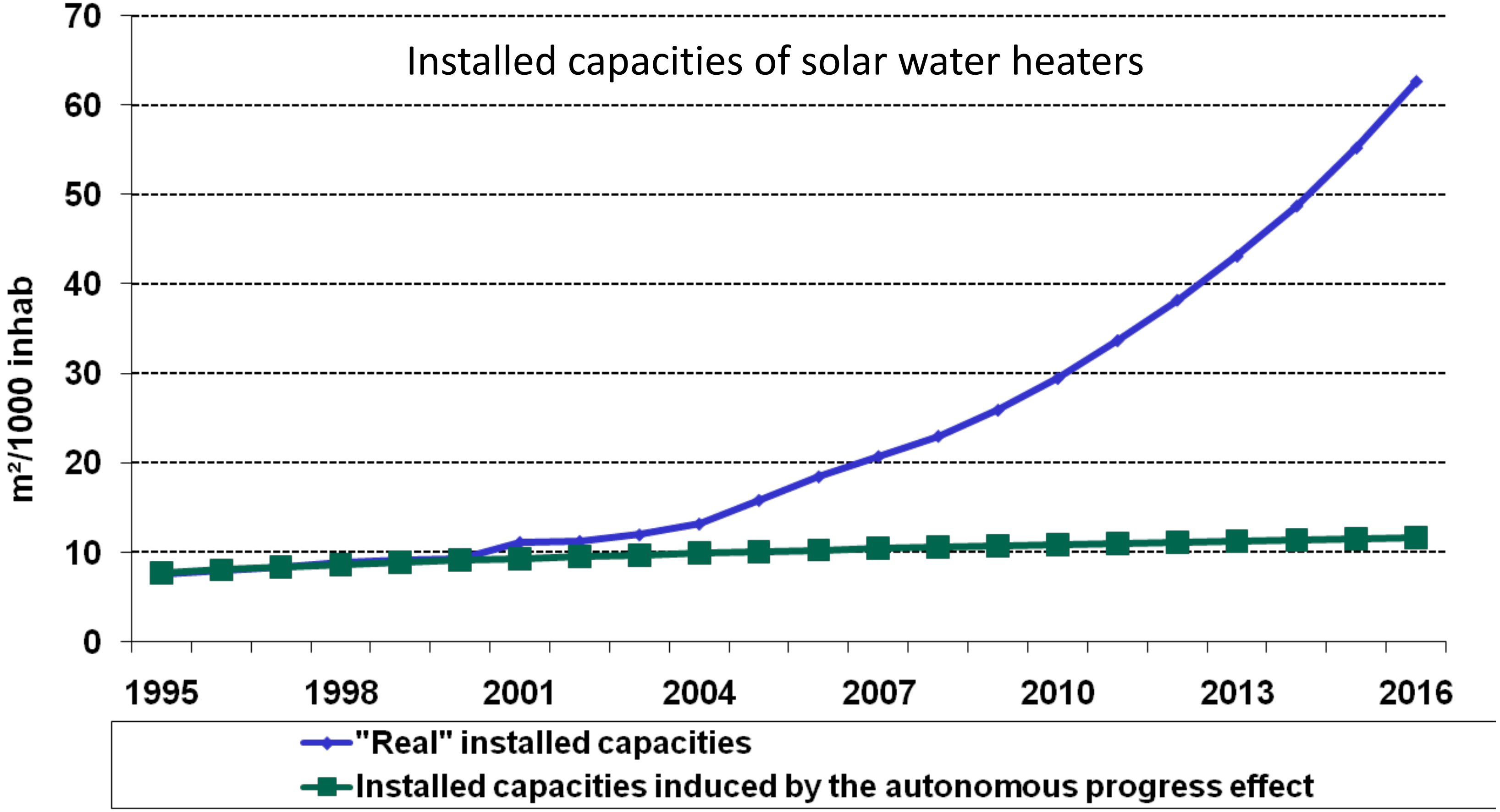
Calculation of “policy” savings: case of France

- Same methodology in three stages whatever the groups of countries :
  - Stage 1 : Estimation of the installed capacities variation from autonomous trend based on the econometric analysis (country specific trends)
  - Stage 2 : Calculation of the total energy savings by multiplying the number of m2 by an amount of energy saving per m2 depending on the country
  - Stage 3 : Energy savings linked to policies calculated by difference: total savings minus trend related savings

Calculation of "policy" savings: case of France

➢Stage 1 : Estimation of the evolution of the installed capacities induced by the autonomous trend



"Real" installed capacities are obtained by assuming a diffusion of solar water heaters at the same rhythm as over 2001-2006

