Did it Work? Tracking progress & assessing the multiple benefits

Lighting, Appliances & Equipment: Session 9

Kevin Lane, Emily McQualter, IEA

#EnergyEfficientWorld

Scenario

The Minister wants to know how effective your programme has been

How do you go about answering this?

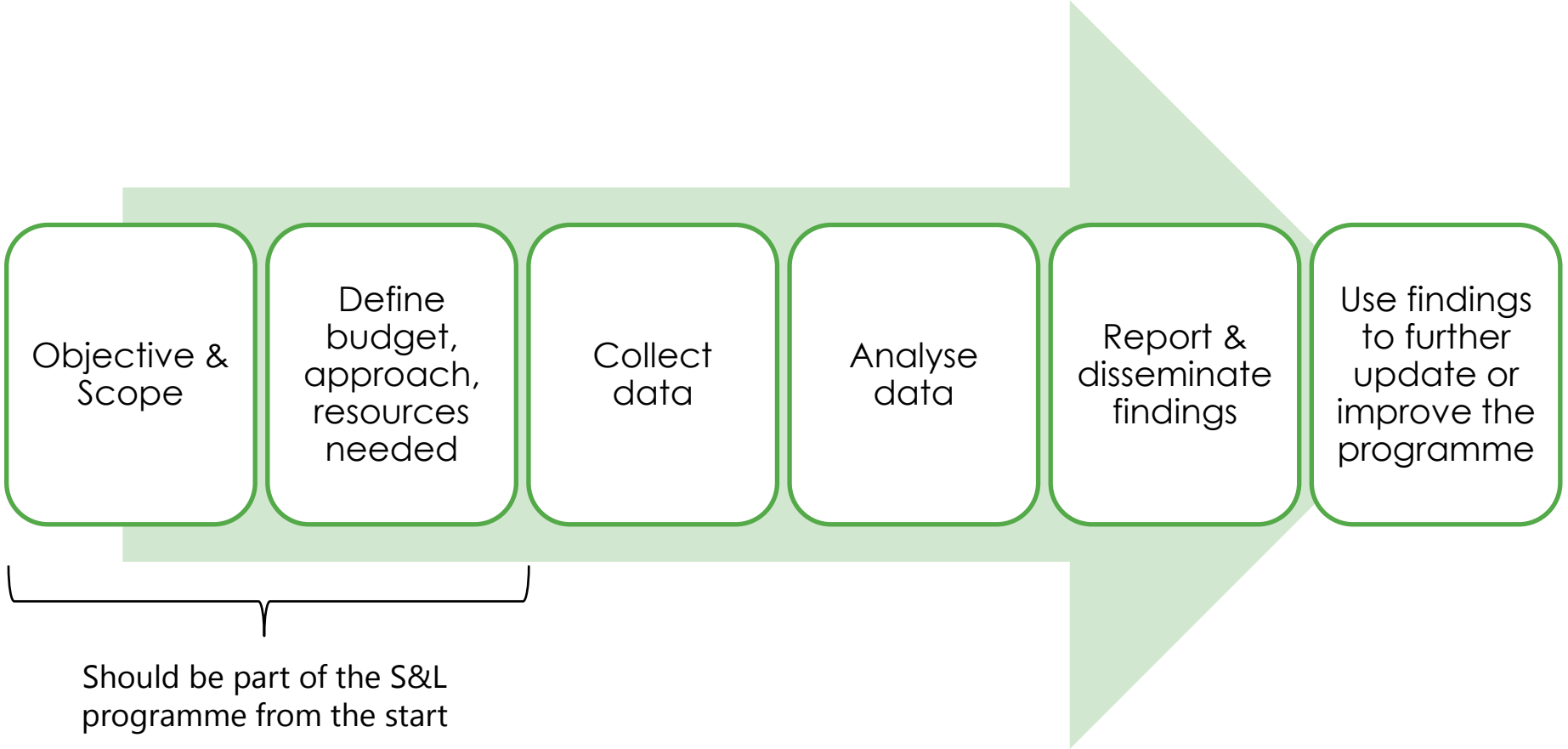
Scenario – background information

- S&L programme covering refrigerators, air conditioners, lighting and electric motors
- No existing evaluation frameworks or targets
- Baselines for each product type done 5 years ago when developing the S&L programme
- Online registration database in place
- Limited budget for a detailed evaluation of effectiveness on minimum energy performance standards (MEPS) and labels
- Significant information available from different agencies, but dispersed

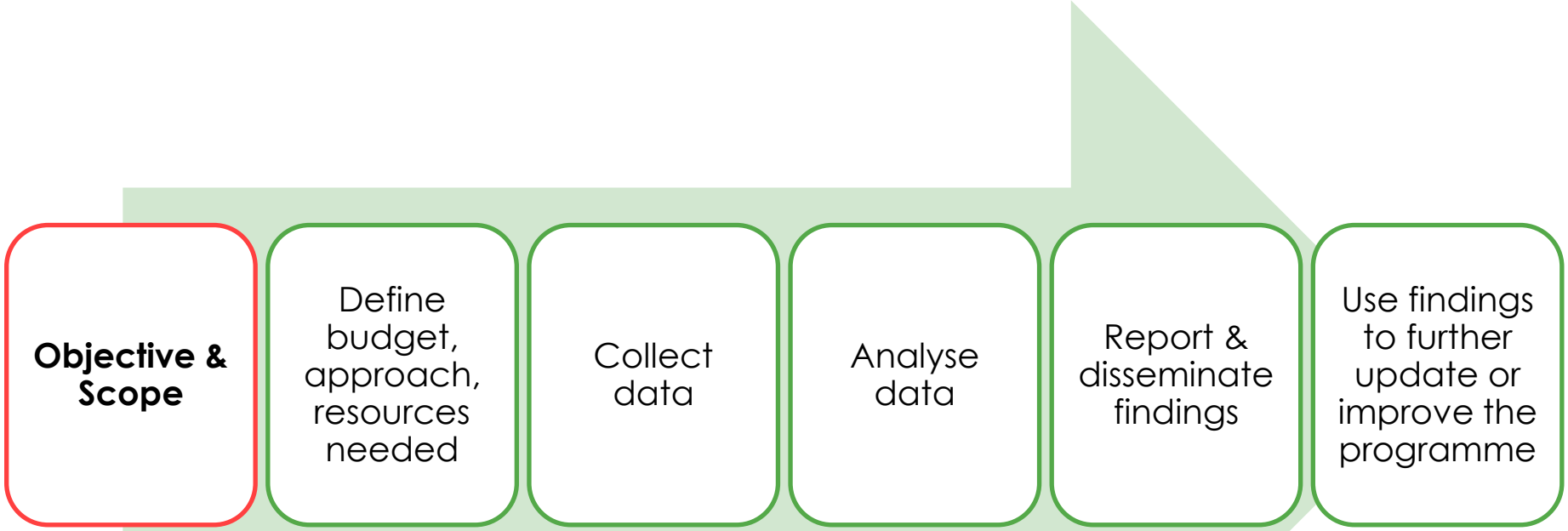
Group exercise

As a group, list the major steps required to conduct an evaluation

Basic Steps for Evaluation



Understanding Programme Objectives

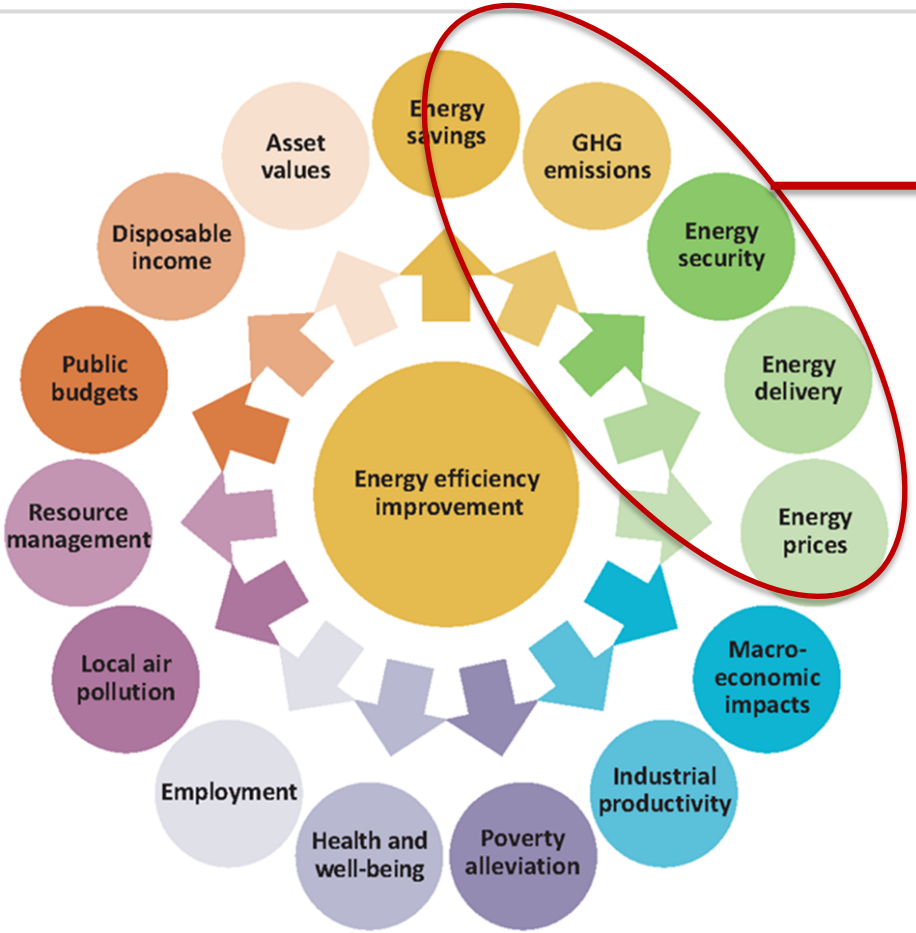


- Why do we want to conduct the evaluation?
- What benefits will we obtain?
- How will we use the results?

Objectives

Can you list the objectives of your programme?

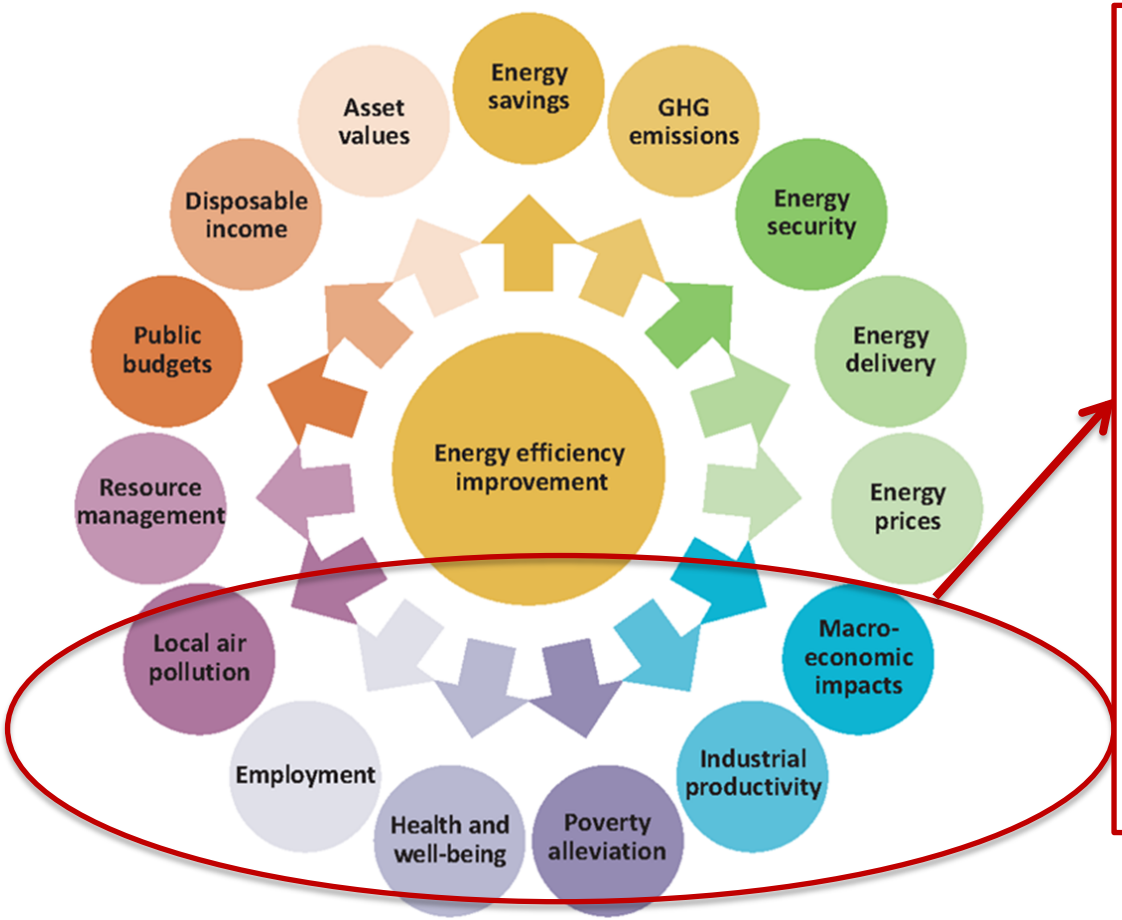
Objectives: What are the Multiple Benefits?



