

6. Examples of top down methods: Solar water heaters

evaluate
energy savings^{EU}

ADEME



Top-down estimation of energy savings for solar heaters

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

➤ The diffusion of solar water heaters can be generally explained by the following variables:

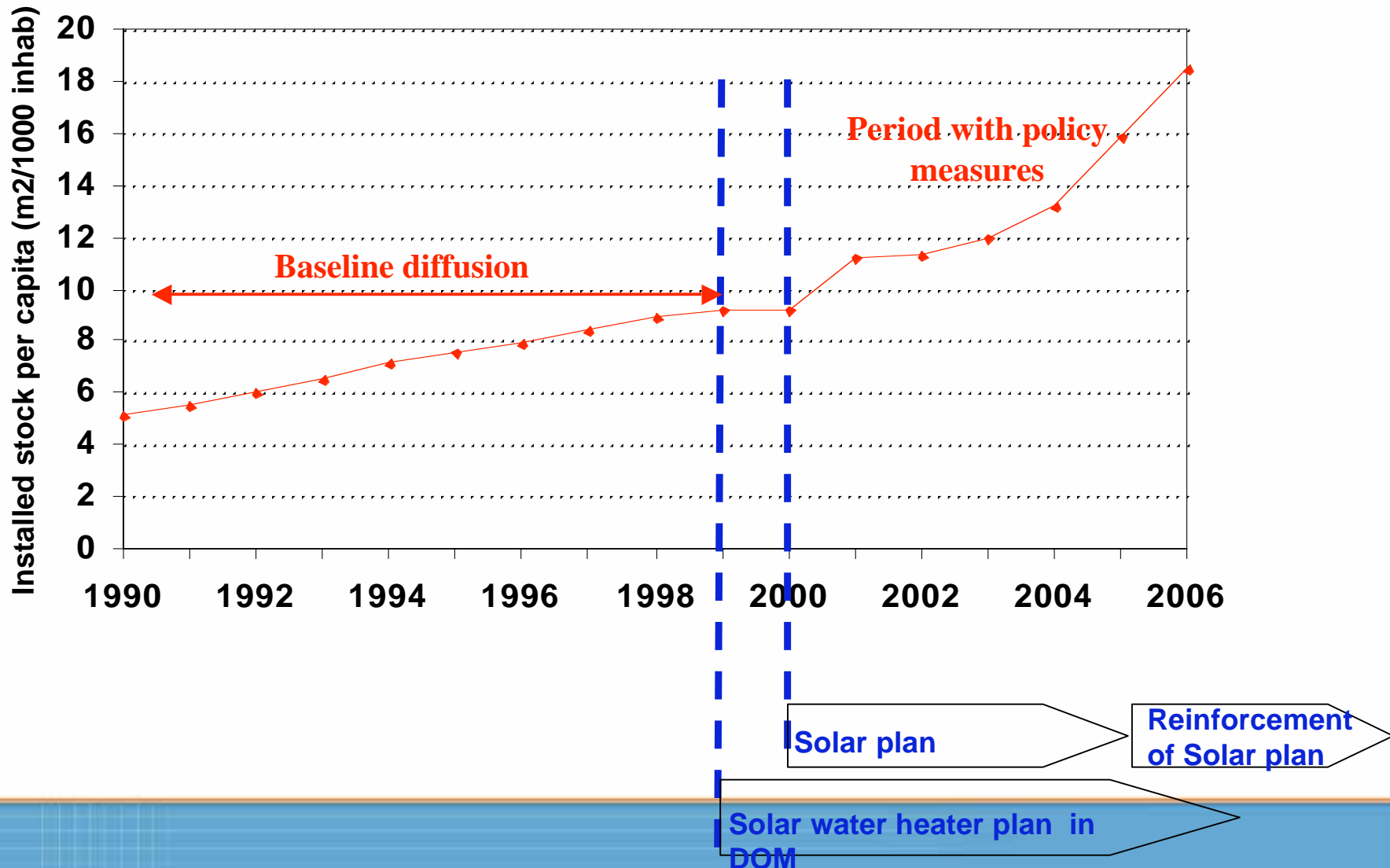
- Autonomous trend
 - Energy price
 - Cost of solar water heaters
 - Energy policy measures (e.g., subsidies, tax credit) (After / before 1995)
- } **Defines the baseline**