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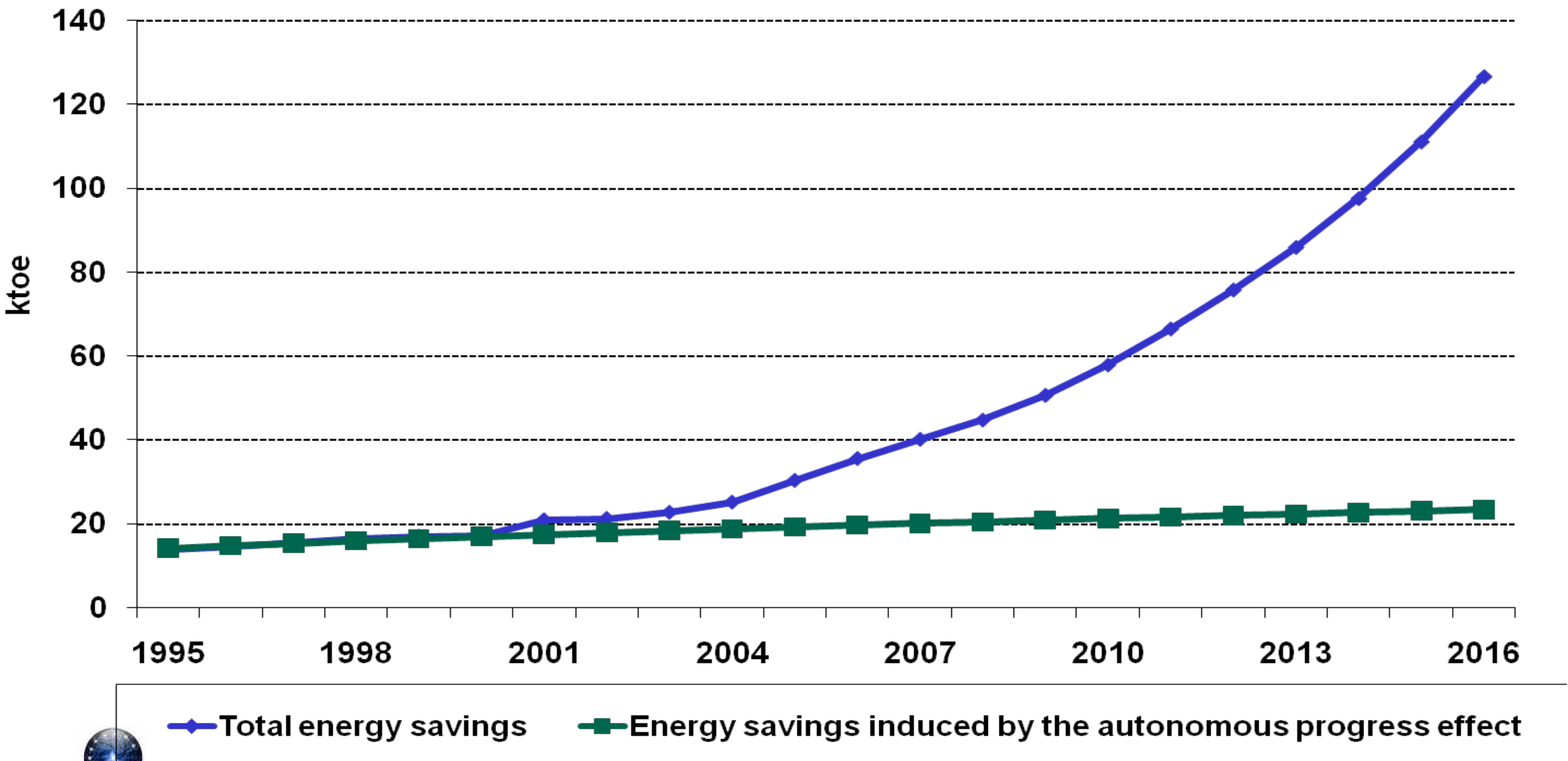
Calculation of of “policy” savings: case of France

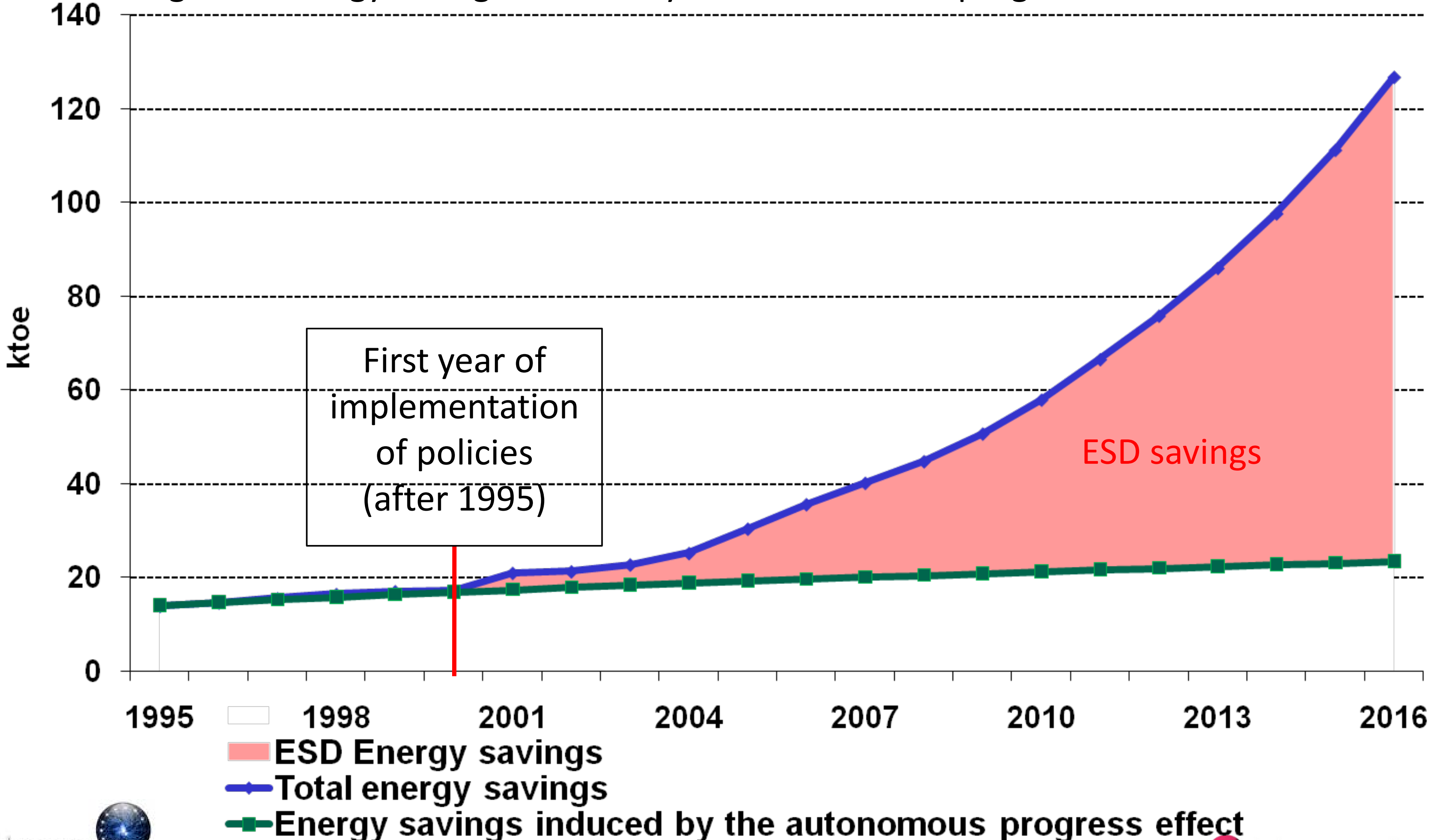
➢Stage 2 : Annual energy savings calculated from installed area of solar collectors and a coefficient in toe/m2 (useful energy provided by the solar energy