Examples:

- Energy savings
- Avoided imported fossil fuels
- Avoided GHG emissions
- Avoided generation capacity
- Peak demand reduction
- Household energy savings

Objectives: What are the Multiple Benefits?



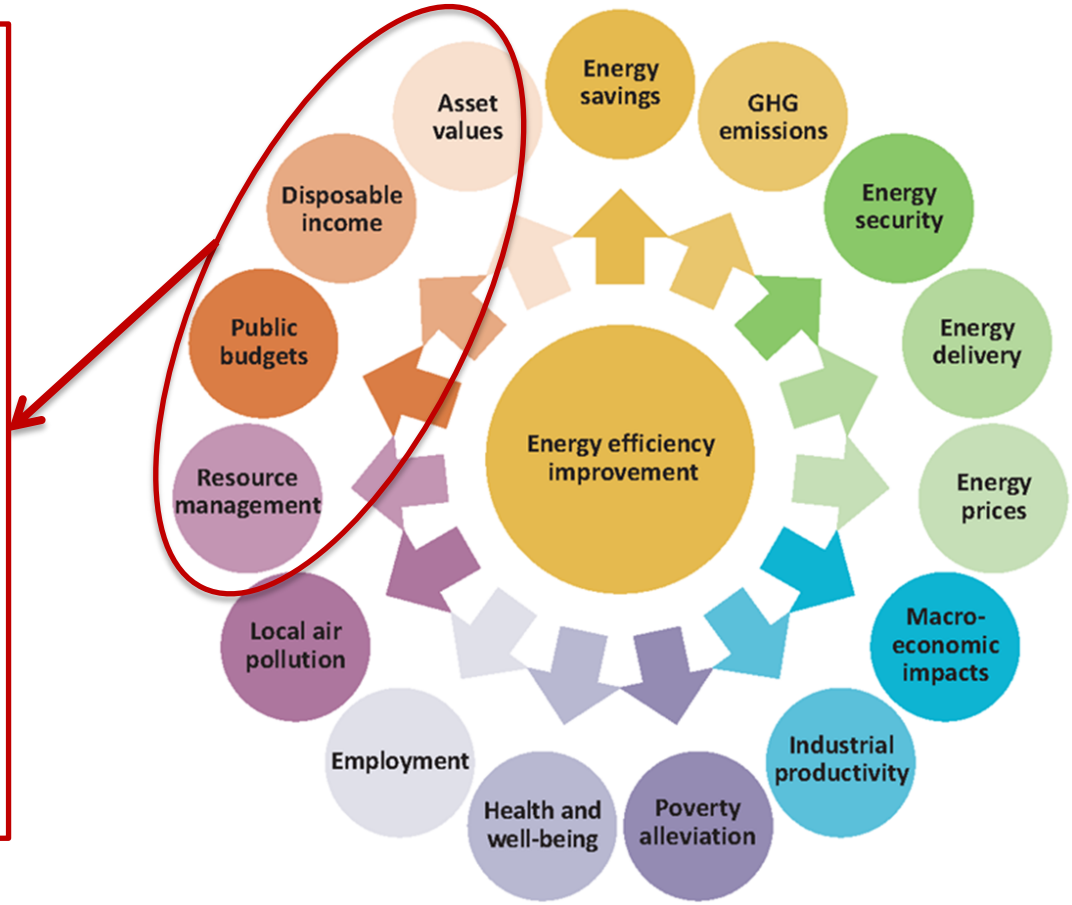
Examples:

- GDP and TPES decoupling
- Job creation and innovation
- Improved energy access
- Improved trade balance
- Reduction in energy prices
- Improved energy intensity in industry (e.g. motors)
- Improved air quality
- Lower public health spending

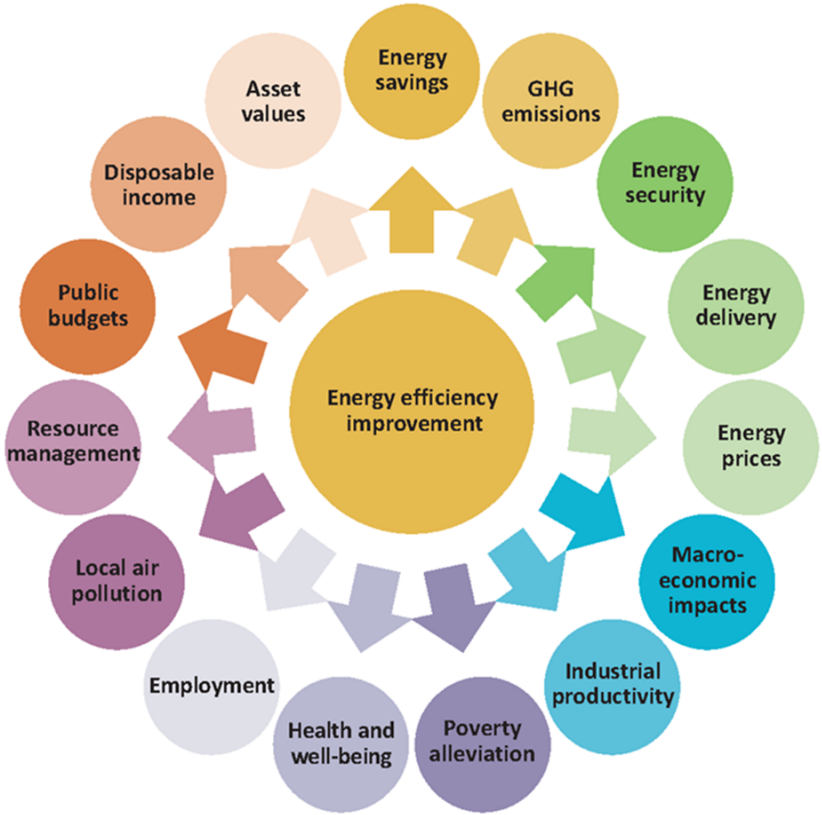
Objectives: What are the Multiple Benefits?

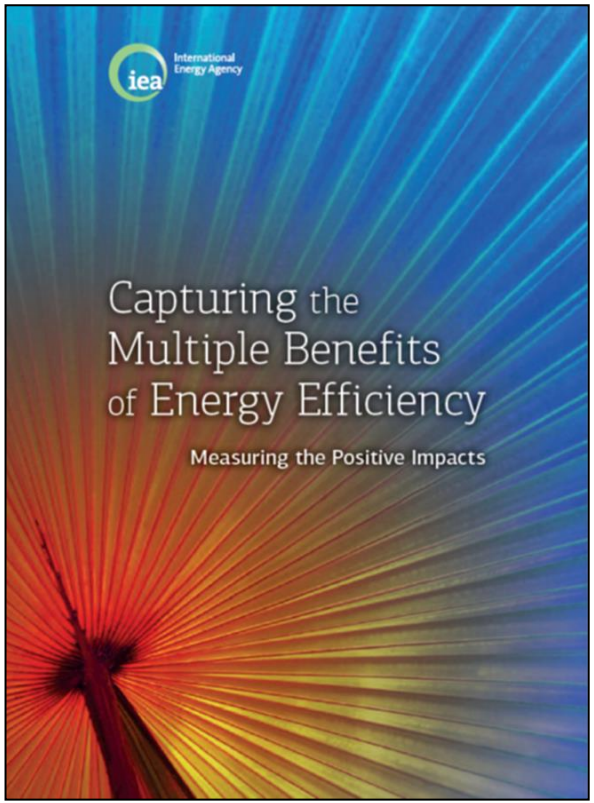
Examples:

- Reduction in energy subsidies
- Reduction in utility debt
- Reduced pressure on scarce domestic resources
- Reduction in impact on environment (e.g. water)
- Increase in household disposable income to invest in economy
- Higher value assets (e.g. public procurement, public buildings)



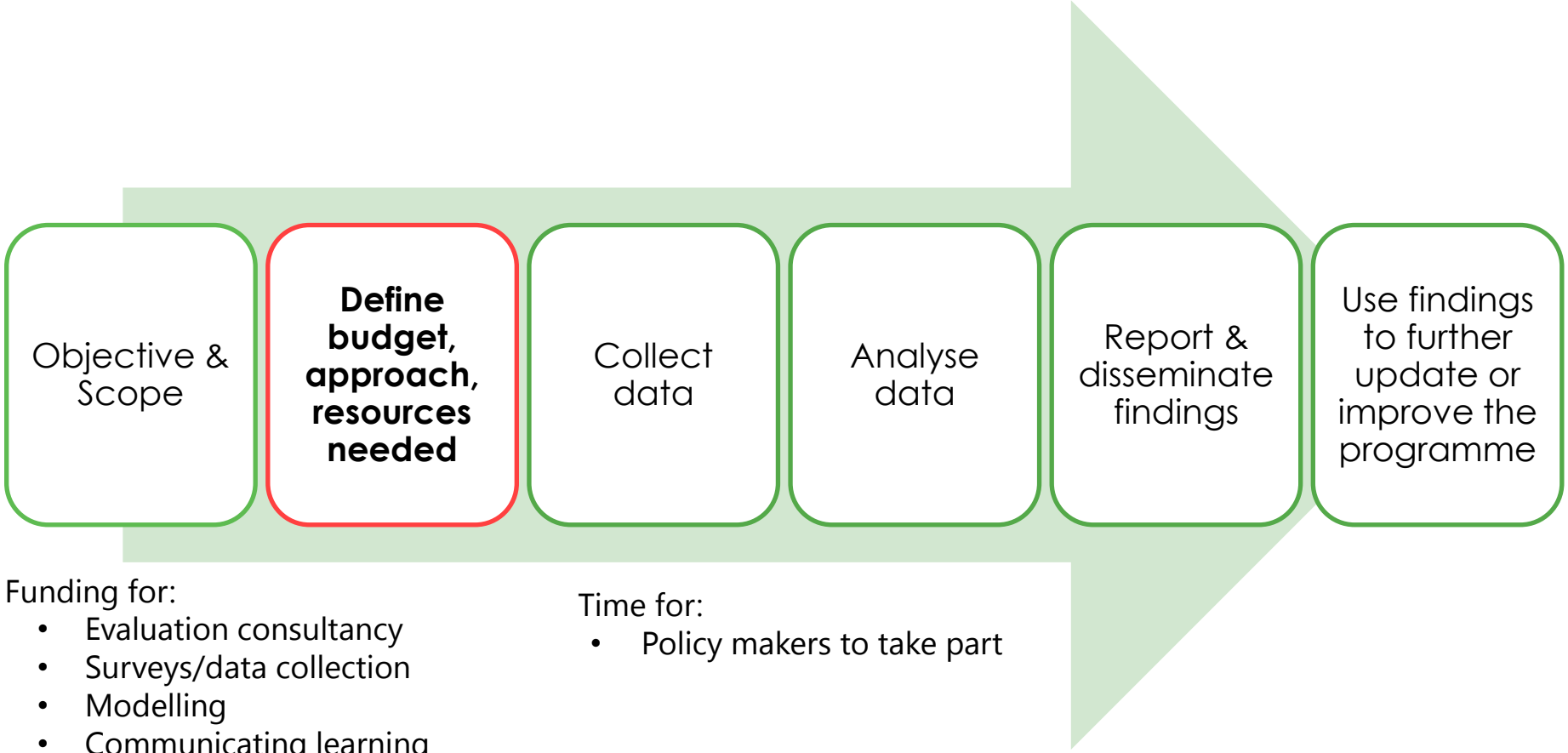
Objectives: What are the Multiple Benefits?





https://www.iea.org/publications/freepublications/publication/capturing-the-multiple-benefits-of-energy-efficiency.html

Define budget, approach, resources



Funding for:

- Evaluation consultancy
- Surveys/data collection
- Modelling
- Communicating learning

Time for:

- Policy makers to take part

Approaches to evaluation

Unfortunately it isn't possible to directly measure most of these indicators!