➤ 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**

Example: case of France



Modelling of the baseline diffusion of solar heaters

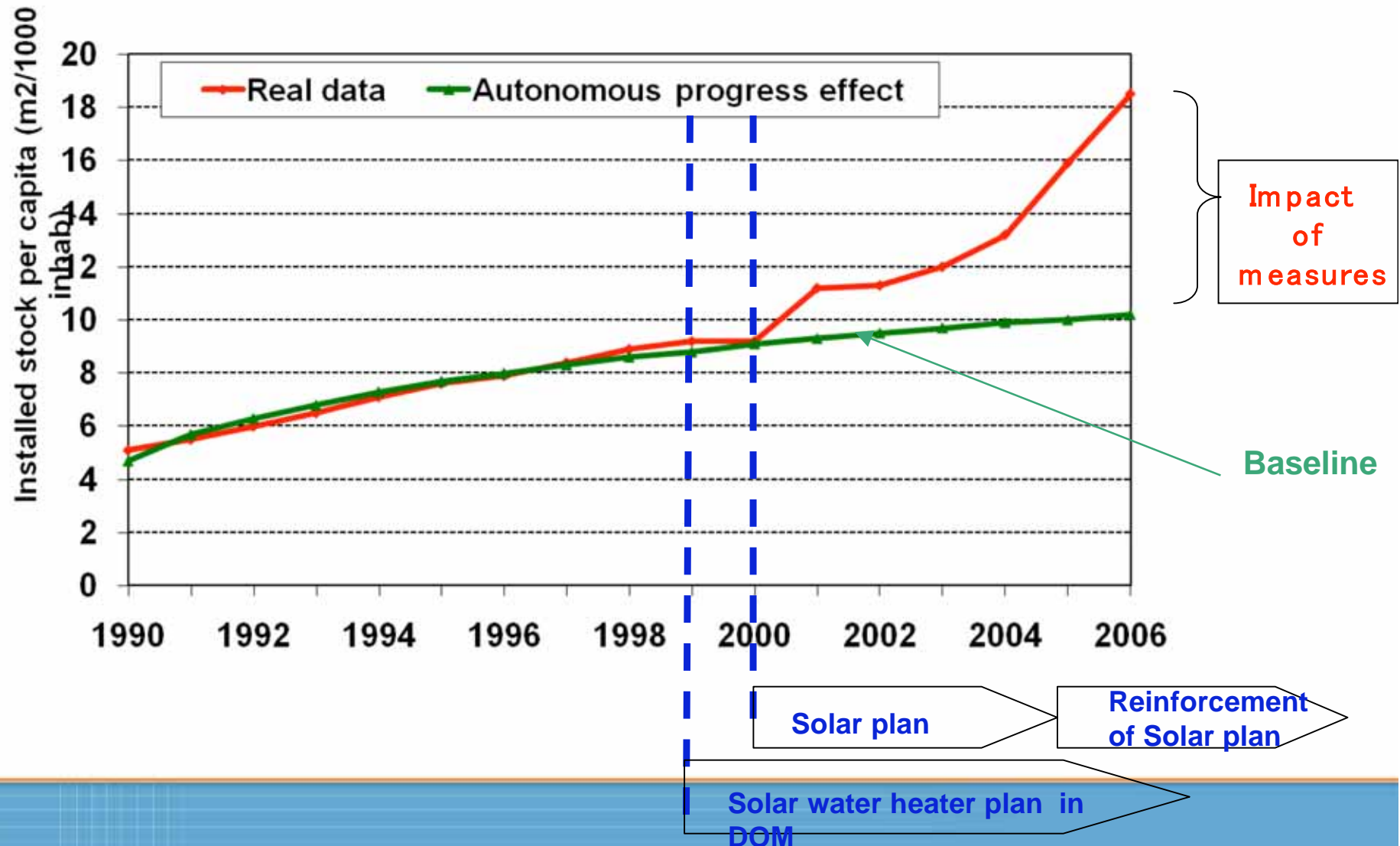
- To capture the trend and price effect, the regression analysis has to be made over a period over which policy measures either are negligible or had a limited impact
- The autonomous trend and price elasticity are calculated over that period through a regression analysis with two variables:
 - Time to capture an autonomous trend
 - Average energy price to measure the impact of prices

$$\text{Ln (IC)} = T \times \text{Ln (t)} + A \times \text{Ln (P)} + K$$

- ✓ T: trend
- ✓ A: price elasticity (>0 as price increase should increase penetration of solar water heaters)
- ✓ P: energy price

- The price effect was generally not validated by statistics test or was not really relevant from an economic viewpoint (price elasticity positive instead of negative or value too high) → may be neglected to define the baseline.

