Halving worldwide electricity demand for residential cold appliances through appropriate policy packages

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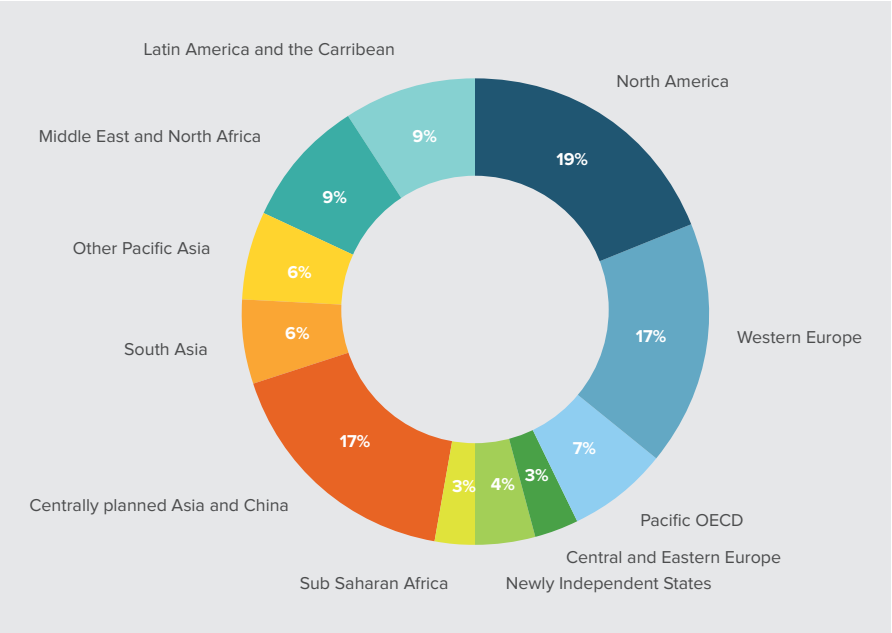
Introduction

- **Domestic refrigerators and freezers** are among **the most widely used electrical appliances** all around the world.
- They **contribute significantly** by their electricity consumption **to the greenhouse effect**.
- It is well known, that **huge differences between the average and the most efficient appliances exist**.
- This raises the questions
  - How high is the **worldwide electricity consumption** in the different world regions?
  - How will this develop in a **Baseline and in an Efficiency Scenario**?
  - What **kind of policy** could address the efficiency potentials?

The overall worldwide stock of domestic refrigerators and freezers

- About **1,4 billion domestic refrigerators and freezers** are in use worldwide with an average annual electricity consumption of **450 kWh each**.
- Altogether they account for almost **14 % of the total electricity consumption from the residential sector or 650 TWh/a**.
- They cause worldwide **annual greenhouse gas emissions of 450 million tons of CO_{2eq}**.



Worldwide distribution of electricity consumption for domestic cold appliances

What users can save with energy-efficient refrigerators and freezers

The most common types of cold appliances worldwide are:

- Single-door refrigerator without freezer
- Single-door refrigerator with freezer
- Double-door fridge-freezer
- Side-by-side fridge-freezer
- Upright freezer
- Chest freezer

Best Practice Example: Double-door fridge-freezer

Comparing inefficient models and Best Available Technologies (BAT) on the worldwide market with future Best No yet Available Technologies (BNAT) potential