- They have to be estimated based on calculation using lots of different inputs and modelling
- Build up a picture using both **Process Evaluation** (What the programme does - generally qualitative), e.g.:
  - Number of labelled products
  - Number of products subject to MEPS
  - Number of registered models
  - Correct display of labels in retail
  - Consumer awareness levels
  - Administrative efficiency
  - Number of manufacturer claims checked
- And **Impact Evaluation**, e.g.:
  - Tracking of sales-weighted efficiency trends
  - Appliance price trends Determination of energy savings or other key objectives
  - Influence of label on purchase decisions

Approach: Select indicators to match objectives

To evaluate against your programme objectives, select a number of appropriate indicators:

- Energy savings per programme investment ($/kWh)
- Annual and cumulative energy savings (kWh)
- Average energy performance of products (kWh, EER)
- Avoided imported fossil fuels (toe)
- Avoided GHG emissions (CO2 emissions)
- Peak demand reduction (MW)
- Household or business energy savings ($)
- Improved air quality (changes in air quality index)
- Net jobs created (number)
- Share of sales by label category over time (% category)

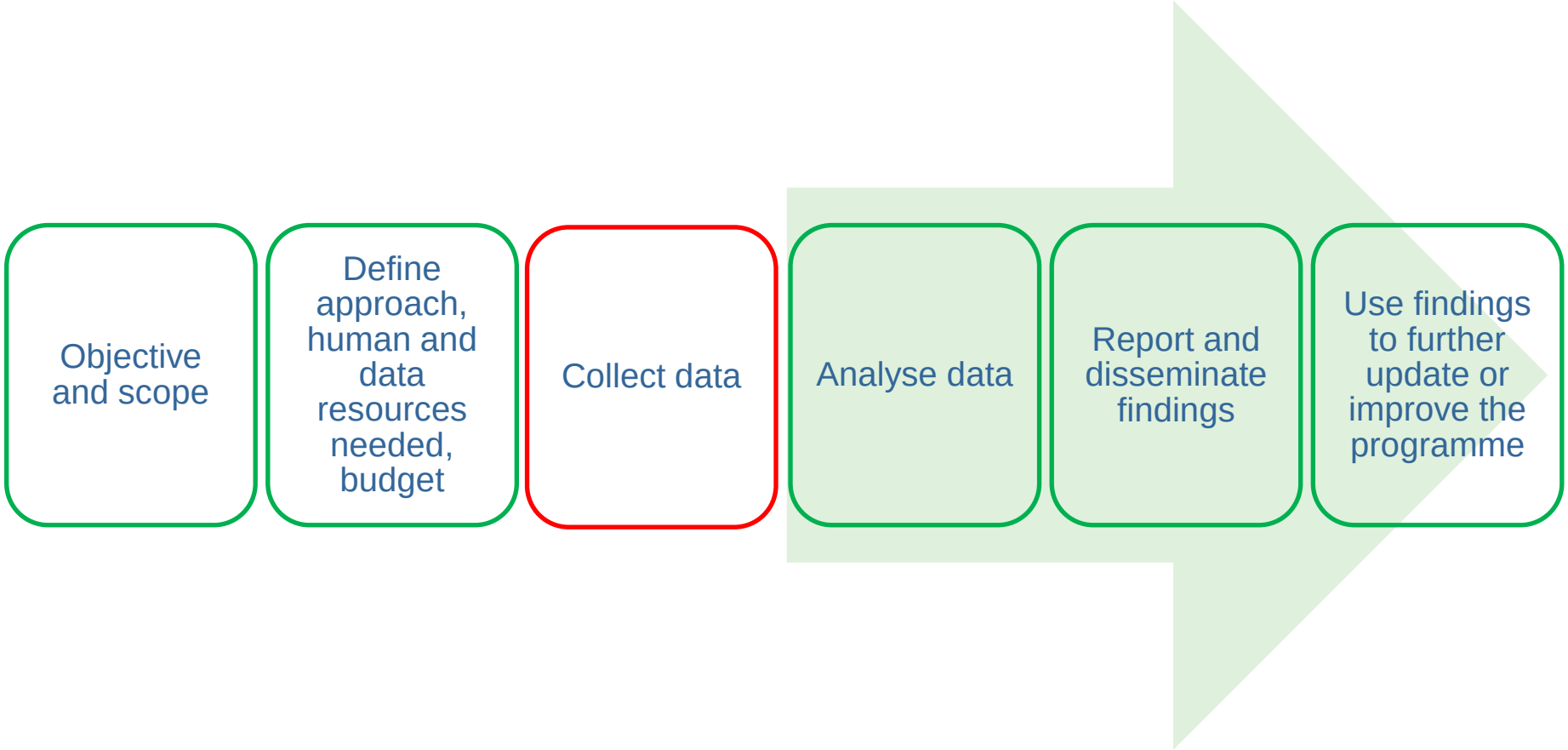
Examples of Evaluation Approaches

Country	Approach
China	**Process** – Survey on awareness and knowledge of the labeling program
Canada	**Impact** – Surveys by government (biannual) and Canadian Appliance Manufacturing Association (confidential – shipment data)
European Union	**Process** – Survey to assess consumer attitudes and issues + interviews with manufacturers and retailers **Impact** – Survey to assess compliance + independent tests in consumer association laboratories to evaluate accuracy of manufacturer product-performance declarations
Thailand	**Process** – Behavior and attitudes of consumers with residential surveys (2,000 households) and influence on manufacturer decisions and market uptake (50 firms) **Impact** – Impact on energy demand savings (actual measurements refrigerators and air conditioners)
United States (Energy Star)	**Process** – Survey on awareness and purchasing decisions **Impact** – Energy savings + equipment sales

Group exercise

- Tell us about your evaluation approaches?
- What challenges have you encountered?

Steps to evaluation…



Data Types and Sources

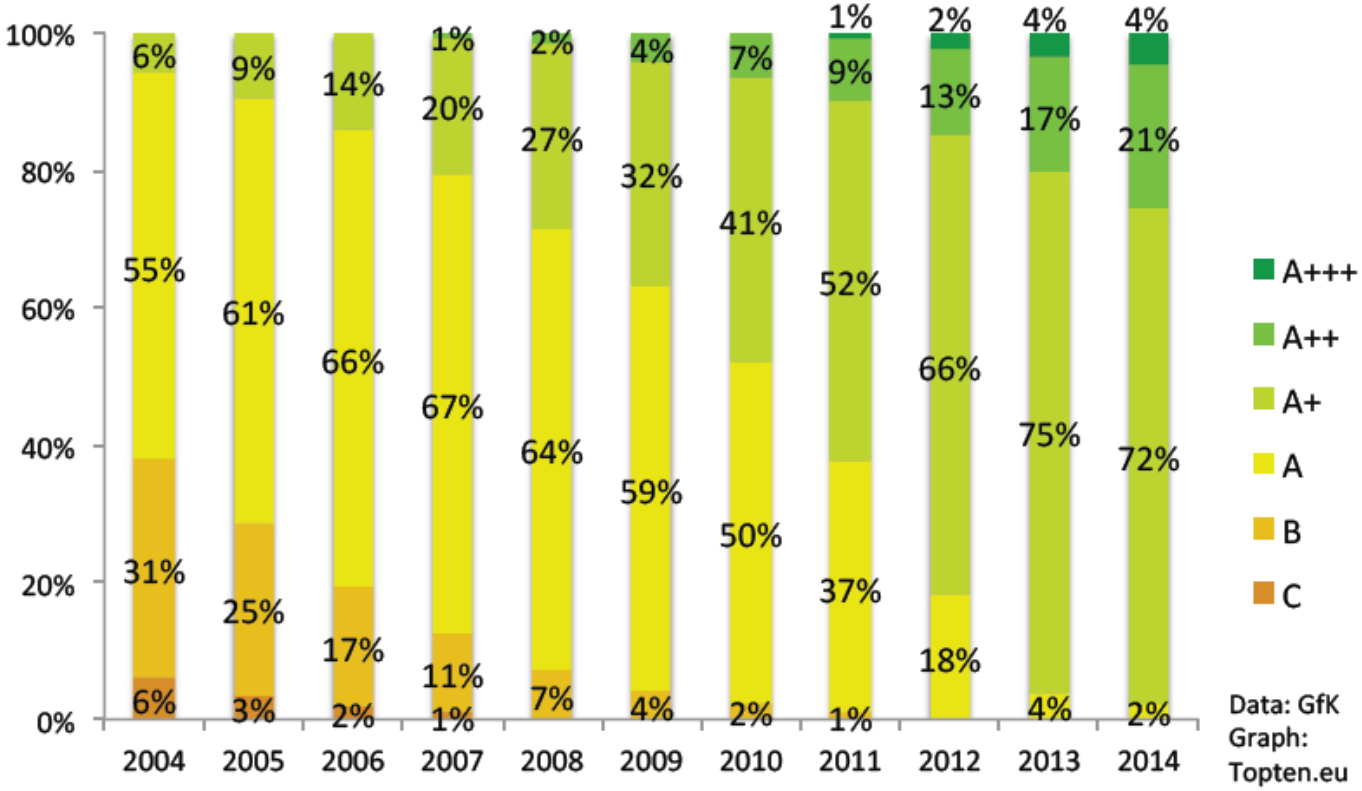
Data Type	Main Data Sources
Customer and retailer knowledge, awareness and understanding	Surveys of customers and retailers
Availability of Products	Sales data from manufacturers, trade associations or government (customs)
	Web crawling and surveys of manufacturers and retailers
	Mandatory registration database
Prices for Efficient Products	Web crawling of websites of retailers and manufacturers
	Surveys of customers, retailers and manufacturers
Market Sales	Sales data from manufacturers, trade associations or government (customs)
	Surveys of customers and suppliers
Energy Use	Manufacturer data
	Independent laboratory data
	Metered end-use data
	Mandatory registration database