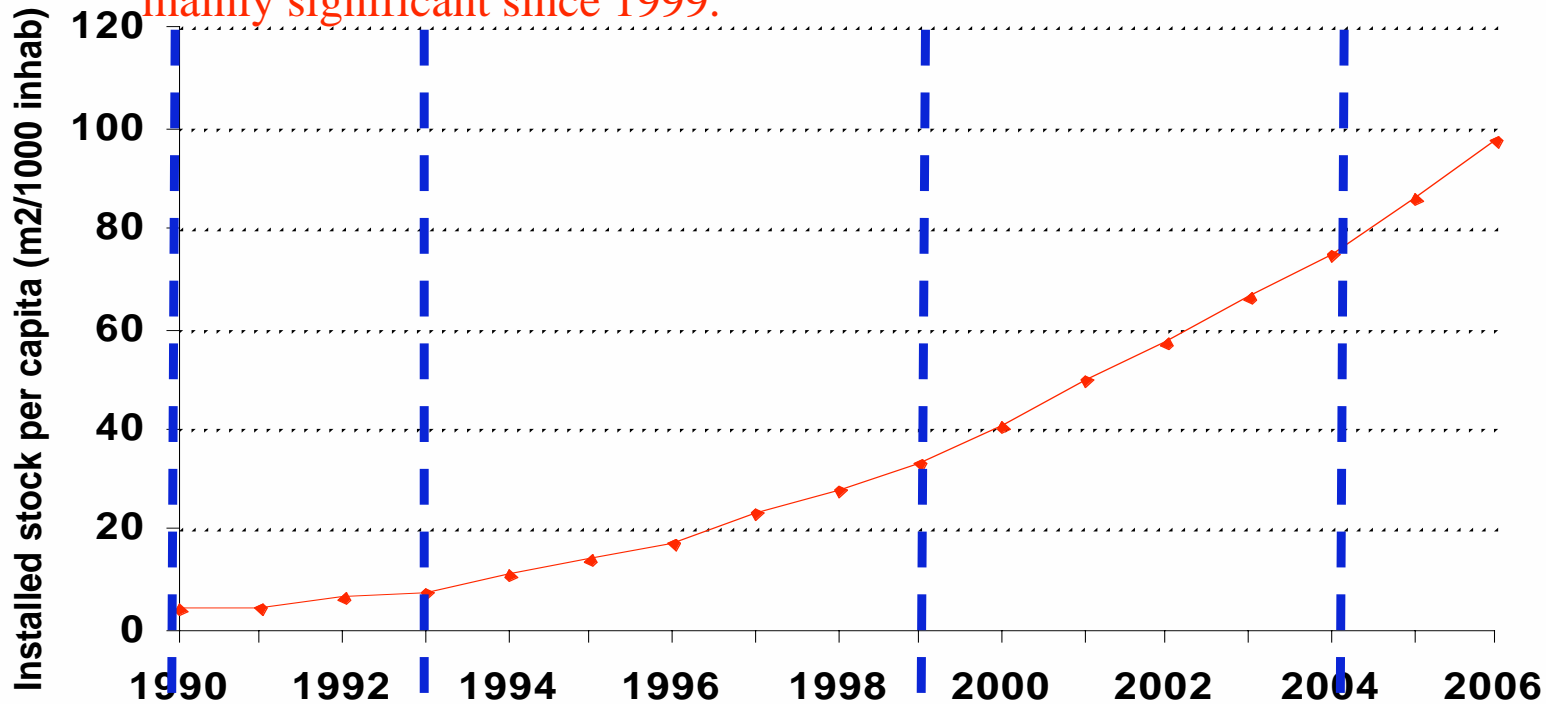
Example of France: modelling of the baseline



Case of a mature market: Germany (1/2)

Historical development

Several policies implemented for solar water heaters (1993, 1995, 1999), plus ecological tax in 1999. Over which period do we do the regression? The diffusion mainly significant since 1999.