		Energy (kWh/ year), in accordance with ISO standard **	Energy class	Energy saving potential vs. inefficient model	Energy cost savings versus inefficient model (EUR in 15 years at 12 EUR-Cent/kWh)
Small[1] 172 litres (Volume in accordance with Chinese standard)	Inefficient model	237	Chinese National energy efficiency grade 2 (equivalent to EU Energy class A)		
	BAT level	91	55 % better than required by the Chinese National energy efficiency grade 1 (equivalent to EU Energy class A+++)	62 %	262
	BNAT level (Calculated in accordance with EU EEI* = 15 %)	77	32 % better than required by EU Energy class A+++	68 %	288
Medium[2] 293 litres (Volume in accordance with EU/ISO standard)	Inefficient model	303	EU Energy class: A+		
	BAT level	139	EU Energy class: A+++	54 %	296
	BNAT level (Calculated in accordance with EU EEI* = 15 %)	97	32 % better than required by EU Energy class A+++	68 %	371
Large[3] 583 litres (Volume in accordance with AHAM U.S. standard)	Inefficient model	510	No Energy Star (equivalent to EU Energy class A+)		
	BAT level	356	12,5 % better than required by Energy Star (equivalent to EU Energy class A++)	30 %	249
	BNAT level (Calculated in accordance with EU EEI* = 15 %)	192	32 % better than required by EU Energy class A+++	62 %	514

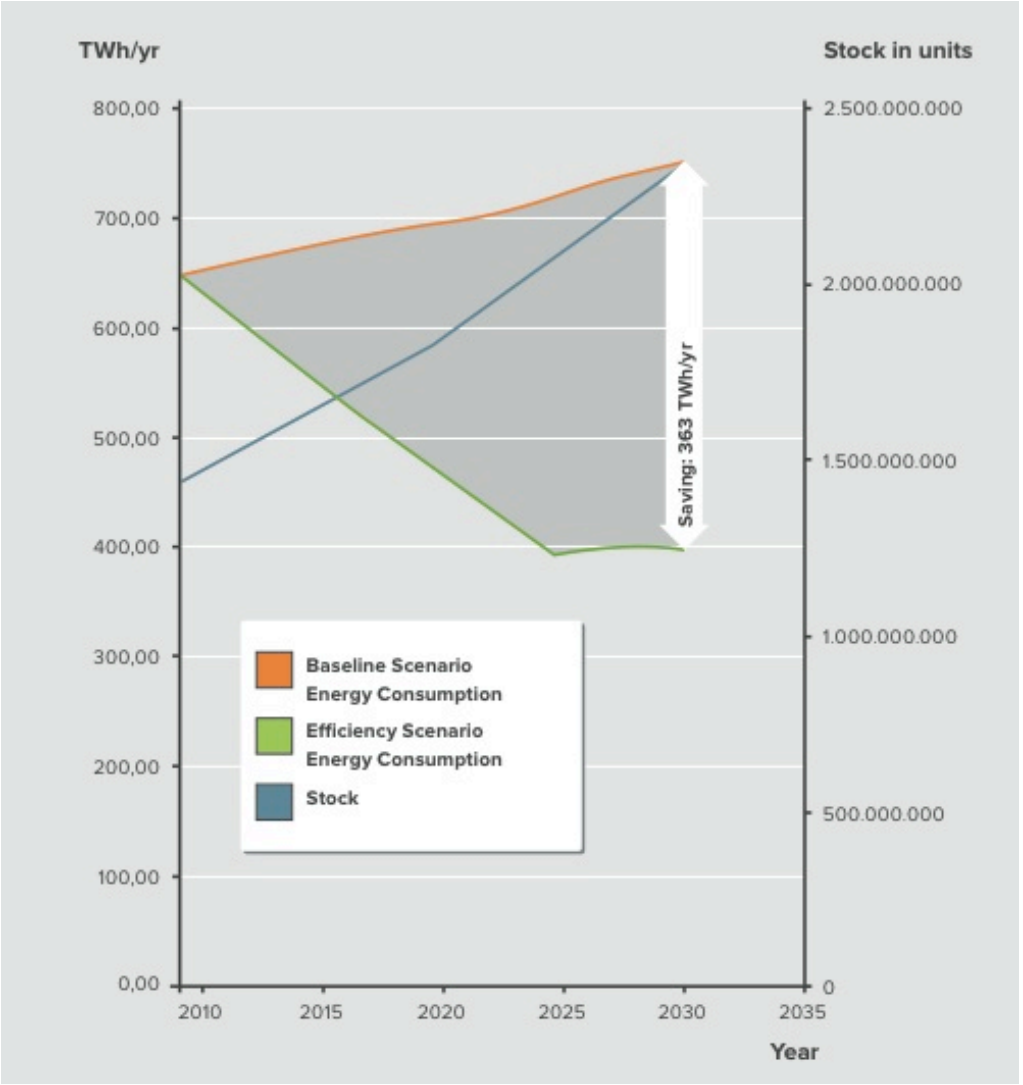
Source: [1]top10.cn / [2]topten.eu / [3]toptenusa.org (2012) for Energy (kWh/year) of a typical inefficient model and example of a BAT model, own calculations of BNAT level, Energy saving potential and Energy cost savings

