
CONTRIBUTION OF EFFICIENCY TO ENERGY SECURITY

**EUFORES Parliamentary Dinner Debate:
Renewables and Energy Efficiency: Their
contribution to Energy Security**

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Fraunhofer is the Largest Organization for Applied Research in Europe

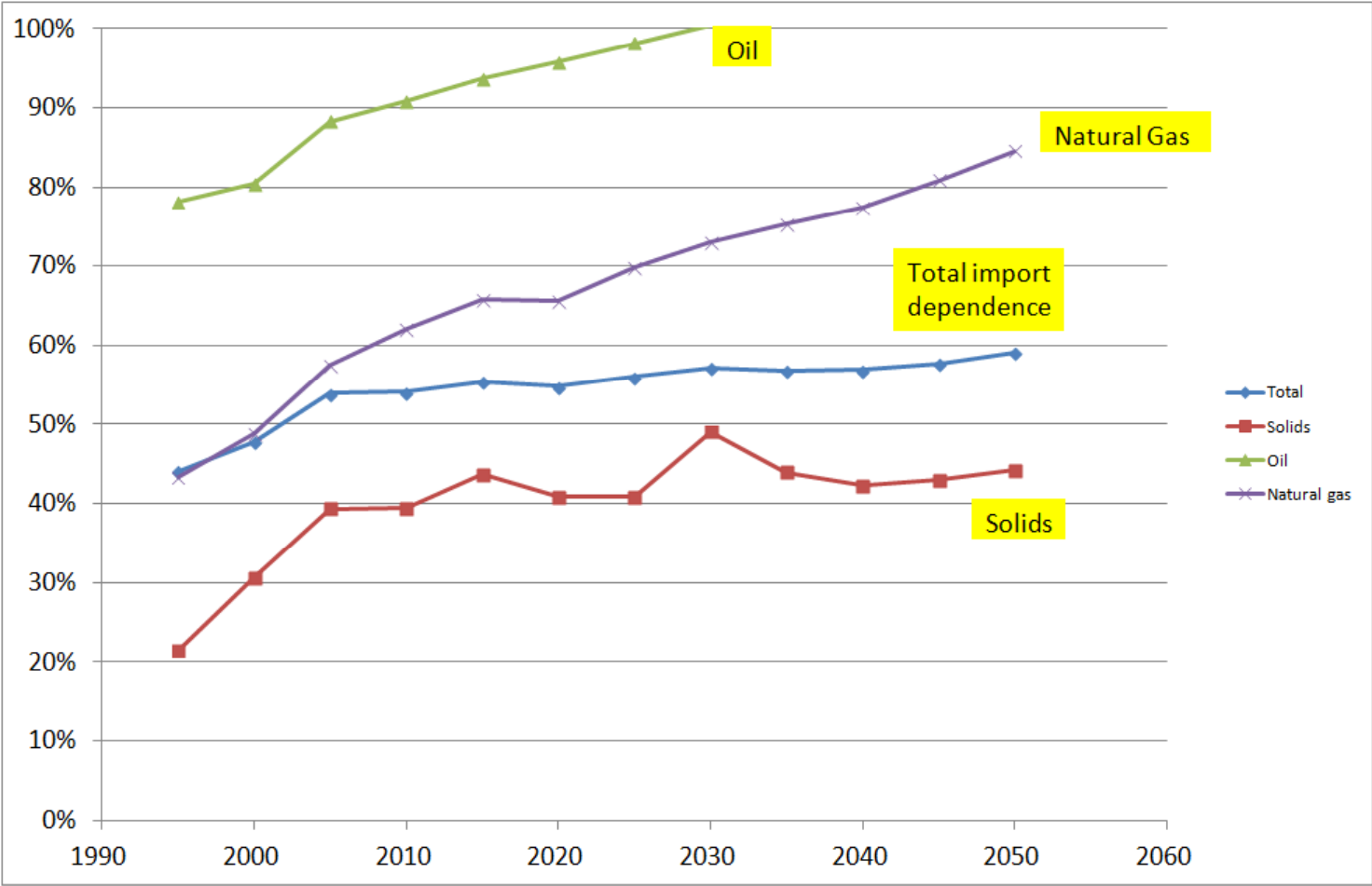
- Private non-profit organisation: > 80 research institutions, 66 Fraunhofer Institutes
- 23 000 employees, primarily natural or engineering science training
- € 2.2 billion research volume annually,
 - 2/3 of this sector is generated with contracts from industry and publicly financed research projects.
 - 1/3 is provided by the federal government and federal states as a basic subsidy for the public mission the organisation carries out in the field of applied research
- International cooperation via affiliated offices in Europe, USA, Asia and in the Near East