Old policies

Market stimulation Programme

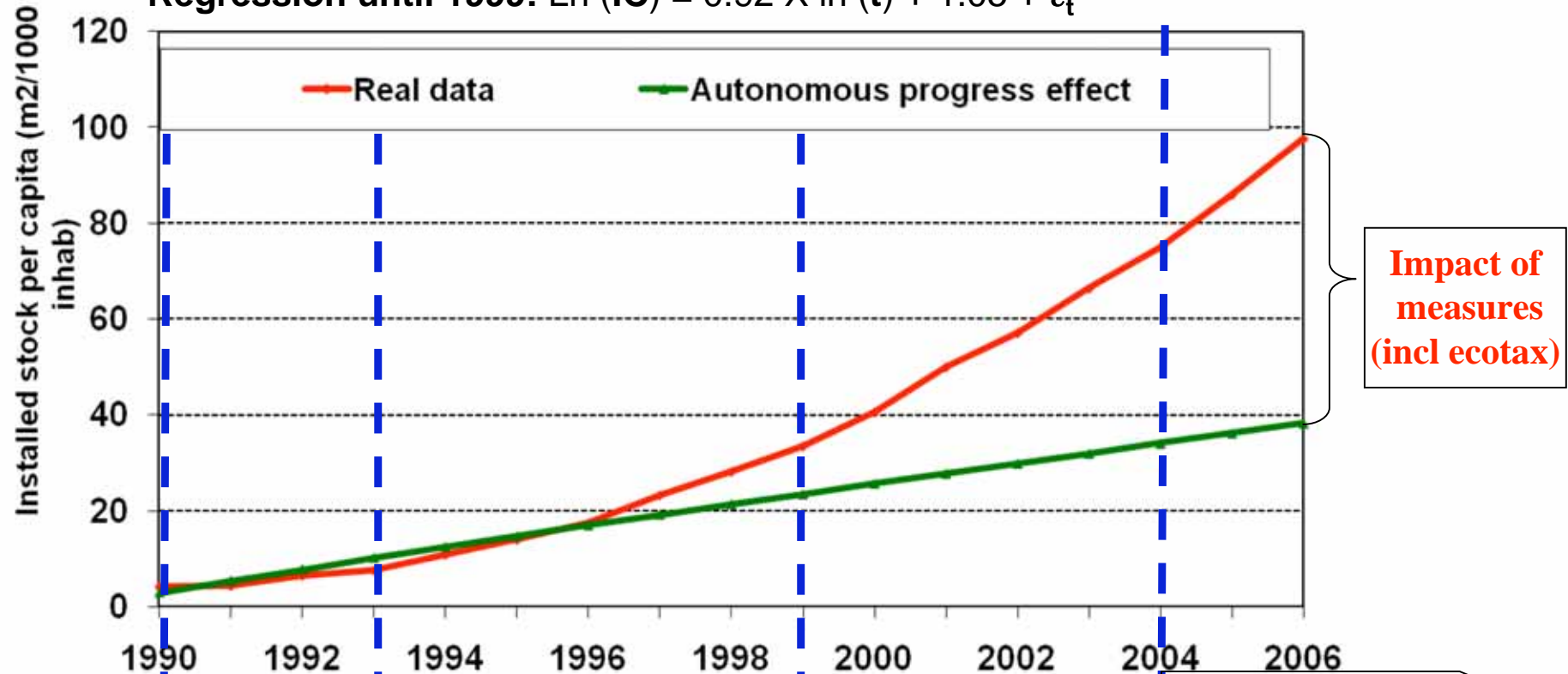
EPR-Environment and Energy Saving Programme

Solarthermie 2000

Solarthermie 2000Plus

Example of Germany: modelling of the baseline

Regression until 1999: $\ln(\text{IC}) = 0.92 \times \ln(t) + 1.05 + \epsilon_t$



Impact of measures (incl ecotax)