Model calculations to calculate the saving potential from domestic refrigerators and freezers

- **Bottom-up model calculations** were carried out to assess the **efficiency potential and the financial benefits/costs.**
- **Model calculations** assume that old inefficient models are replaced by modern energy-efficient ones every time a new cold appliance is bought.
- They include **improvements in the most efficient models** over the years as well as **increasing saturation** and the **trend to bigger models**.

The overall worldwide saving potential from domestic refrigerators and freezers

- The expected worldwide **annual electricity consumption** by domestic cold appliances **could be reduced from 775 TWh to 413 TWh by 2030** despite the expected 62 % increase in the number of cold appliances in use by 2030.



The overall worldwide saving potential from domestic refrigerators and freezers in the 11 IPCC regions

World regions	Present situation			Results of model calculations for 2030			
	Stock number domestic cold appliances [m]	Electricity consumption [TWh/year]	Average electricity consumption in the stock of a domestic cold appliance [kWh/year]	Stock number domestic cold appliances [m]	Baseline Scenario electricity consumption [TWh/year]	Efficiency Scenario electricity consumption [TWh/year]	Electricity savings Efficiency Scenario vs. Baseline Scenario
North America	209	123.3	590	265	117.7	62.0	47 %
Western, Central and Eastern Europe	335	126.3	377	411	111.1	59.1	47 %
Pacific OECD	108	48.6	450	137	49.6	28.0	44 %
Newly Independent States	69	28.5	413	125	39.2	17.8	54 %
Sub Saharan Africa	49	20.4	416	107	33.7	18.1	46 %
Centrally planned Asia and China	260	108.3	417	570	179.7	96.5	46 %
South Asia	63	40.2	638	138	54.5	29.4	46 %
Other Pacific Asia	82	31.8	388	148	48.1	29.2	39 %
Middle East and North Africa	142	60.4	425	256	80.9	43.5	46 %
Latin America and the Caribbean	118	61.6	522	175	60.2	30.1	50 %
Total	**1,435**	**649.4**	**453**	**2,332**	**774.8**	**413.8**	**47 %**

The overall worldwide saving potential from domestic refrigerators and freezers

- The calculations also show that **policy measures and programmes to capture this potential improvement are cost-effective** for society as well as for end-users **in all 11 world regions**.