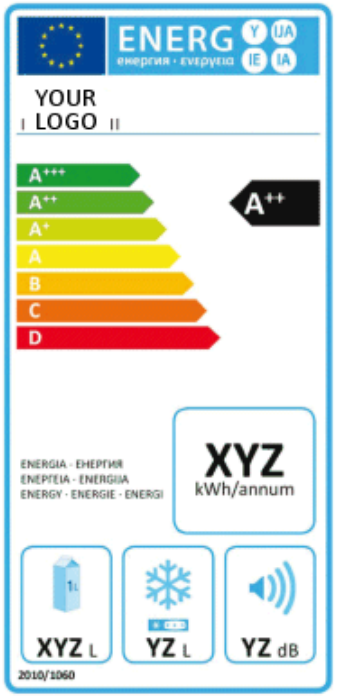
Adapted from Vine et al, 2000. Evaluating the impact of appliance efficiency labelling programs and standards: process, impact and market transformation evaluations

IEA energy efficiency indicator framework

- One source of data
- Over 10 years of developing energy efficiency indicators
- Based on statistics from members
- Detailed analysis
- Multiple publications
- https://www.iea.org/topics/energyefficiency/statistics/

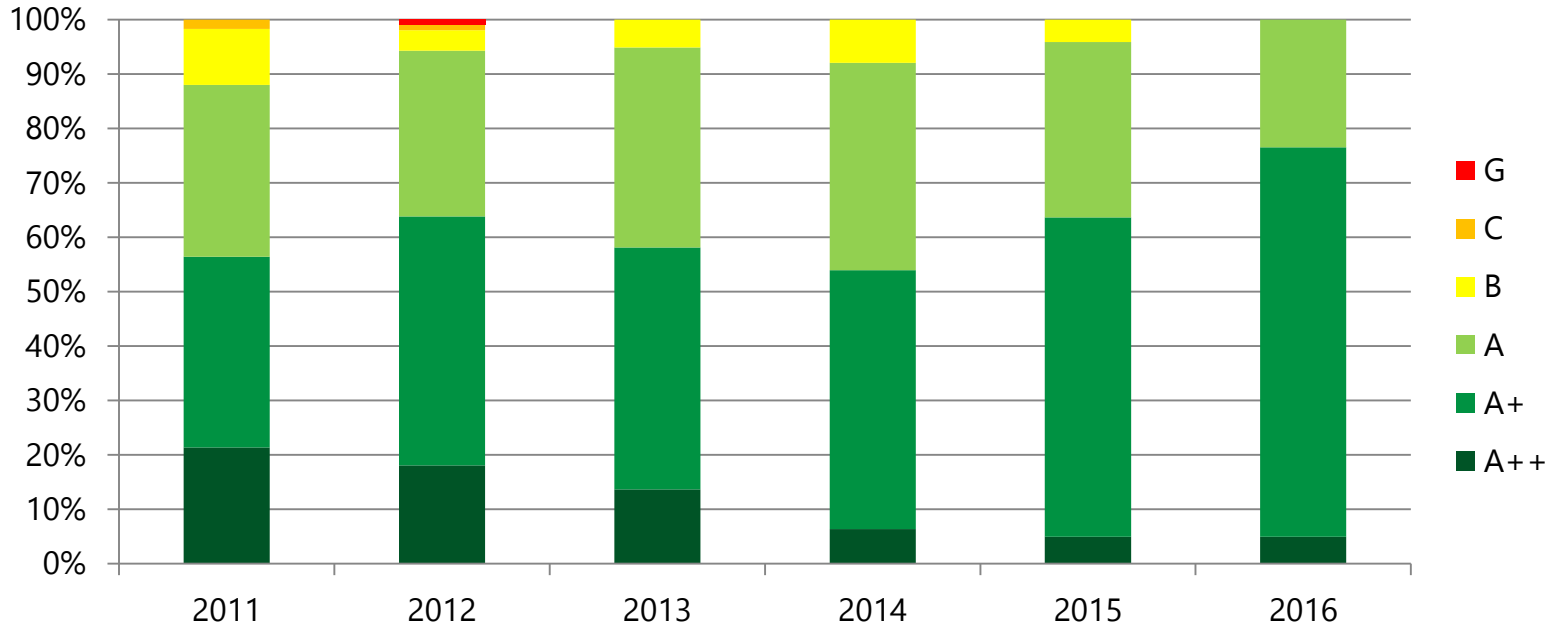
Example indicator: EU Energy Label and Refrigerator Sales





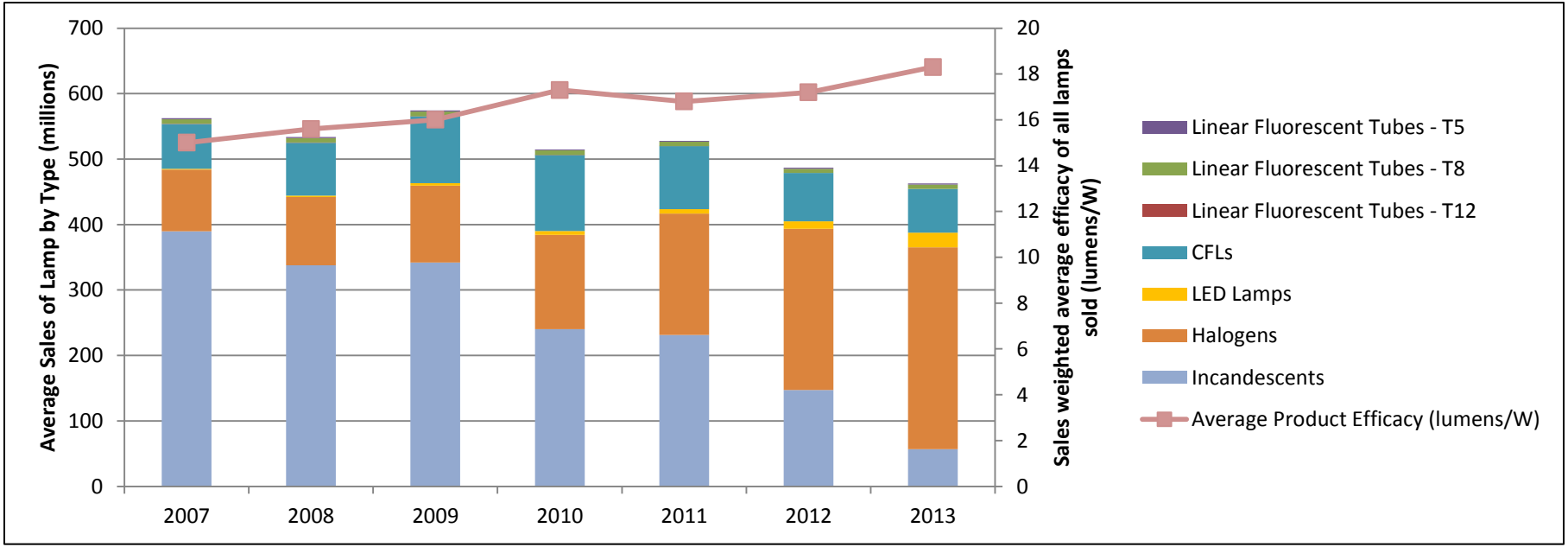
topten.eu - Energy efficiency of White Goods in Europe: monitoring the market with sales data (2004-2014)

Example indicators: Chile refrigerator sales by label



Example: Monitoring the Sales of Lighting in Seven EU Countries

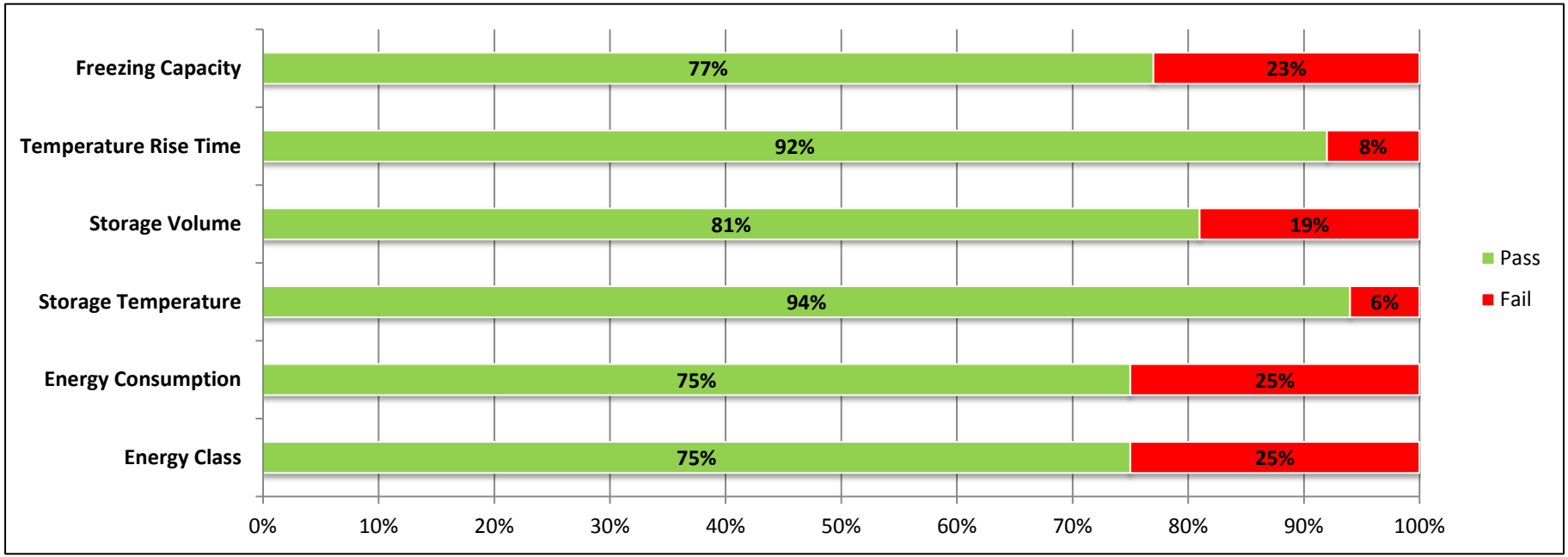
- Incandescent bulb sales fell by almost 2/3 in the same period = wide EU phase-out in 2012
- Halogen sales grew by 22% from 2008 to 2013, LED sales increased by 71%, CFLs almost unchanged
- In 2013, 308 million halogens were sold compared to only 22 million LEDs



IEA 4E Mapping and Benchmarking. EU Mapping Report, September 2014, mappingandbenchmarking.iea-4e.org