Overview

- **Supply security dimension:** Import dependency of Europe, especially for natural gas/important suppliers
 - **Political and military dimension:** Financing of world-wide conflicts by the large financial streams to countries that are directly or indirectly involved in conflicts
 - **Economic dimension:** Cost of the energy system (including for storage, e.g. for oil) and costs of energy imports
 - **Energy efficiency potentials and policies** up to 2030 and beyond
 - Excursion: develop understanding **how to measure** efficiency / reference developments)
 - **Cost of energy efficiency potentials**
 - Excursion: the important issue of **discount rates** to evaluate investments
 - **Benefits** of an ambitious energy efficiency policy
 - **Conclusions**
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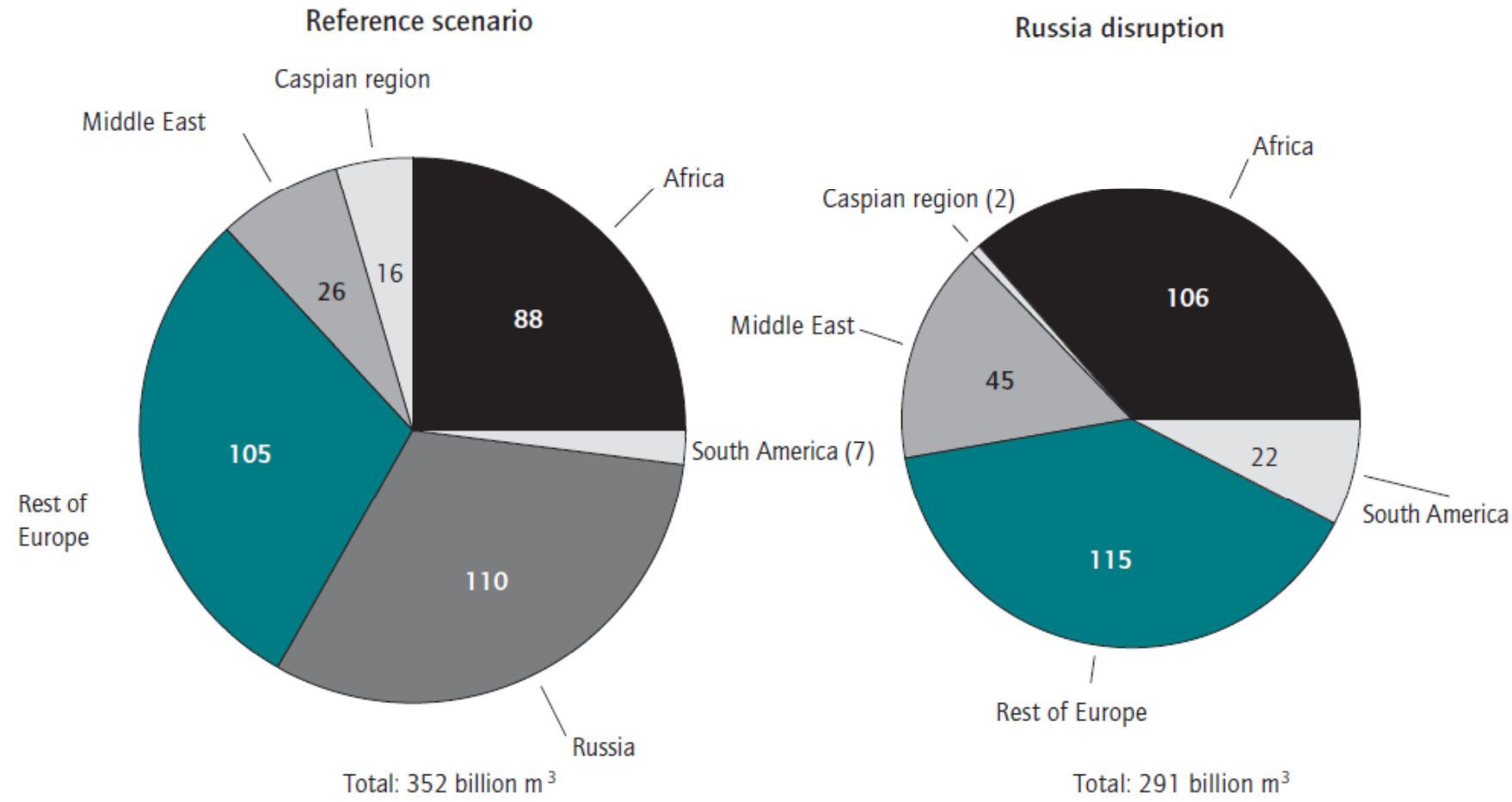
Import dependence on fossil fuels will strongly increase (EU28) if we don't counteract...