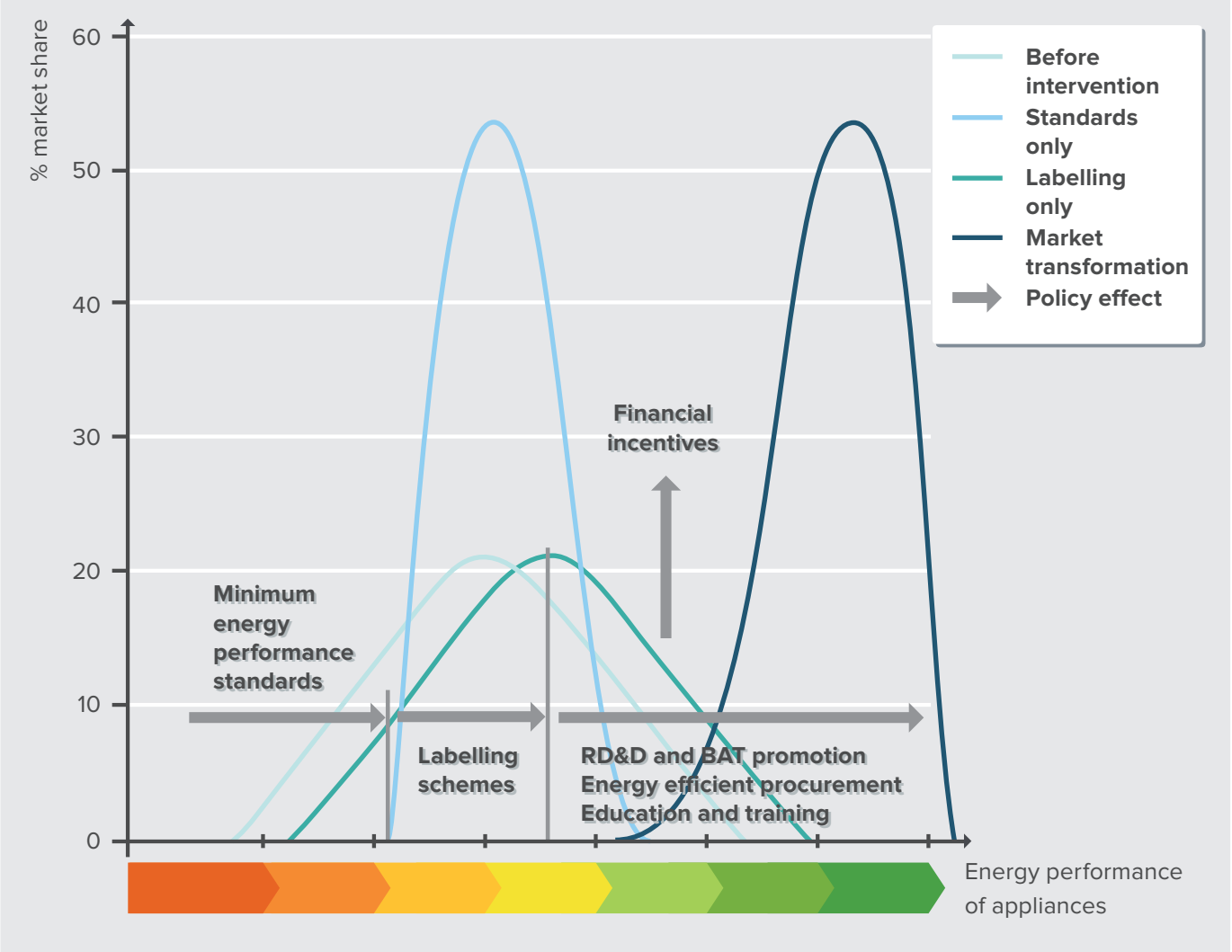
- Over the lifetime of the energy-efficient refrigerators and freezers in use by 2030, **consumers worldwide would benefit from total net savings of around € 13 billion** (including energy taxes and value added taxes) while **net benefits to society would be about € 10 billion**.

A policy package for appliances

Outline

- An ‚ideal' policy package
- An established package for refrigerators
- A good practice example from California

A policy package for appliances



Source: Wuppertal Institute 2012

Appliance-specific policy packages

- Specific barriers and incentives to manufacture, sell or buy an energy-efficient product
- Product specialities
- Technical differences