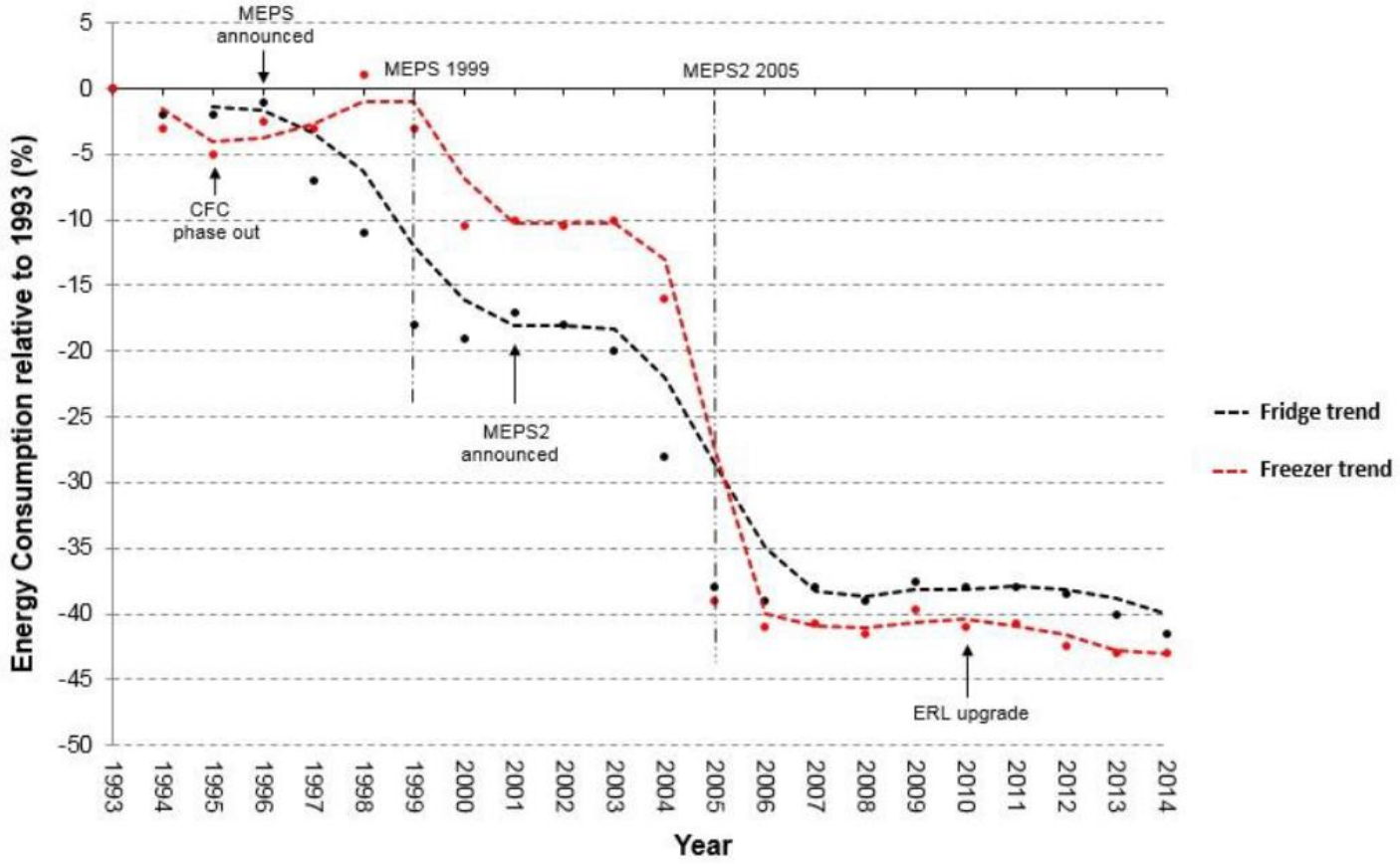
Example: Compliance of Refrigerators and Freezers in Germany

- 21 models selected for compliance verification
- 5 models failed



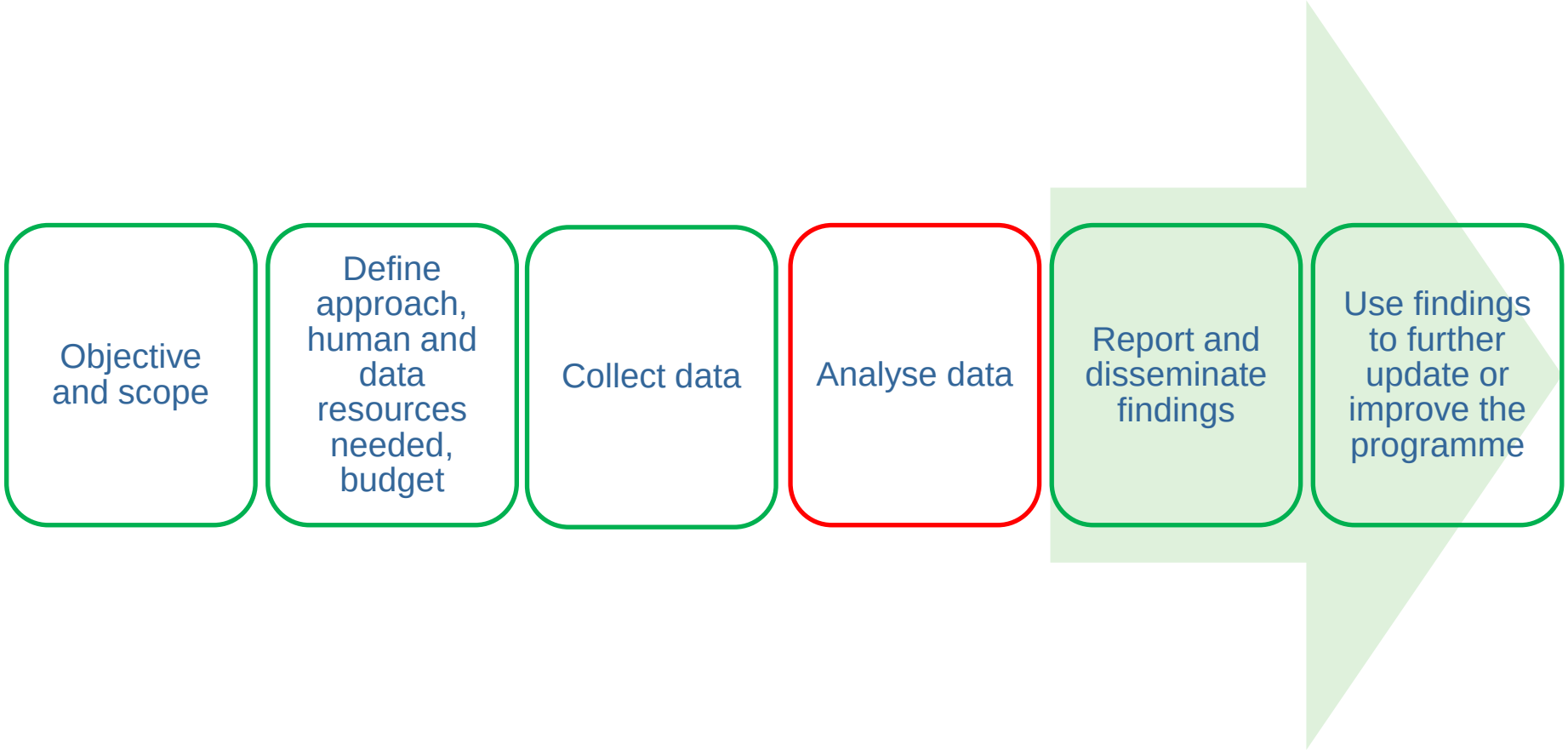
EU Come On Labels Project www.come-on-labels.eu

Example: Improvements in Refrigerator and Freezer Efficiency in Australia



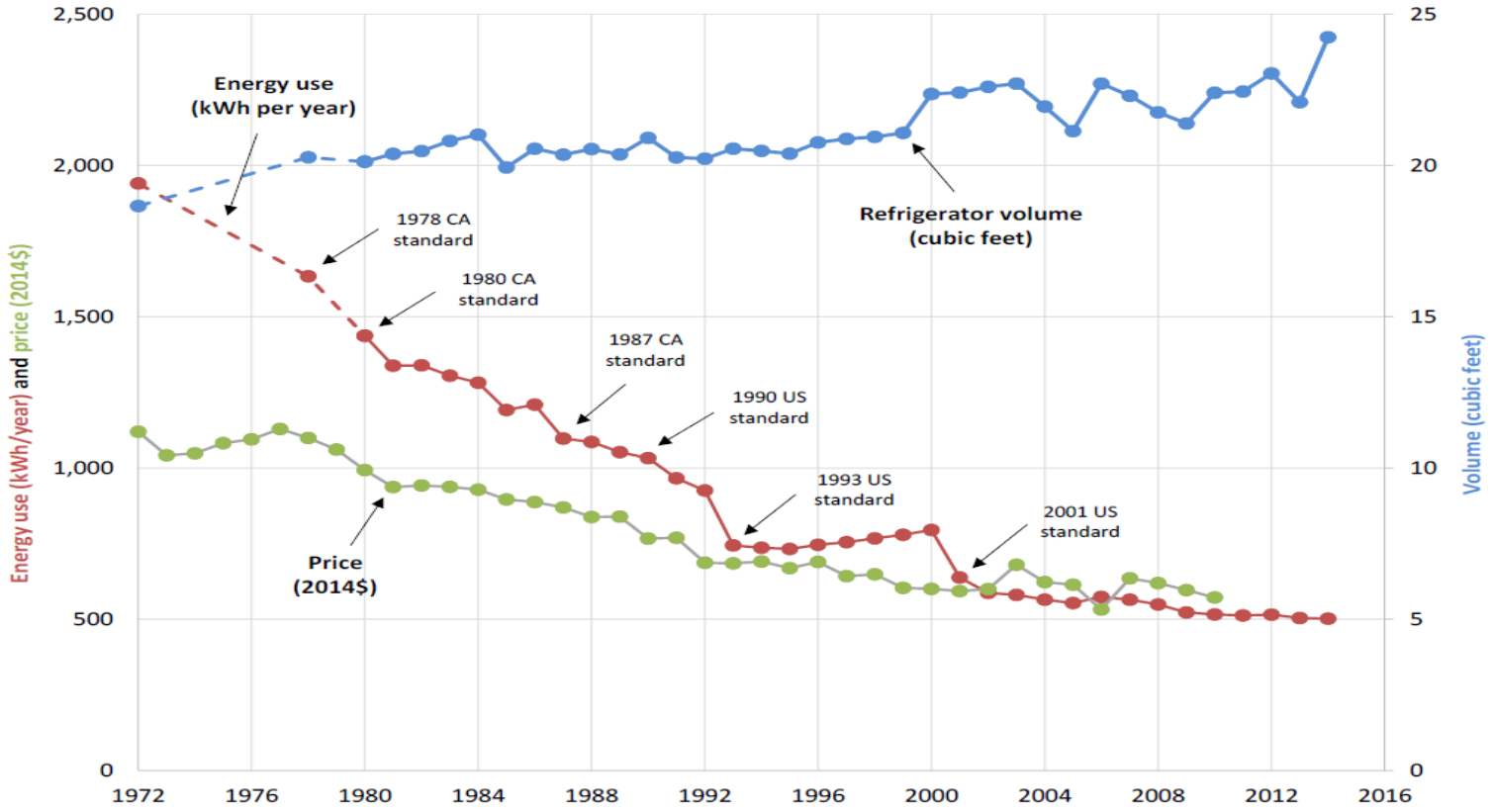
AUS/NZ, Consultation Regulation Impact Statement – Household Refrigerators and Freezers, April 2017

Steps to evaluation…



AUS/NZ, Consultation Regulation Impact Statement – Household Refrigerators and Freezers, April 2017

Analysis: Impact of Refrigerator Standards: Energy Consumption in the USA



ACEEE, 2017. Energy-Saving States of America: How Every State Benefits from National Appliance Standards