Energy savings related to the diffusion of solar water heaters



Calculation of of "policy" savings: case of France

- Stage 3 : Policy related energy savings calculated by the gap between total energy savings and energy savings induces by the autonomous progress effect



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* Prepared by Wolfgang Eichhammer, Fraunhofer ISI, June 2012

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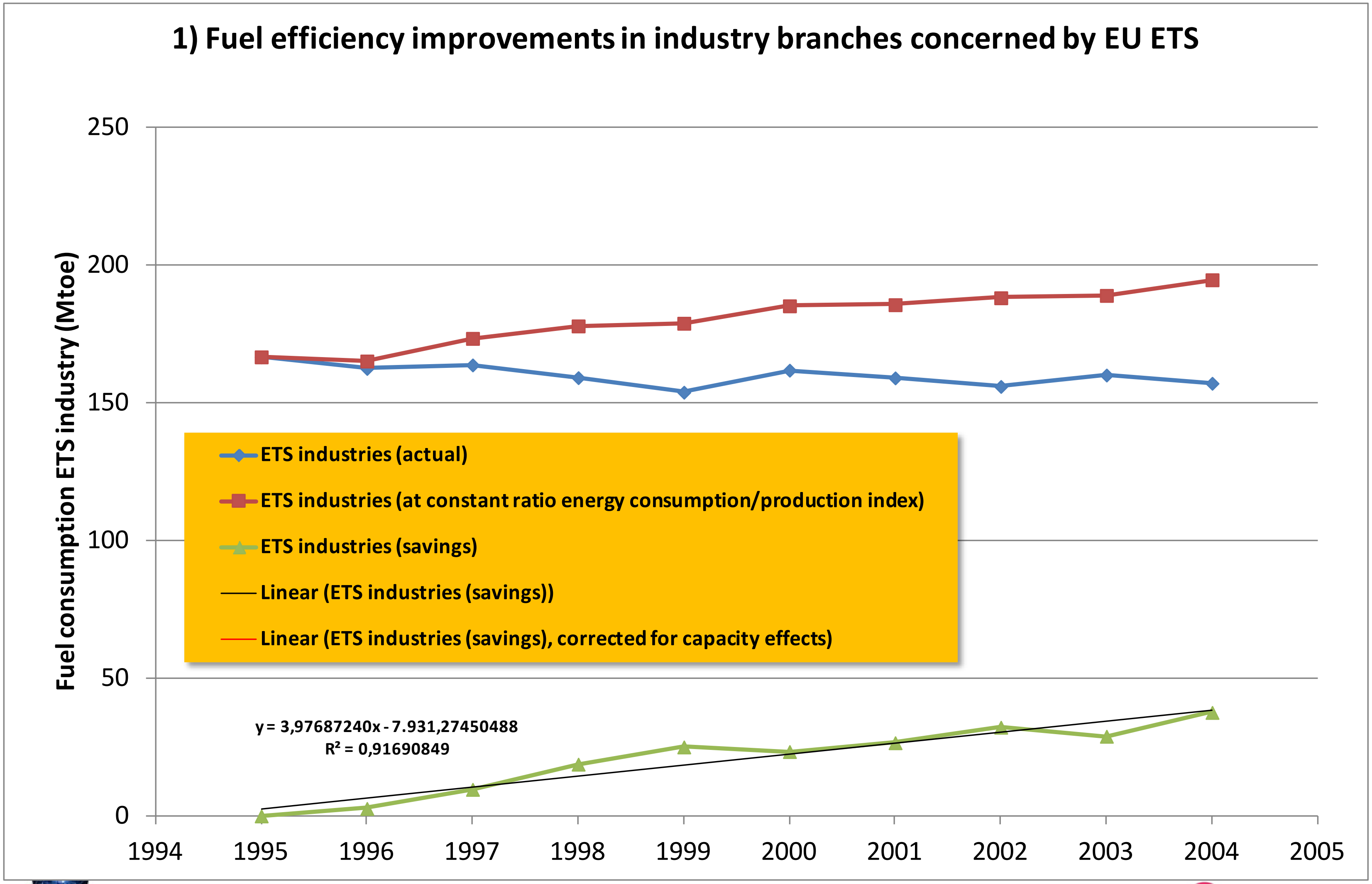
Effects considered

Effect	Name of effect	Methodology	Overlapping other factors
1	Fuel efficiency ETS industry	Indicators: ODYSSEE	Fuel prices
2	Electricity efficiency all manufacturing industry	Indicators: ODYSSEE	Fuel prices for electricity generation; electricity prices
3	Fuel shift ETS industry	Indicators: ODYSSEE	Fuel prices
4	Carbon leak-age/reduction in ETS production volume	Trade pattern analysis	
5	Efficiency thermal power plants	Indicators: ENERDATA Global Stat	Fuel prices for electricity generation;
6	Power plant mix	Indicators: ENERDATA Global Stat	Fuel prices for electricity generation; Renewables promotion schemes
7	Electricity efficiency all sectors (excludes 2)	Indicators: ODYSSEE	Fuel prices for electricity generation; electricity prices
8	Power plant dispatch	Indicators: ODYSSEE (part of 6) or explicit modelling elec-tricity market on hourly basis	Fuel prices for electricity generation
9	Fuel efficiency aviation	Indicators: ODYSSEE	Kerosene prices
10	Modal shift from avia-tion to more efficient transport modes	Indicators: ODYSSEE	Kerosene prices