→The package must be adapted to special circumstances

An established package for refrigerators

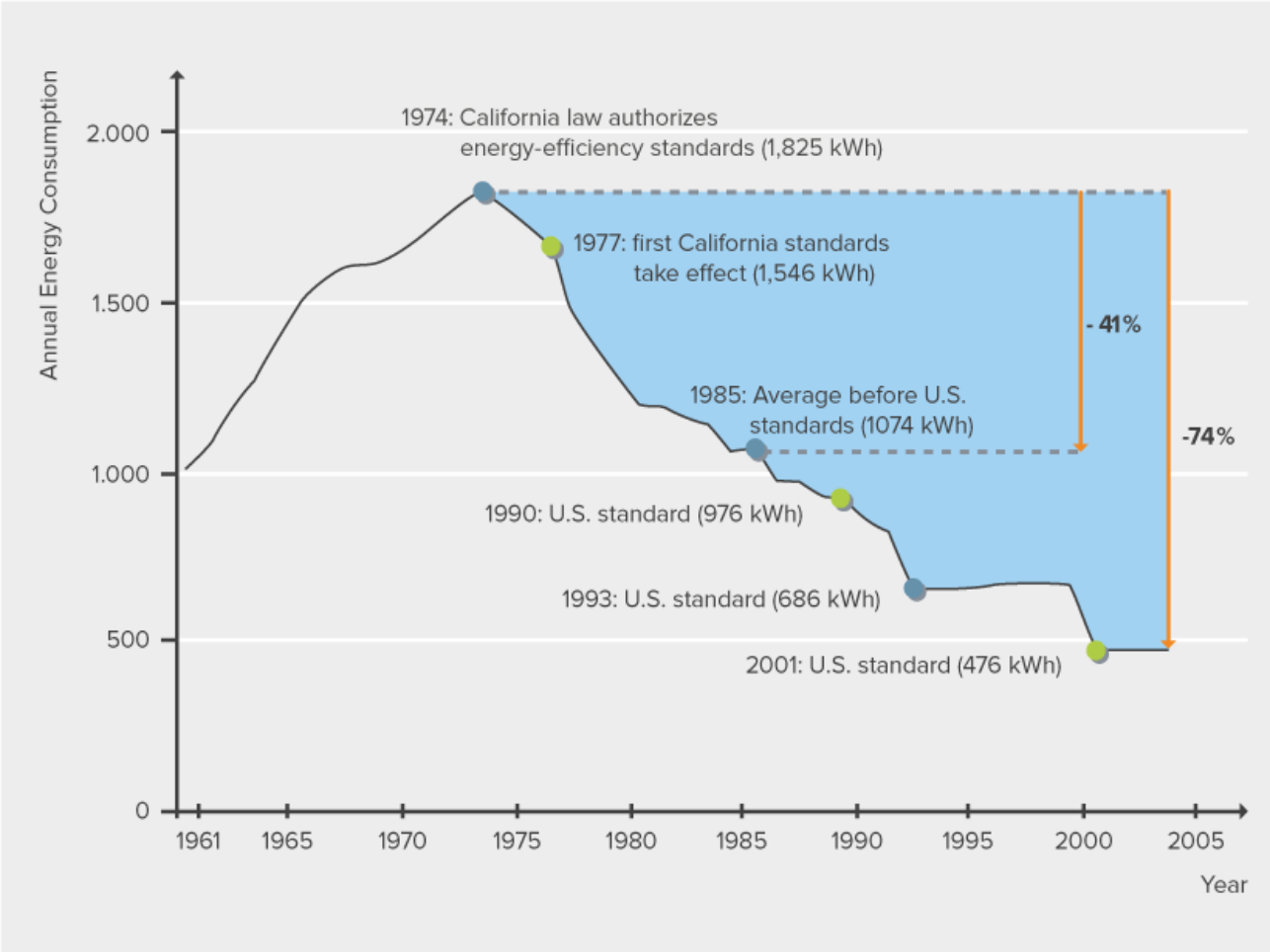
Relevant policy types:

- Governance framework
- Regulation
- Transparency and Information
- Incentive and Financing
- Education and training
- Procurement programmes and BAT promotion

A good practice package from California

- Overall reduction target: The California Global Warming Solution Act
- MEPS form the central element of the policy (since 1976)
- Financial incentives (offered by investor-owned utility companies)
- Energy Star label and EnergyGuide label
- Campaigns and training courses for consumers and retailers
- Awards to stimulate demonstration projects
- Public procurement programme

A good practice package from California



Source: CLASP 2005

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Thank you for your attention!

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