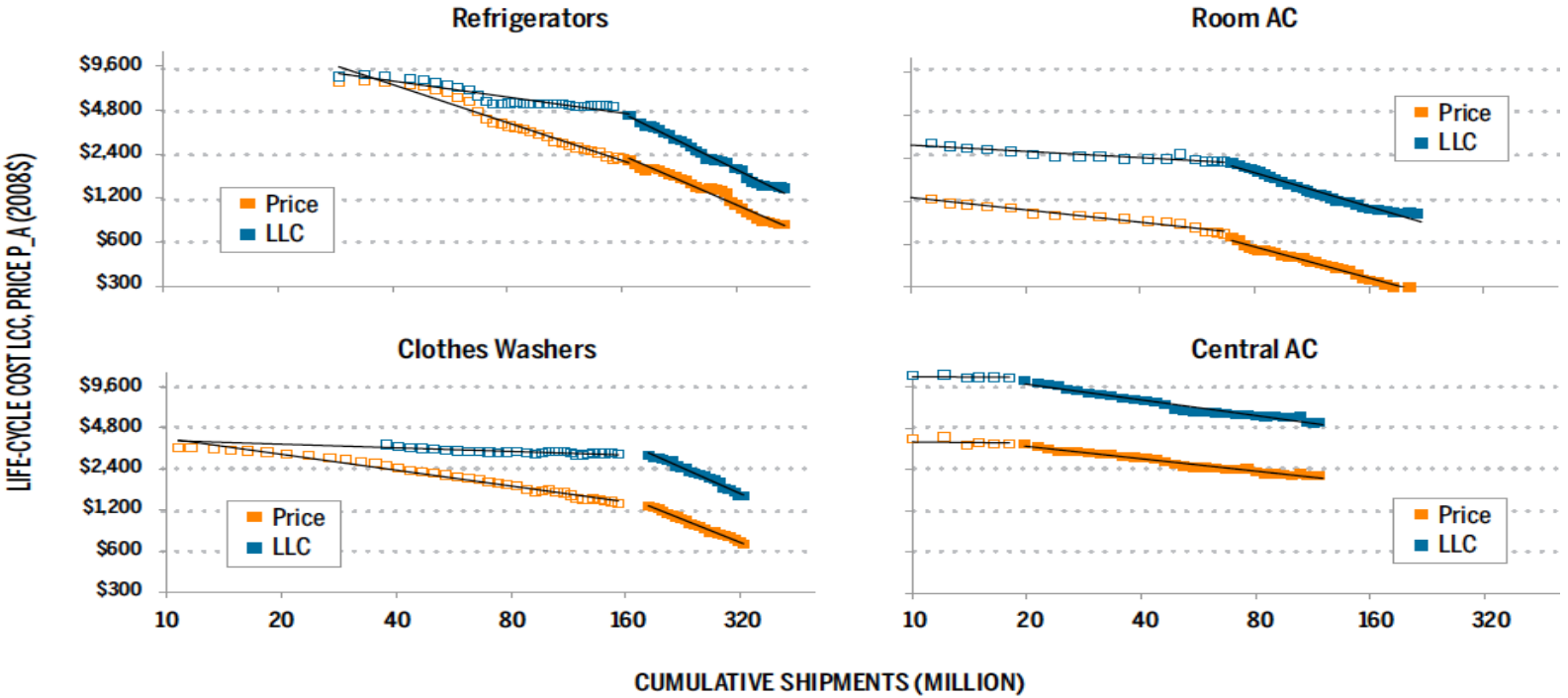
Analysis: Effect of MEPS on price

Table 1: Comparison of predicted and actual price increases from US MEPS [22]

PRODUCT	DOE ESTIMATE OF INCREMENTAL PRICE OF STANDARD (NOMINAL $)	DOE ESTIMATE (2011$)	COST FROM CENSUS (2011%)	DIFFERENCE (2011$)
Refrigerators	32	56	37	-18
Clothes Washers	34	54	-35	-89
Clothes Washers	126	199	10	-188
Electric Water Heaters	67	108	28	-80
Non-Electric Water Heaters	75	121	34	-88
Central AC – 3 tons	167	267	207	-59
Room AC	7.50	13	-162	-175
Commercial AC – 15 tons	334	512	-224	-736
Ballasts	4.27	6.73	-1.74	-8.47
Average		148	-12	-158
Median		108	10	-88

Analysis: Price and LCC after MEPS, USA

Figure 8: Purchase price (red) and LCC (blue) trends for appliances pre-standards and post-US Federal MEPS [12]

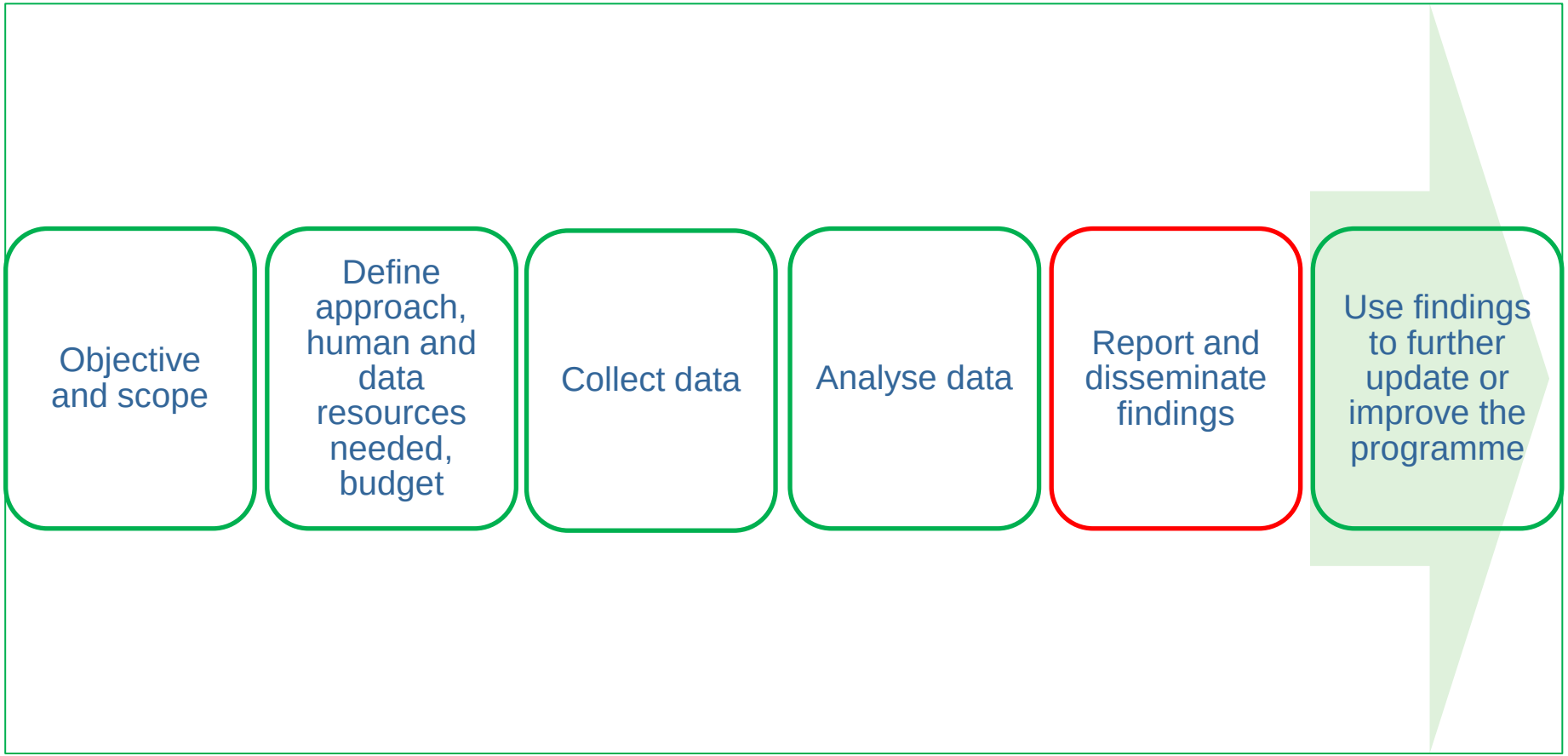


Analysis: Multiple Benefits (impacts) in Europe

- **Benefits to Consumers:**
  - Electric Oven A+ can save €230 compared to D class
  - Standby MEPS can save €40 per household per year
  - Overall savings estimate at €465 per year per household by 2020
- **Benefits to Producers and Retailers:**
  - €55 billion extra revenue per year for European business
  - Protect EU industry from low quality and low cost products
  - Approximately 30% non-EU countries have adopted EU product regulations
- **Impact on Energy Security:**
  - Reduction in energy import of 65 million barrels of oil per year
  - Last 5 years €100 billion saved
- **Benefits for the Environment:**
  - 166 million toe in primary energy = TPES of Italy or 60 million households

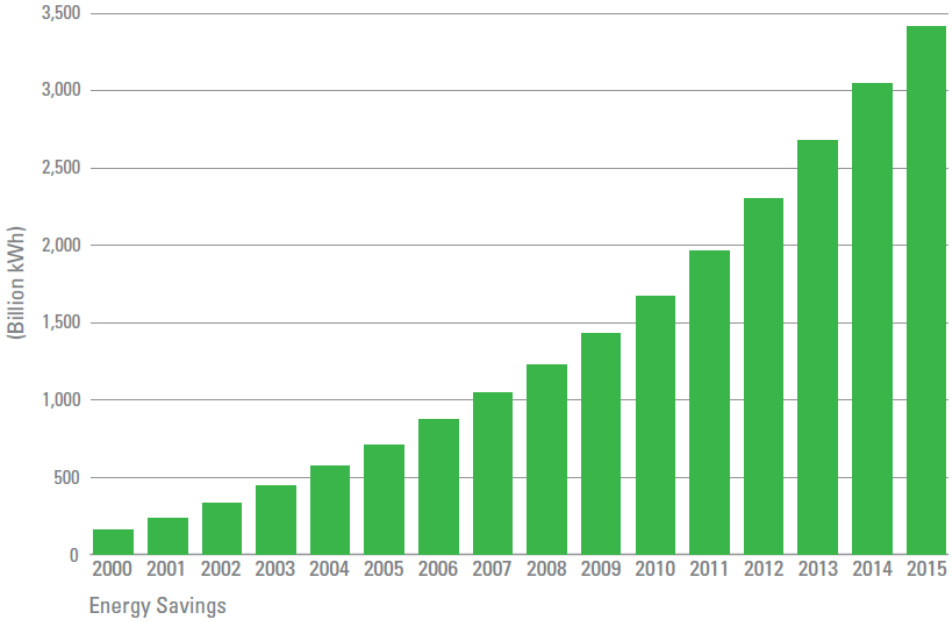
European Commission, 2015 - https://ec.europa.eu/energy/node/2349

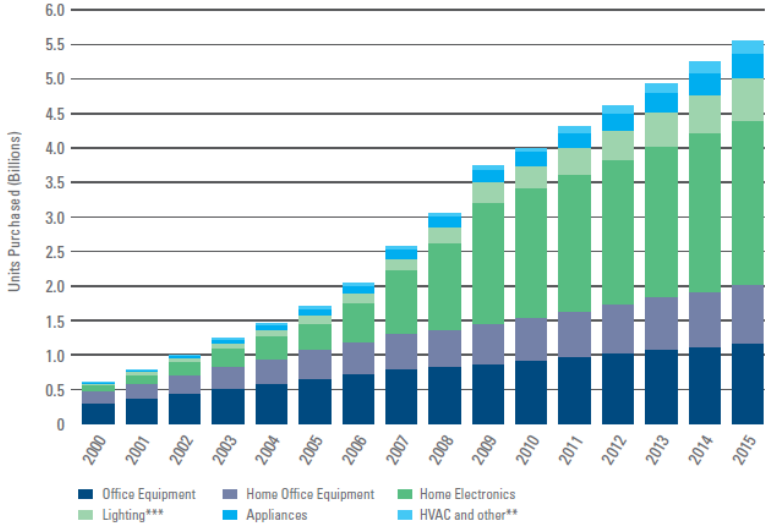
Steps to evaluation…



Reporting: Energy Star Label in the US

- Cumulative Savings since 1992 = > 3,300 TWh by 2016
- In 2015, global electricity generation = 23,816 TWh
- Brand awareness rose from 40% in 2000 to >85% in 2015