Construction of the counterfactual for effect 1



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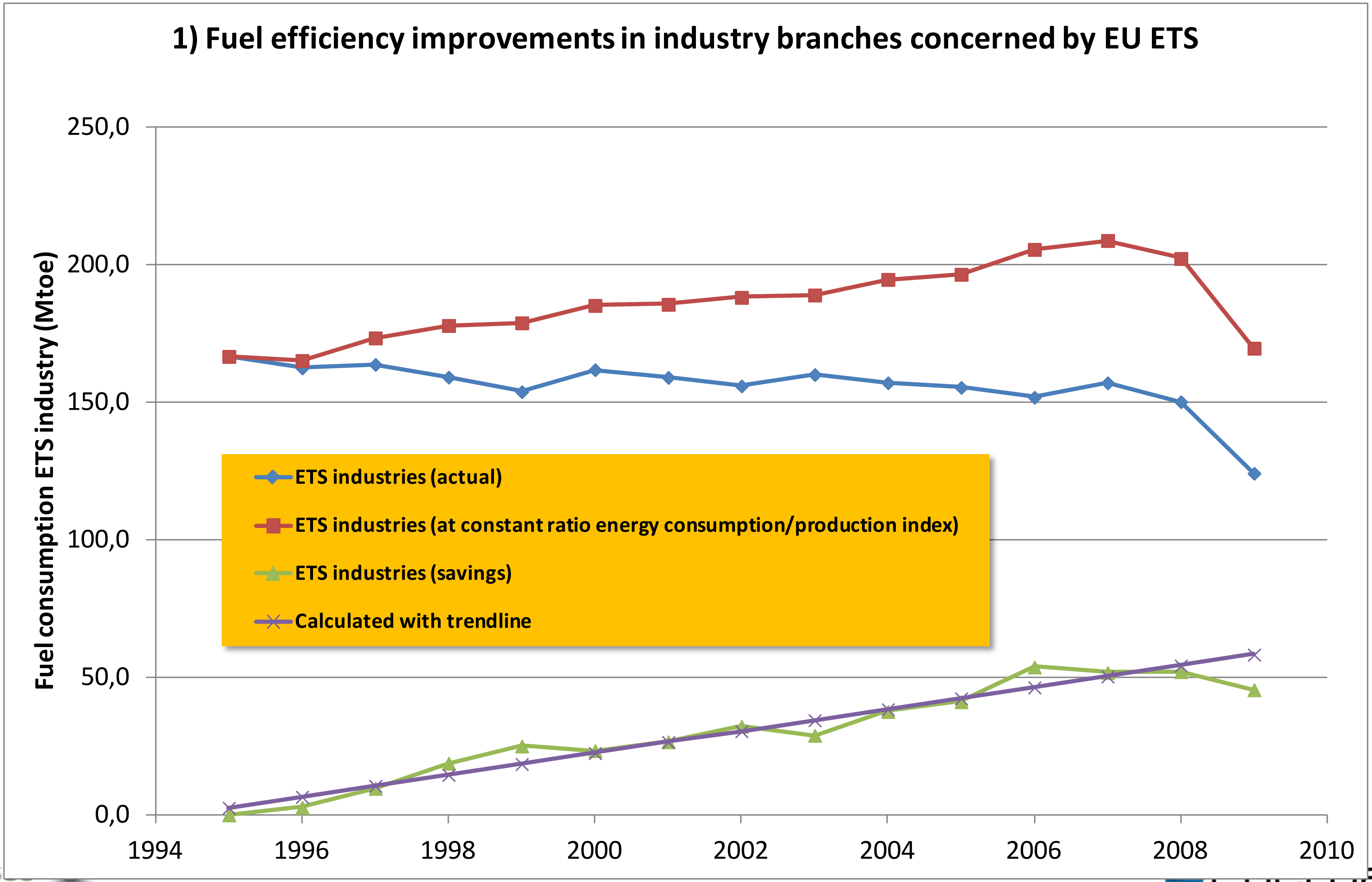
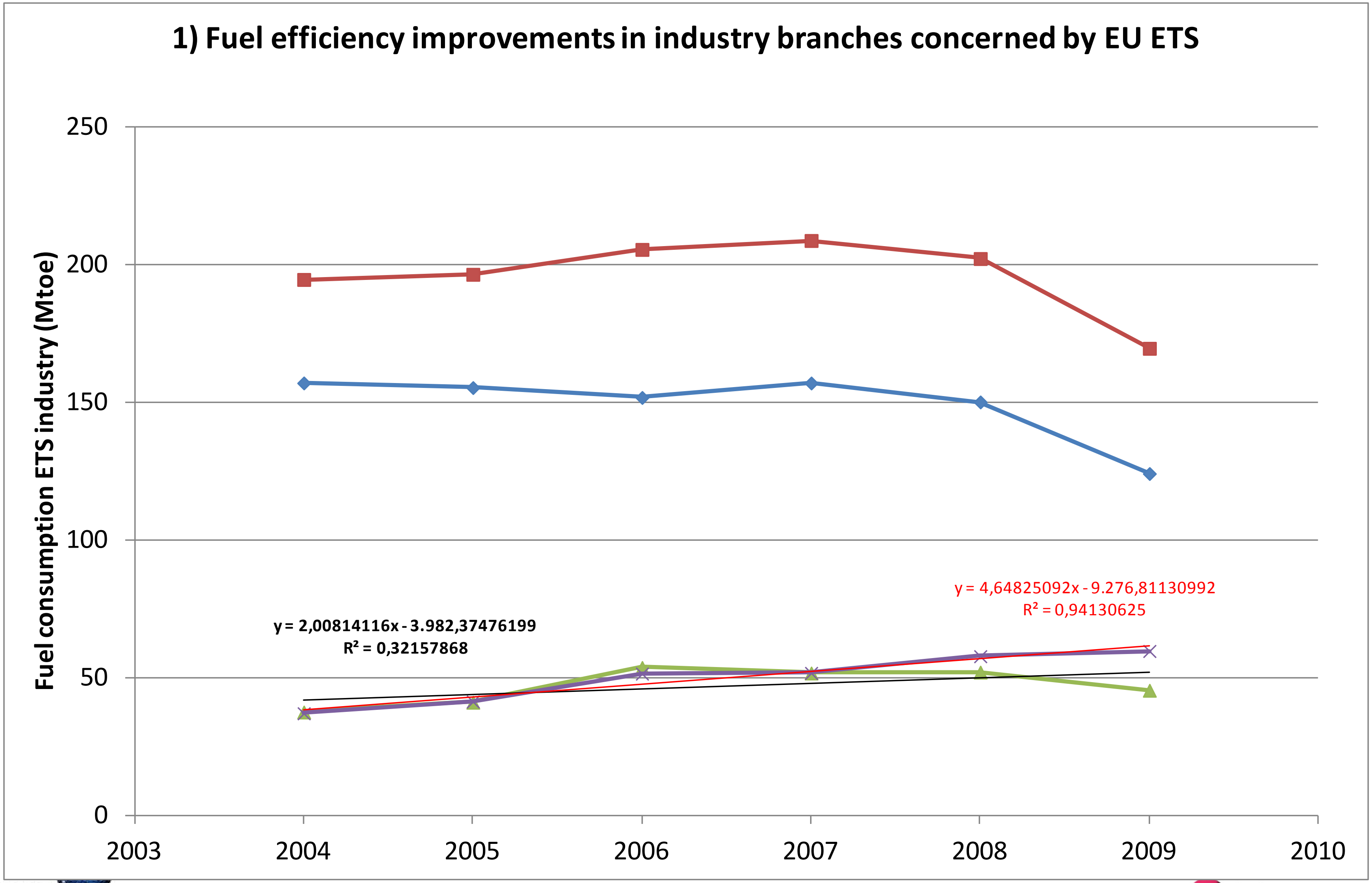
Extrapolation of the counterfactual to the period 2005-2009 for effect 1