Old policies

Market stimulation Programme

Solarthermie 2000

Solarthermie 2000Plus

EPR-Environment and Energy Saving Programme

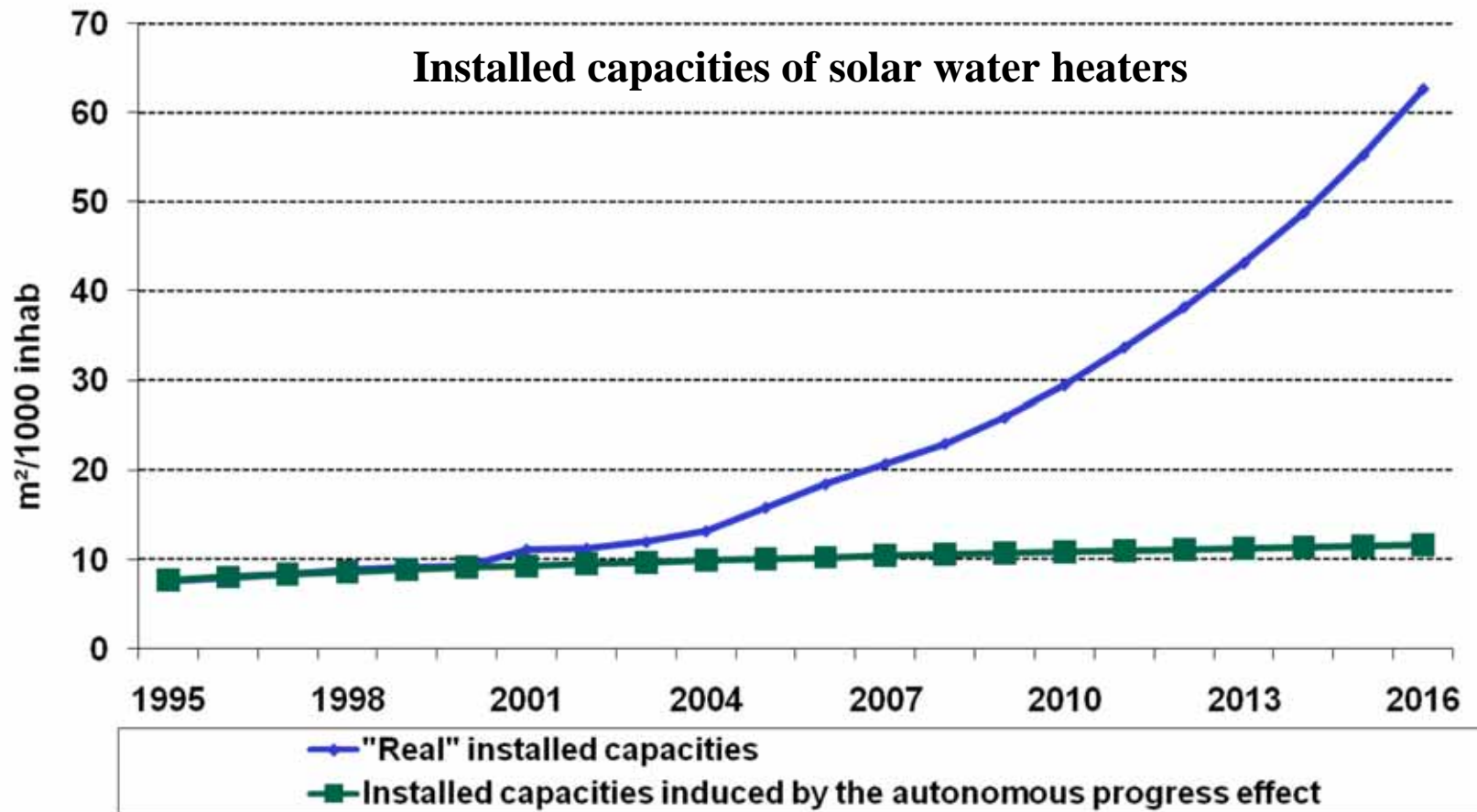
Calculation of ESD energy savings for solar water heaters

Calculation in 3 stages

- **Stage 1** : Estimation of the baseline installed capacities variation from autonomous trend based on econometric modelling (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** : ESD energy savings calculated by difference: totals savings minus trend related savings

Calculation of energy savings (example)