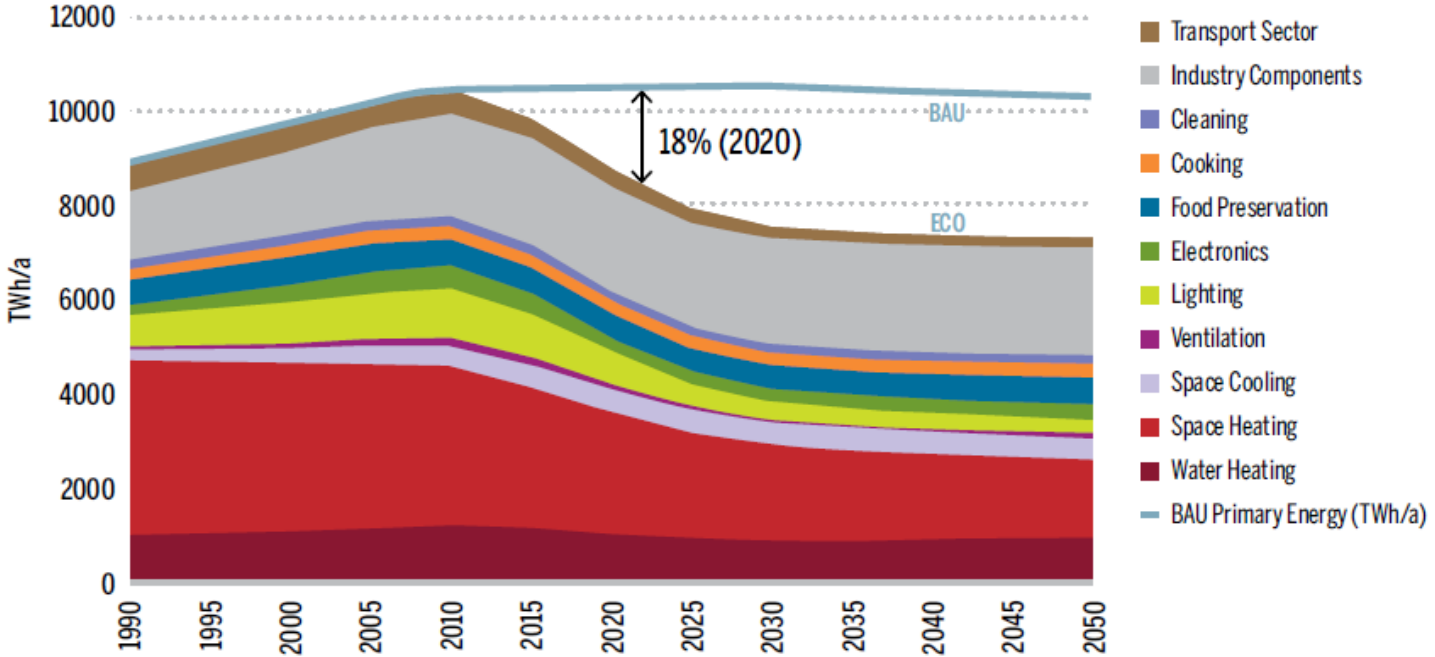




* Program began in 1992.
** Other category does not include roofing purchases.
*** Lighting category does not include purchases of light bulbs.

Energy Star, 2015. Overview of 2015 Achievements, http://www.energystar.gov/

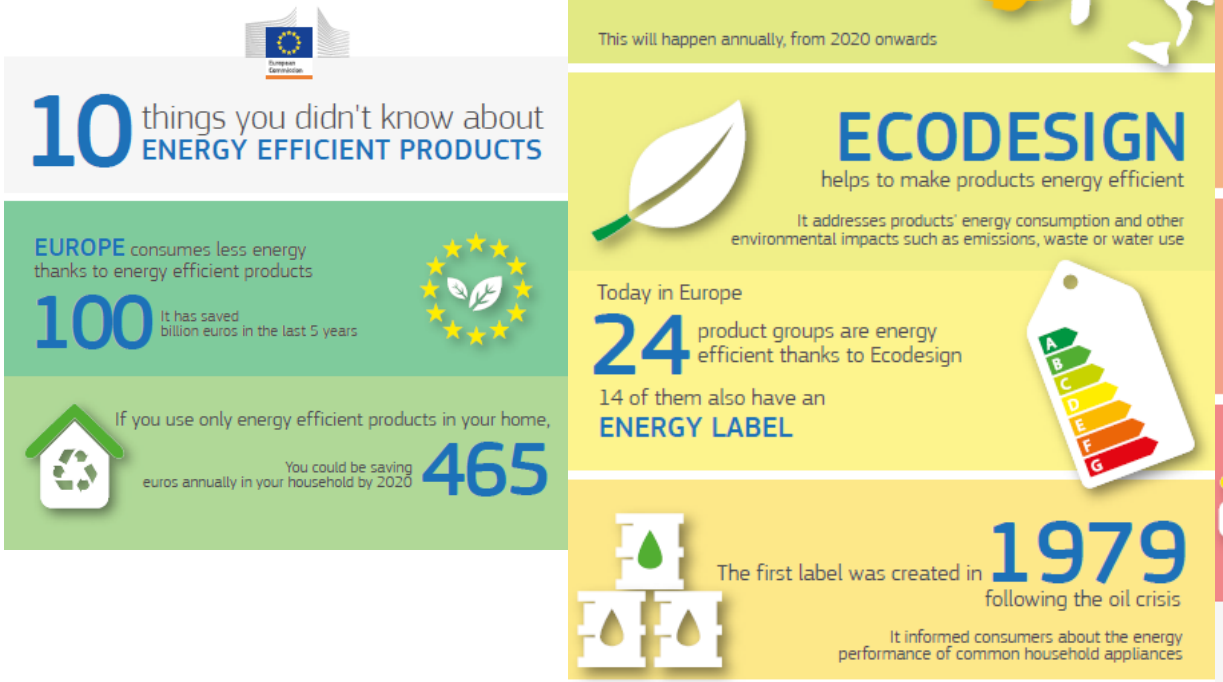
Reporting: Impact of EU Ecodesign Programme on Primary Energy Consumption



Impact analysis of the EU Ecodesign programme indicates that it will cut primary energy consumption by 18% by 2020 (890 TWh) – equivalent to 9% of total energy consumption in EU in 2010

IEA 4E, Achievements of appliance energy efficiency standards and labelling programs - A Global Assessment in 2016

Reporting: Multiple Benefits in Europe



European Commission, 2015 - https://ec.europa.eu/energy/sites/ener/files/documents/eep_infographic_en.pdf

Reporting: Energy Efficient Prosperity: India's Domestic Lighting Programme

1 Affordable:
The cost of the **LED bulb** is paid through the utility bill at **10 INR** per month making energy efficiency **affordable to everyone.**

2 Employment:
UJALA provides temporary employment to more than **35,000 people** in the distribution of the LED bulbs across the country. A total of about **700 million INR is paid in wages per month**, providing significant benefits to local economies and families.

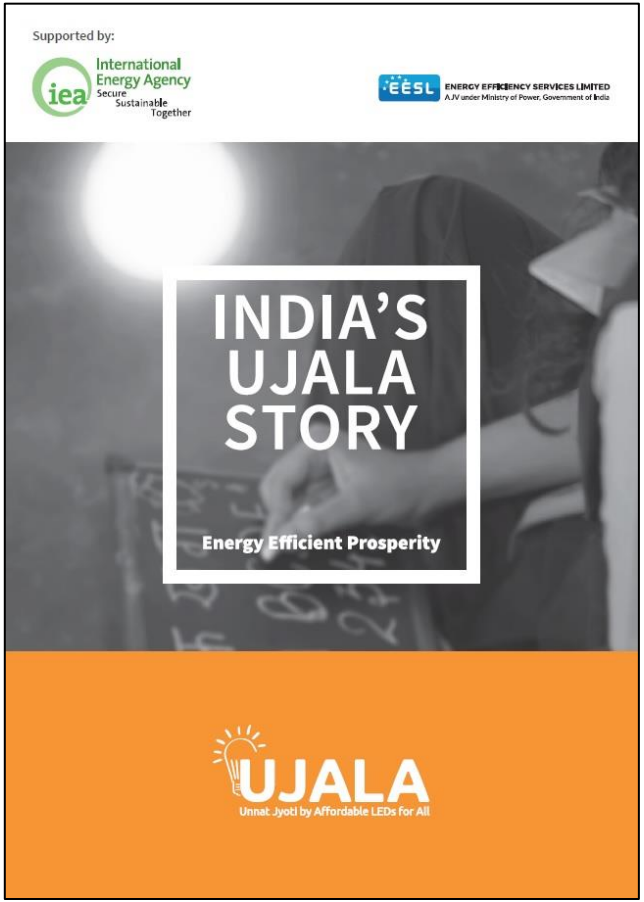
3 Help families save money:
UJALA has cut annual household **electricity bills by about 15%**, equivalent to saving one week's average wages per year. Total **savings** are over **16 billion INR** every year - equivalent to the GDP of Mumbai - which families can then spend on **goods and services** to improve their standard of living.

4 UJALA is cheaper than electricity:
EESL's investment in **UJALA is approximately 2.3 INR per kWh** saved while the cost of electricity generation from a coal power plant in India is about **5.2 INR per kWh** generated.

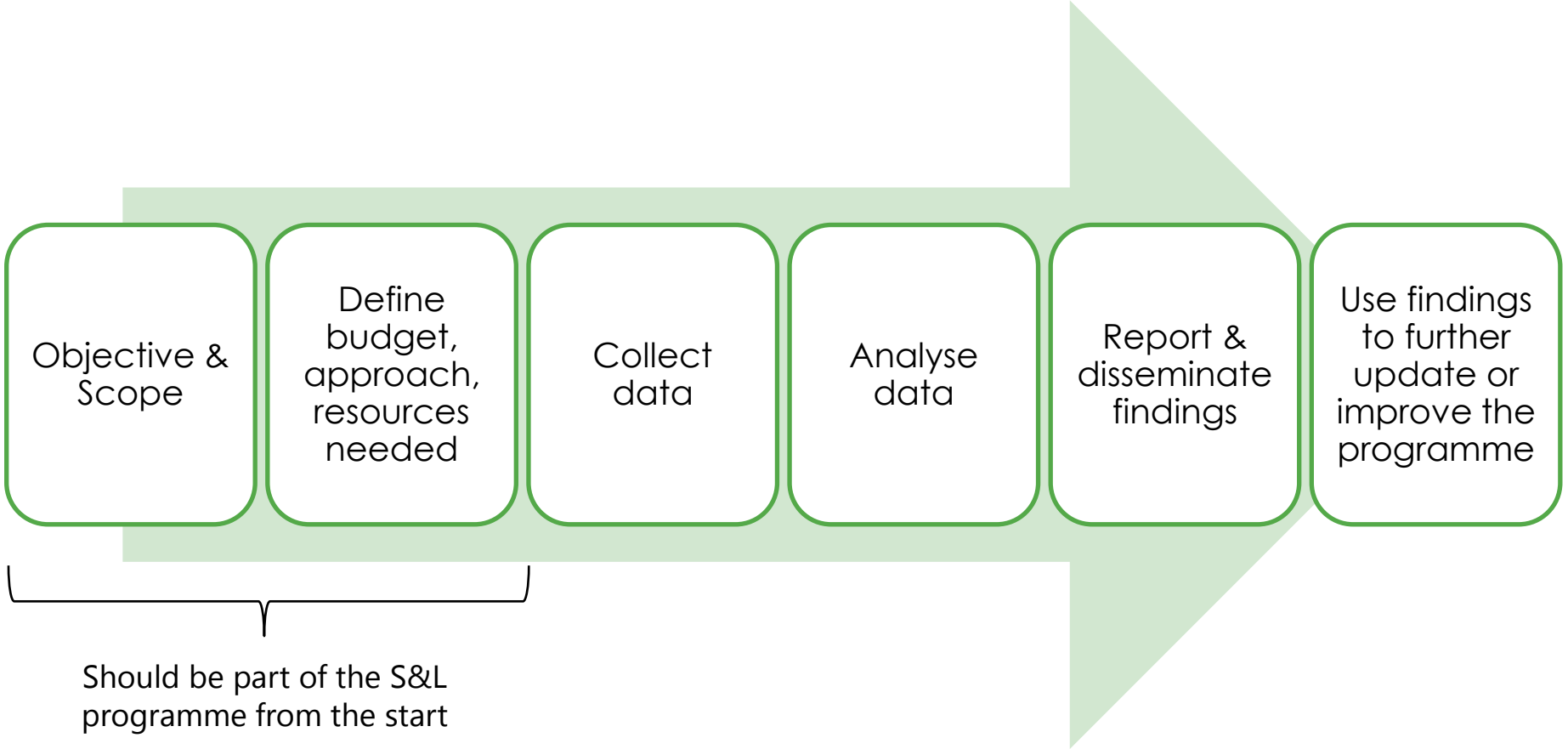
5 Reducing air pollution:
Cutting **CO_2 emissions** by **3 million tonnes a year** equivalent to **removing 2.7 million cars** from the road.