Extrapolation of the counterfactual to the period 2005-2009 for effect 1 (with correction for capacity use)



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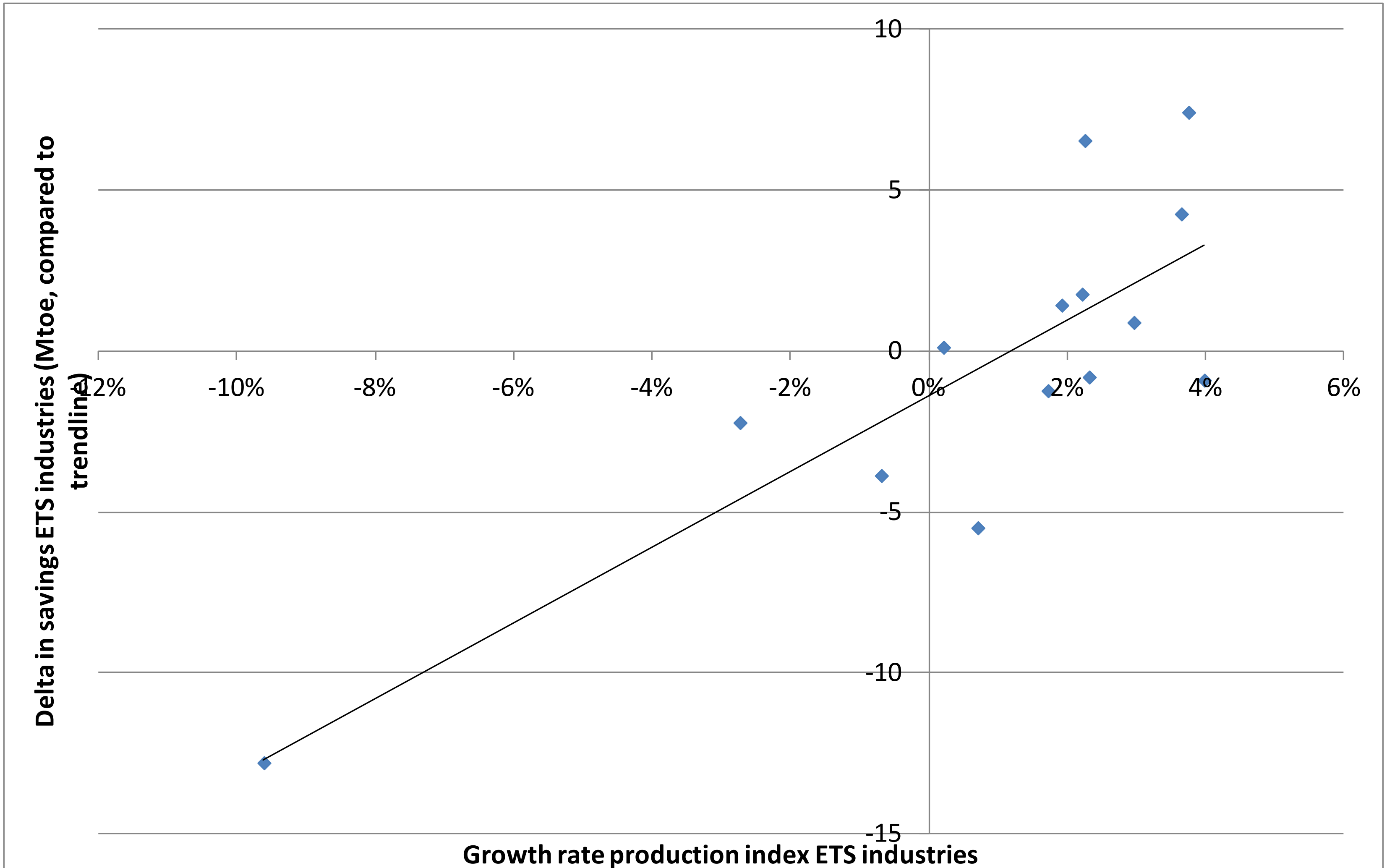
Correlation between growth in production index and deviations from the trend line