Source:
EU Com,
Primes
2013

Renewables and energy efficiency are already mitigating import total dependence! (Absolute level and share!)

Composition of European Imports by Supplier in 2015 (in billion m³) – Change Scylla for Charybdis?



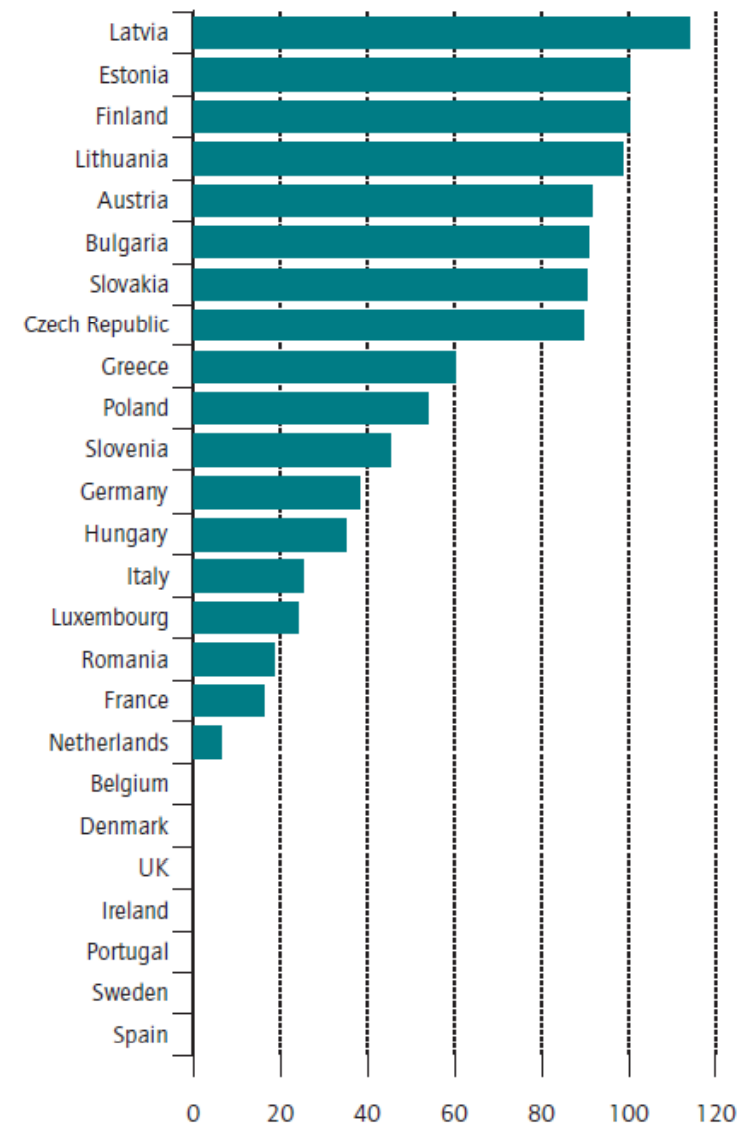
Eastern EU MS: High vulnerability due to high exposure to Russian gas dependency and comparatively high inefficiencies !

Primary energy intensity, climate corrected (www.odyssee-mure.eu)