6 Helps manage growing energy demand:
The **electricity savings** achieved under UJALA are equivalent to the generation of a **500 MW coal fired power plant**, which would cost **40 billion INR** to build at current prices. In addition, these savings could help power at least an additional **1 million households.**

http://www.eeslindia.org/writereaddata/Ujala%20Case%20study.pdf



Summary - Basic Steps for Evaluation



Summary

- Plan evaluation from the start and budget ahead!
- If you have limited budget keep the goals simple and prioritise
- Assess the multiple benefits as these can help secure funding and support from other ministries (e.g. health, environment)
- Use new technologies and approaches to reduce staff time in administrative work (e.g. online registration systems)
- Work with industry associations and utilities to assess the multiple benefits
- Publish findings

www.iea.org

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Annex – extra examples, slides

- Kevin Lane
- Paris, May 2018

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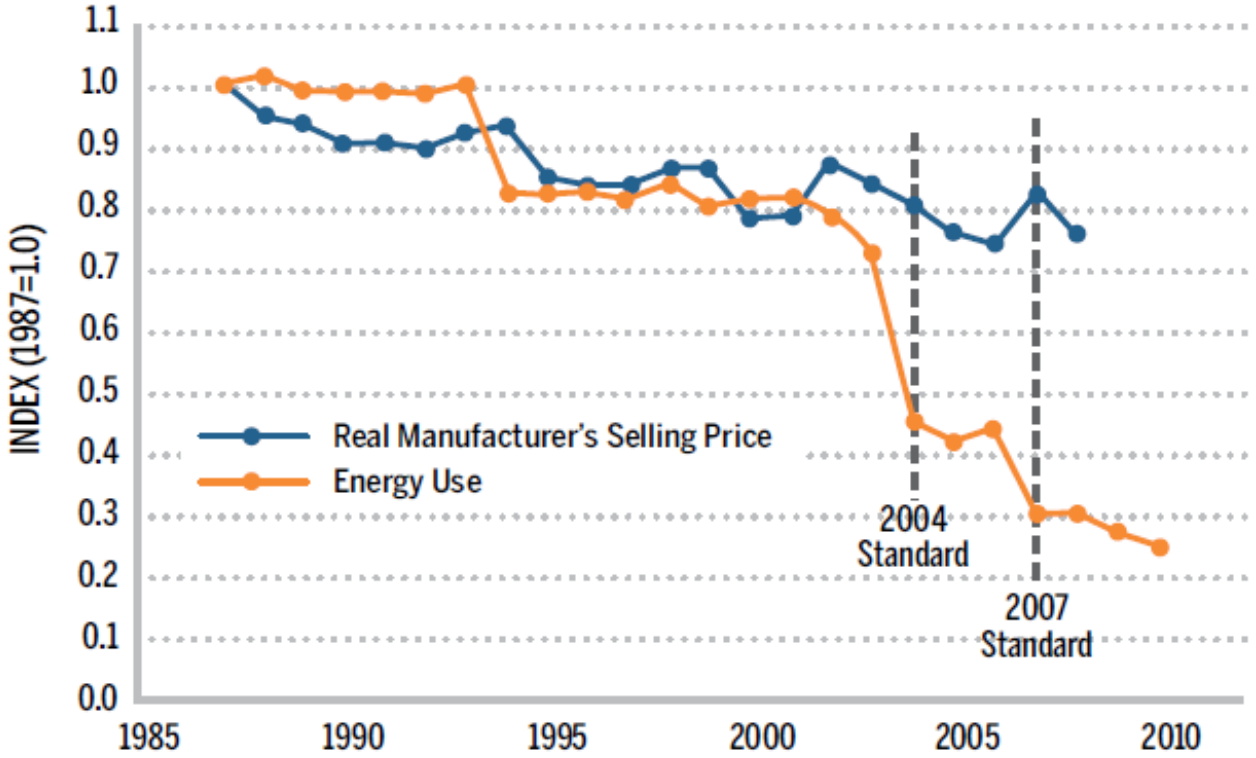
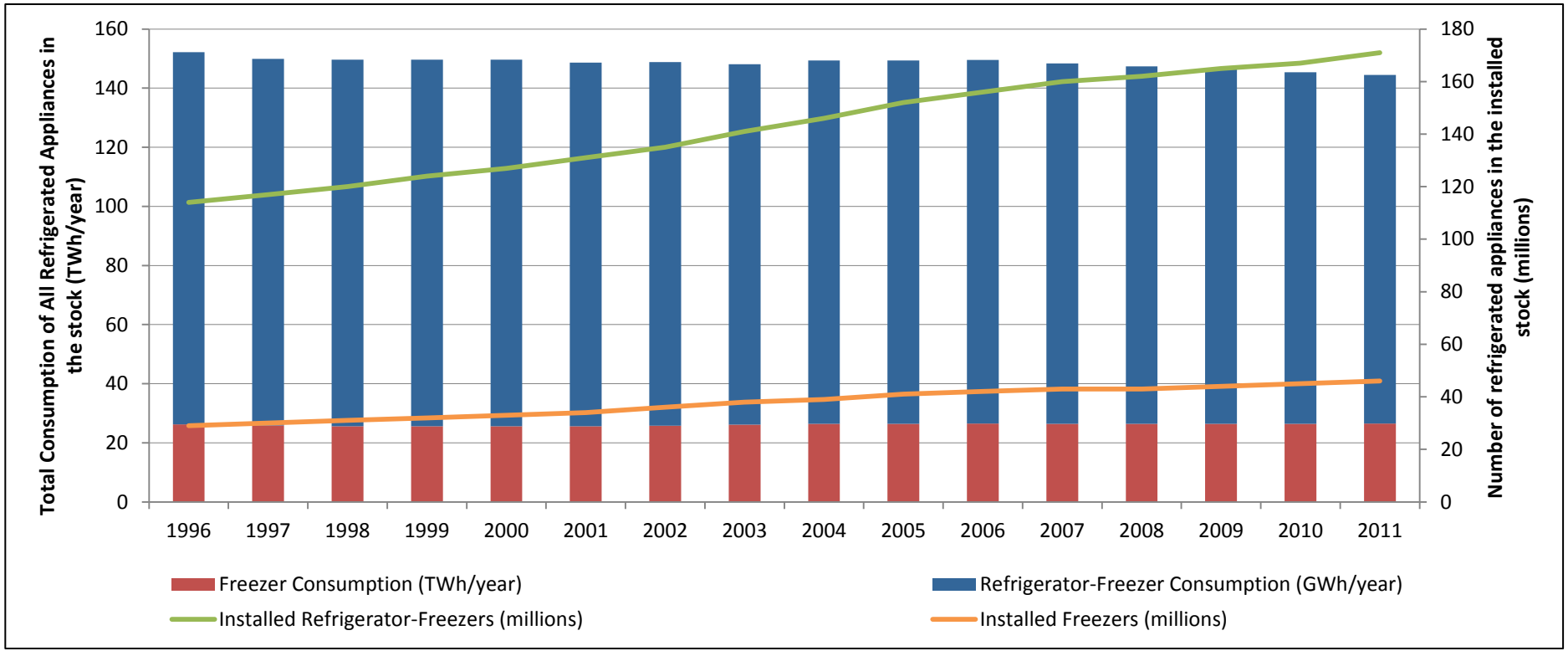
Analysis: Impact of Clothes Washer Standards on Annual Energy Consumption in the US



IEA 4E, Achievements of appliance energy efficiency standards and labelling programs - A Global Assessment in 2016

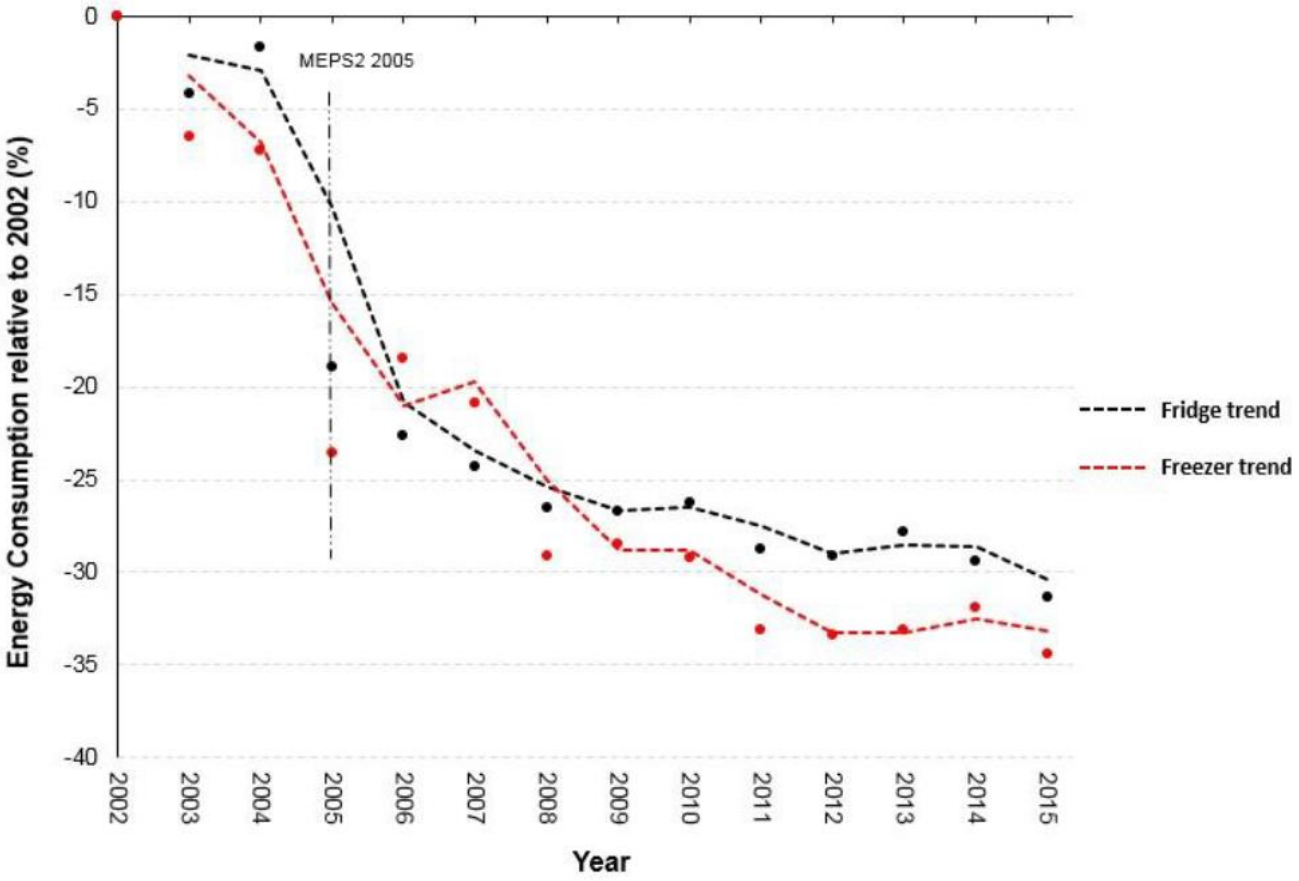
Example: Energy Consumption and Sales of Refrigerators in the USA

- Stock rising while total consumption is decreasing slightly



IEA 4E Mapping and Benchmarking. US Mapping Report, December 2012, mappingandbenchmarking.iea-4e.org

Example Indicator: Improvements in Refrigerator and Freezer Efficiency in New Zealand



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