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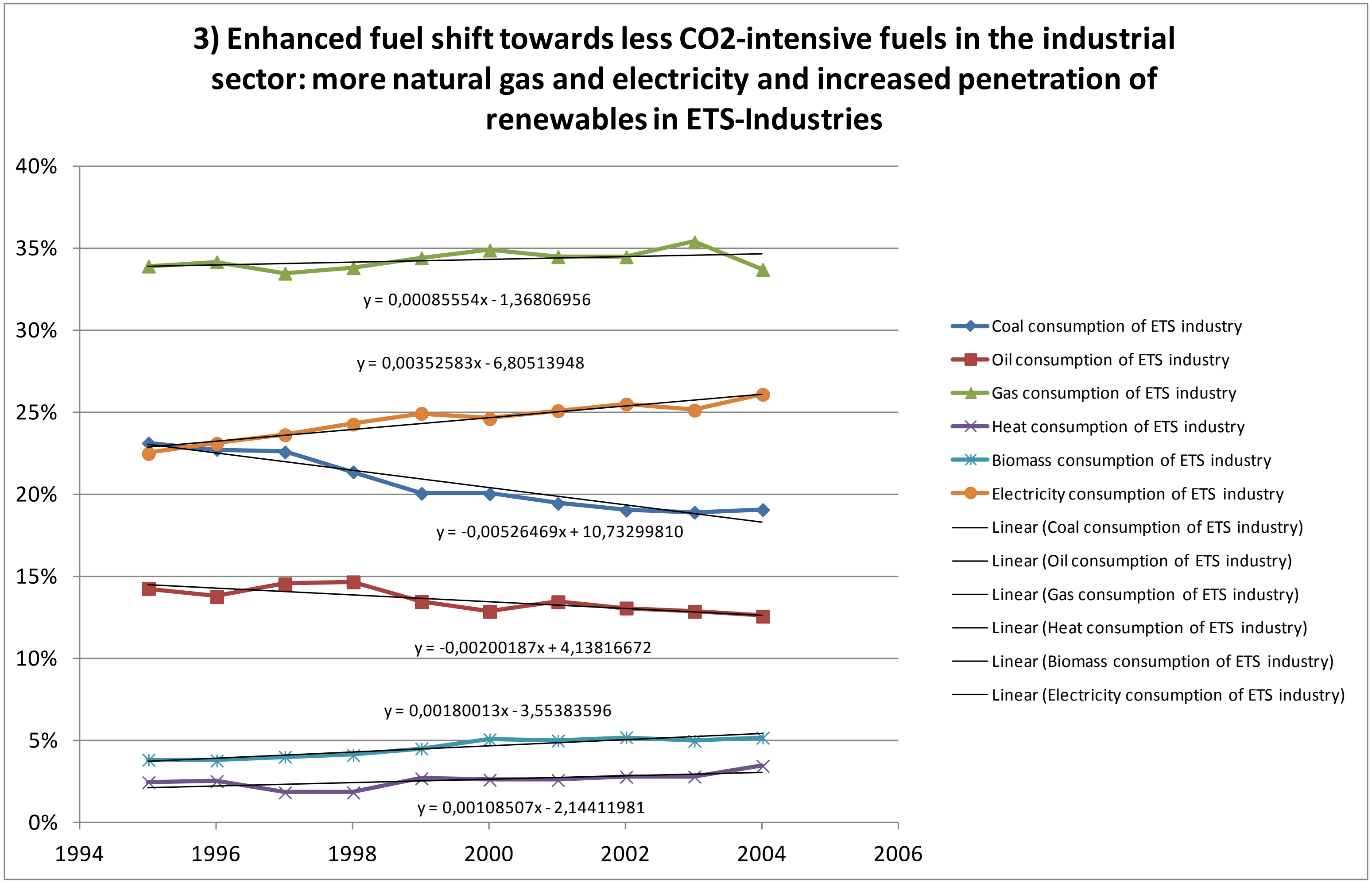
Summary of results for the possible impact of the EU ETS on fuel savings in ETS industries (Effect 1)

Summary of results	**2008**		**2009**		**2008**		**2009**	
Fuel efficiency improvements in industry branches concerned by the EU ETS (Effect 1)	**(no correction capacity use)**				**(correction capacity use)**			
		Standard deviation		**Standard deviation**		**Standard deviation**		**Standard deviation**
Calculation of savings with Formula derived from:	**Mtoe**	**Mtoe**	**Mtoe**	**Mtoe**	**Mtoe**	**Mtoe**	**Mtoe**	**Mtoe**
1995-2004 (baseline)	54,29	3,84	58,26	3,84	54,61	3,28	58,63	3,28
2004-2008/2009 (incl. ETS)	55,18	5,48	51,98	8,63	58,30	2,91	61,52	3,43
Savings possibly due to ETS (and possible other factors in particular fuel prices)	**0,89**	**savings not significant**	**-6,28**	**savings not significant**	**3,69**	**significant but at the limit**	**2,90**	**savings not significant**

Construction of the counterfactual for effect 3 for the period 1995-2004 for the different fuels