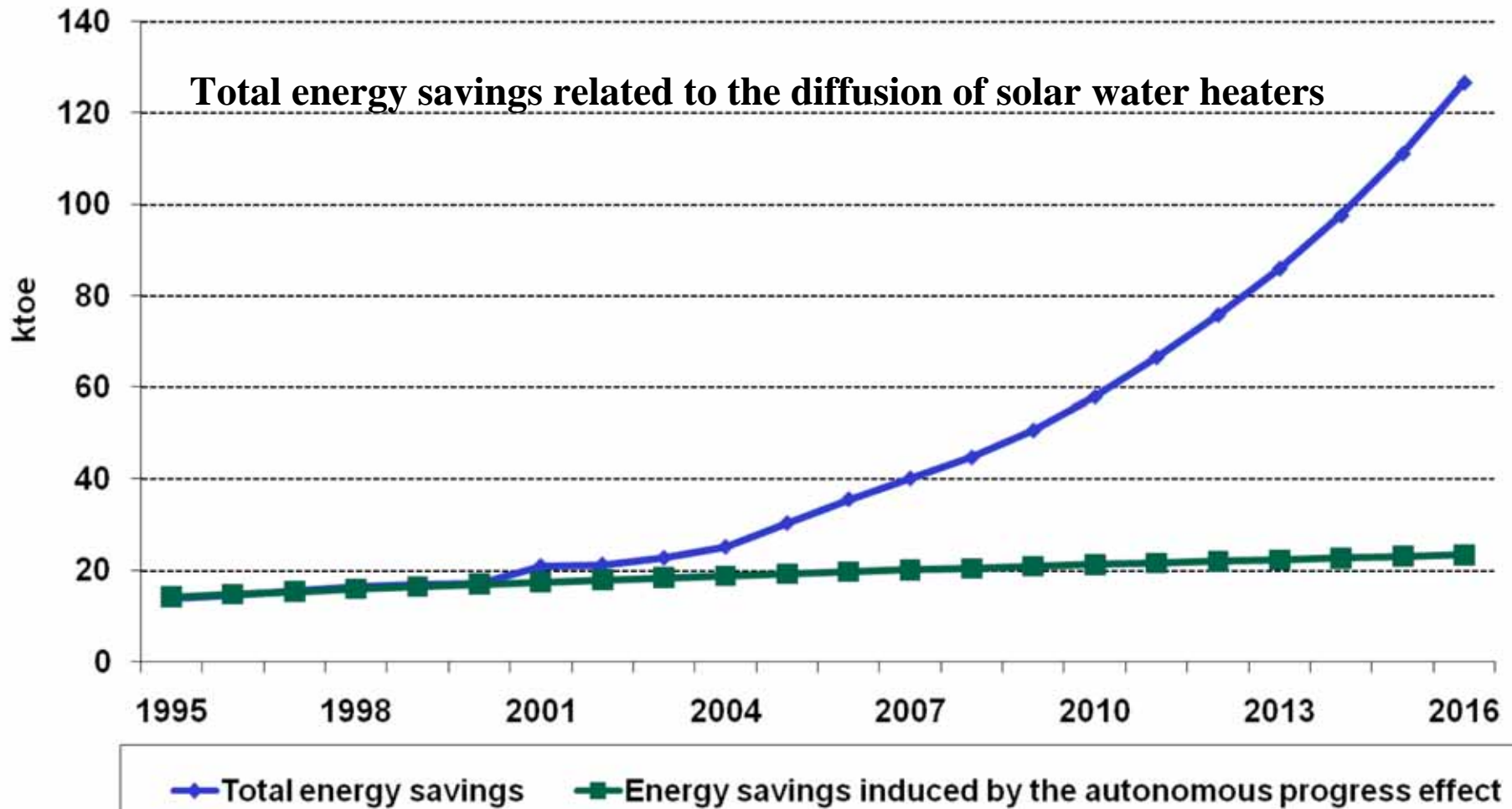
➤ **Stage 1** : Estimation of the evolution of the installed capacities induced by the autonomous trend