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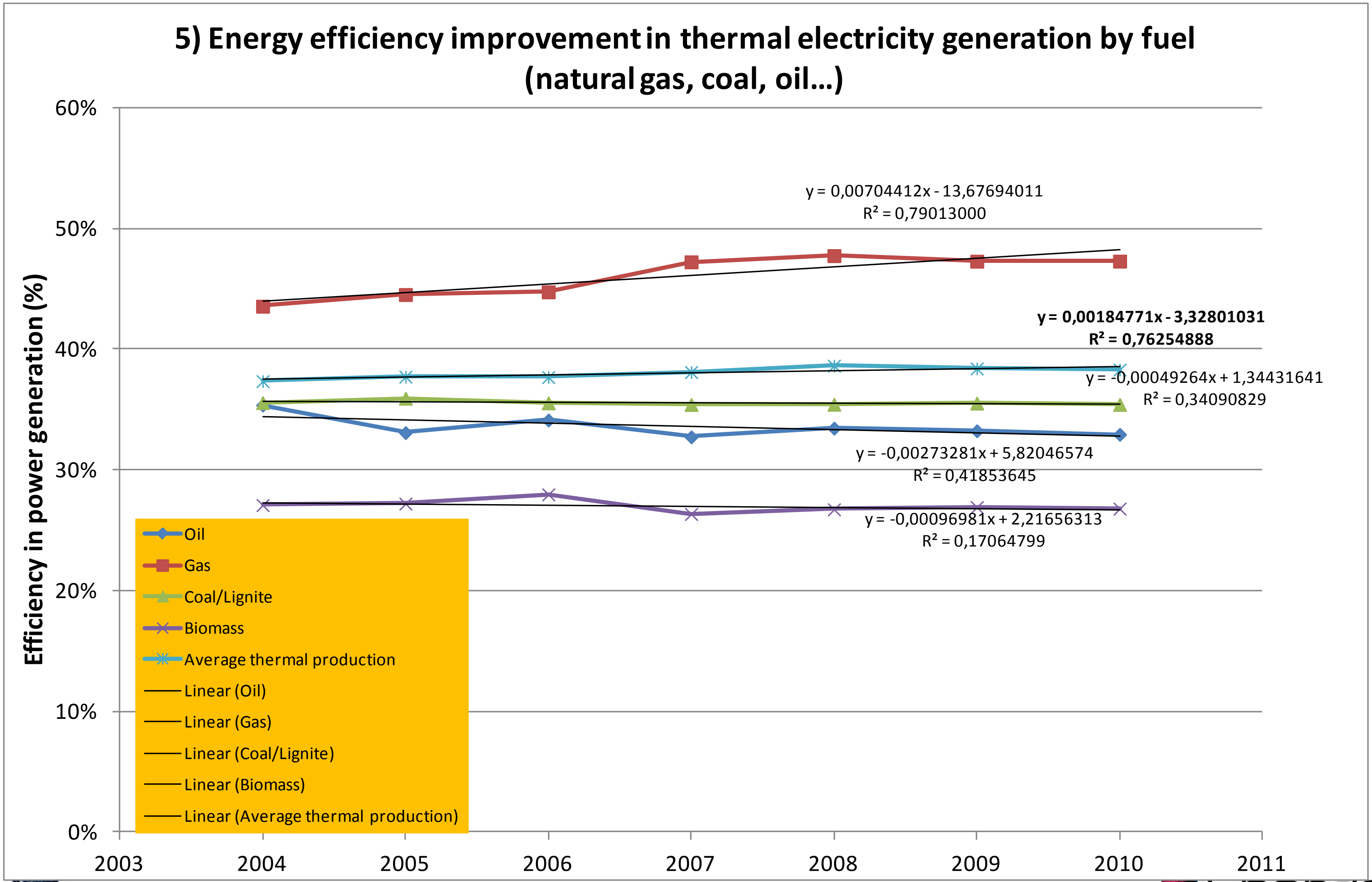
Results for the possible impact of the EU ETS on fuel shift in ETS industries by fuel (Effect 3)

Summary of results				
Enhanced fuel shift towards less CO_2-intensive fuels in the industrial sector: more natural gas and electricity ; increased penetration of renewables in ETS-Industries.	**2008**	**Standard deviation**	**2009**	**Standard deviation**
Average emission coefficient (kt/PJ)	**kt/PJ**	**kt/PJ**	**kt/PJ**	**kt/PJ**
based on 1995-2004 (baseline)	81,43	0,85	81,35	0,85
based on 2004-2008/2009 (incl. ETS)	81,54	0,62	81,15	1,02
Change in average emission coefficient possibly due to ETS (and possible other factors in particular fossil fuel prices)	-0,11	impact on fuel shift not significant	0,20	impact on fuel shift not significant

	2008 (based on 1995-2004)	Standard deviation	2008 (based on 2004-2008)	Standard deviation	2009 (based on 1995-2004)	Standard deviation	2009 (based on 2004-2009)	Standard deviation	Emission coefficients (kt/PJ)
Coal consumption of ETS industry	0,16150099	0,00522916	0,18940484	0,00048706	0,15623630	0,00522916	0,17708514	0,00793965	96
Oil consumption of ETS industry	0,11840207	0,00447836	0,11554689	0,00116733	0,11640020	0,00447836	0,11801806	0,00357586	74
Gas consumption of ETS industry	0,34985755	0,00548021	0,31225858	0,00434947	0,35071309	0,00548021	0,30612462	0,00379985	56
Heat consumption of ETS industry	0,03469175	0,00357144	0,05038300	0,00572211	0,03577682	0,00357144	0,05663750	0,00505191	60,3
Biomass consumption of ETS industry	0,06082850	0,00222936	0,06699805	0,00263545	0,06262863	0,00222936	0,07224082	0,00235786	0
Electricity consumption of ETS industry	0,27471913	0,00364705	0,26540864	0,00340475	0,27824496	0,00364705	0,26989385	0,00381698	129
Final consumption of ETS industry	1,00000000	0,00000000	1,00000000	0,00000000	1,00000000	0,00000000	1,00000000	0,00000000	
Coal consumption of ETS industry			-0,02790385	impact on fuel shift not significant			-0,02084884	impact on fuel shift not significant	
Oil consumption of ETS industry			0,00285518	impact on fuel shift not significant			-0,00161786	impact on fuel shift not significant	
Gas consumption of ETS industry			0,03759897	impact on fuel shift not significant			0,04458847	impact on fuel shift not significant	
Heat consumption of ETS industry			-0,01569125	impact on fuel shift significant			-0,02086068	impact on fuel shift significant	
Biomass consumption of ETS industry			-0,00616955	impact on fuel shift significant			-0,00961220	impact on fuel shift significant	
Electricity consumption of ETS industry			0,00931050	impact on fuel shift not significant			0,00835111	impact on fuel shift not significant	

Calculation of the savings for effect 5 in the period 2004-2008/2009/2010 (ENERDATA Global Stat)



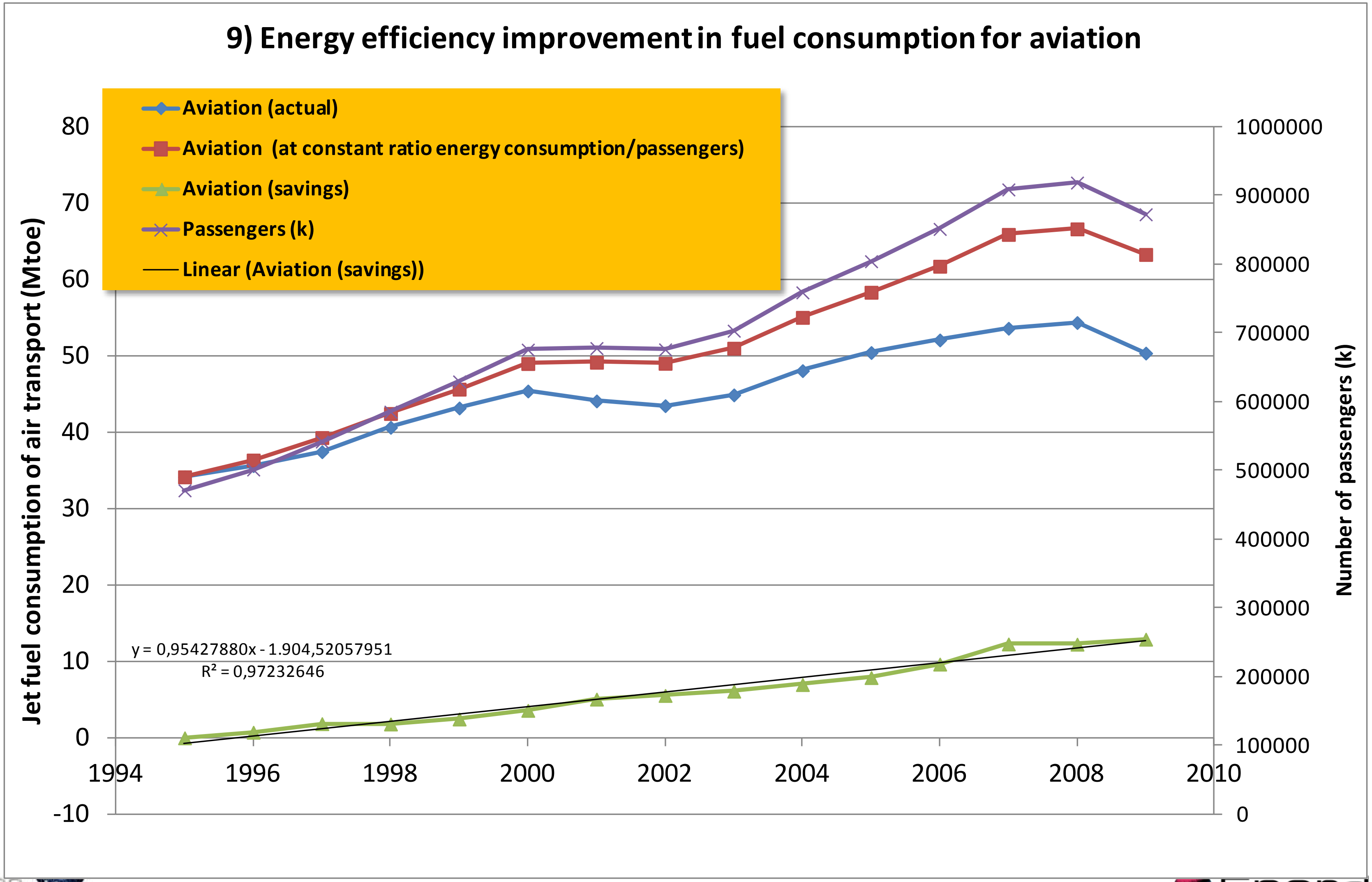
Summary of results for the possible impact of the EU ETS on the overall efficiency for thermal power generation (2008, 2009 and 2010)

Summary of results						
Energy efficiency improvement in thermal electricity generation by fuel (natural gas, coal, oil…)						
Average power plant efficiency	**2008**	**Standard deviation**	**2009**	**Standard deviation**	**2010**	**Standard deviation**
based on 1995-2004 (baseline)	**39,60%**	**0,49%**	**39,96%**	**0,49%**	**40,33%**	**0,49%**
based on 2004-2008/2009/2010 (incl. ETS)	**38,49%**	**0,17%**	**38,59%**	**0,20%**	**38,59%**	**0,24%**
		impact on power plant efficiency		**impact on power plant efficiency**		**impact on power plant efficiency**
Change in average thermal power plant efficiency possibly due to ETS (and possible other factors in particular fossil fuel prices)	**1,11%**	**not significant**	**1,38%**	**not significant**	**1,74%**	**not significant**

Odyssee

Enerdata

Construction of the counterfactual for effect 9 for the period 1995-2009



Odyssee

Enerdata

Summary of results for the possible impact of the EU ETS on the different effects

Effect	Name of effect	Methodology	Possible maximum impact EU ETS	Significant?	Overlapping other factors
1	Fuel efficiency ETS industry	Indicators: ODYSSEE	2.9-3.7 Mtoe (around 10 Mt CO_2)	No or at the limit	Fuel prices
2	Electricity efficiency all manufacturing industry	Indicators: ODYSSEE	7.3-8.3 Mtoe (around 42 Mt CO_2)	yes	Fuel prices for electricity generation; electricity prices
3	Fuel shift ETS industry	Indicators: ODYSSEE	1.4 Mt CO_2	no	Fuel prices
4	Carbon leakage/reduction in ETS production volume	Trade pattern analysis	So far no leakage effects proven		
5	Efficiency thermal power plants	Indicators: ENERDATA Global Stat	No impact	No	Fuel prices for electricity generation;
6	Power plant mix	Indicators: ENERDATA Global Stat	25.6 Mt CO_2 (2010)	yes	Fuel prices for electricity generation; Renewables promotion schemes
7	Electricity efficiency all sectors (excludes 2)	Indicators: ODYSSEE	1.2-2.5 Mtoe (6.5-13.5 Mt CO_2)	no/yes	Fuel prices for electricity generation; electricity prices
8	Power plant dispatch	Indicators: ODYSSEE (part of 6) or explicit modelling electricity market on hourly basis	3.5 - 6 Mt CO_2 (2005/2006) (Germany)	yes	Fuel prices for electricity generation
9	Fuel efficiency aviation	Indicators: ODYSSEE	Starting 2012	-	Kerosene prices
10	Modal shift from aviation to more efficient transport modes	Indicators: ODYSSEE	Starting 2012	-	Kerosene prices

Upper limit EU ETS: CO_2 savings of around 86-93 Mt CO_2 observed by 2009