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

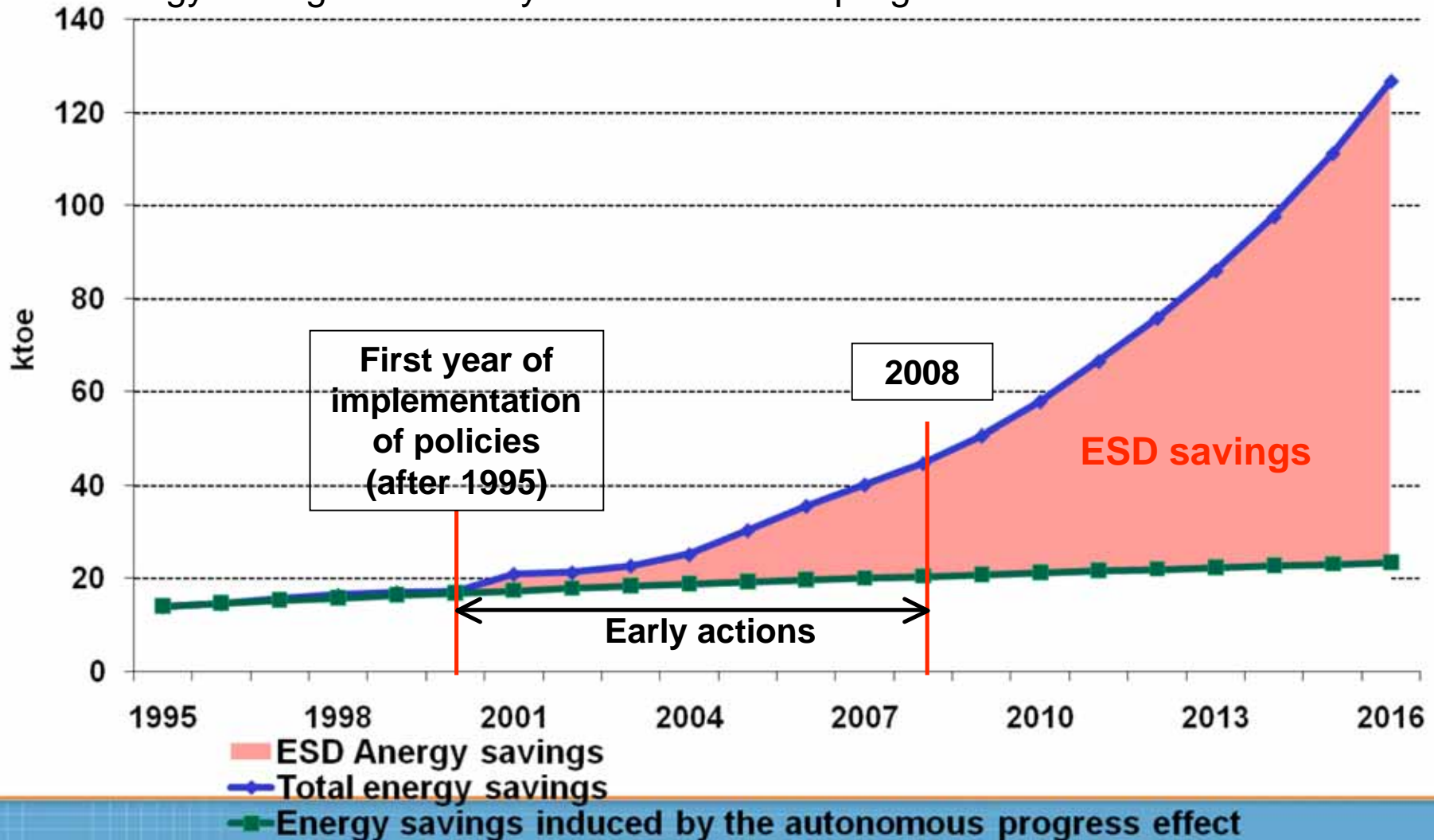
Calculation of ESD savings (example)

➤ **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)



Calculation of ESD savings (example)

➤ **Stage 3** : ESD energy savings calculated by the gap between total energy savings and energy savings induces by the autonomous progress effect



Conclusion and issues for replication

➤ Definition of trends or baseline:

- ✓ easy for countries with rapid take off following measures implementation
- ✓ difficult for countries with mature markets

➤ Role of energy price from econometric analysis not significant econometrically or economically:

- ✓ quality of the estimate of price elasticity questionable as short period and price not changing so much over the period of regression;
- ✓ price effect to be neglected

➤ Need of country specific coefficient of energy saving to account for difference in solar flows (koe/m² or kWh/m² of solar panel)

➤ No need to account for the lifetime of energy savings: removal/ replacement of solar heaters at the end of their lifetime implicitly taken into account in the measurement of the installed solar area