	Unit	2005	2006	2007	2008	2009	2010	2011
European U	koe/€2005	0.16	0.16	0.15	0.15	0.15	0.15	0.15
Austria	koe/€2005	0.14	0.14	0.13	0.13	0.13	0.13	0.13
Belgium	koe/€2005	0.20	0.19	0.19	0.19	0.19	0.18	0.20
Bulgaria	koe/€2005	0.92	0.89	0.80	0.74	0.69	0.70	0.73
Cyprus	koe/€2005	0.18	0.19	0.18	0.18	0.18	0.18	0.17
Czech Rep.	koe/€2005	0.43	0.41	0.40	0.37	0.37	0.37	0.36
Denmark	koe/€2005	0.10	0.10	0.10	0.10	0.10	0.09	0.09
Estonia	koe/€2005	0.46	0.41	0.43	0.44	0.44	0.49	
Finland	koe/€2005	0.21	0.22	0.20	0.19	0.20	0.21	0.20
France	koe/€2005	0.16	0.16	0.15	0.15	0.15	0.15	0.15
Germany	koe/€2005	0.16	0.16	0.15	0.14	0.14	0.14	0.14
Greece	koe/€2005	0.16	0.15	0.15	0.15	0.15	0.15	0.15
Hungary	koe/€2005	0.31	0.30	0.29	0.29	0.29	0.29	
Ireland	koe/€2005	0.09	0.09	0.09	0.09	0.09	0.09	0.08
Italy	koe/€2005	0.13	0.13	0.13	0.12	0.12	0.12	0.12
Latvia	koe/€2005	0.35	0.33	0.31	0.31	0.35	0.36	0.33
Lithuania	koe/€2005	0.41	0.38	0.38	0.37	0.39	0.31	0.30
Luxembourg	koe/€2005	0.16	0.16	0.15	0.14	0.14	0.15	0.14
Malta	koe/€2005	0.20	0.19	0.20	0.18	0.18	0.17	
Netherlands	koe/€2005	0.15	0.15	0.15	0.14	0.14	0.15	0.14
Poland	koe/€2005	0.38	0.38	0.36	0.34	0.32	0.32	0.32
Portugal	koe/€2005	0.17	0.16	0.15	0.14	0.15	0.13	0.13
Romania	koe/€2005	0.47	0.46	0.43	0.41	0.38	0.39	0.39
Slovakia	koe/€2005	0.49	0.45	0.40	0.39	0.37	0.37	0.35
Slovenia	koe/€2005	0.25	0.24	0.23	0.23	0.23	0.23	0.23
Spain	koe/€2005	0.16	0.15	0.15	0.14	0.14	0.13	0.14
Sweden	koe/€2005	0.19	0.18	0.17	0.18	0.18	0.17	0.17
United Kingd	koe/€2005	0.13	0.12	0.12	0.11	0.11	0.11	0.11

Share of Imports from Russia in Natural Gas Consumption in 2012

In percentage



Source: IEA, Natural Gas Information 2013, OECD/IEA, Paris.

The military/policy dimension: Countries spending the most on the military

3. Russia

- > **Military expenditure:** \$84.9 billion
- > **Expenditure as pct. of GDP:** 4.1% (10th highest)
- > **1-yr. spending change:** 4.8% (48th highest)
- > **Total arms imports:** \$148 million (33rd highest)
- > **Total arms exports:** \$8.3 billion (the highest)

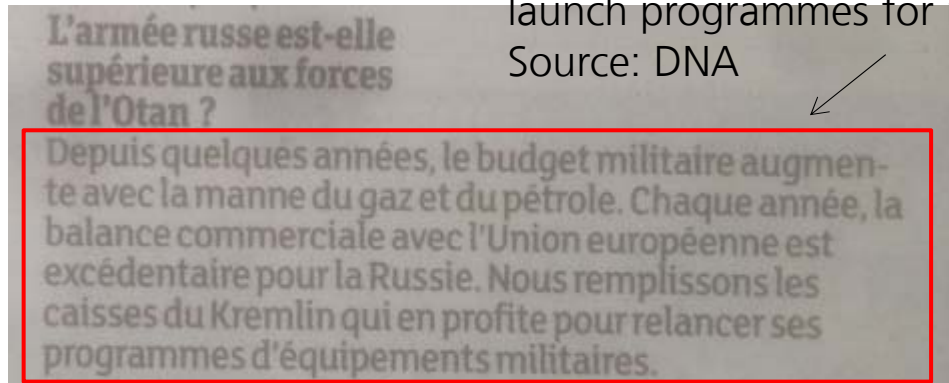
85 Bill. \$

Russia leads the rest of the world in military exports, with more than \$8 billion worth last year, well above the U.S.'s \$6.2 billion in exports. While total military spending in Russia remains a fraction of what it was in the late 1980s, it has been on the rise in recent years as a result of Russia's involvement in various regional conflicts. With the more recent ongoing Crimean crisis, this spending trend may likely continue. The country's military expenditure was roughly \$85 billion last year compared to just \$64.5 billion in 2009. Russia now spends 4.1% of its GDP on its military, exceeding that of the U.S. for the first time in over a decade. The dramatic increase is likely due in part to Russia's stated plans to invest more than \$700 billion to modernize its weapons system by 2020. According to some onlookers, making these improvements may be difficult given Russia's low birth rates, poverty and lingering soviet-era corruption problems.

<http://247wallst.com/special-report/2014/07/10/10-countries-spending-the-most-on-the-military/>

„We fill the treasure of Russia who profits to launch programmes for military equipment....“

Source: DNA



4. Saudi Arabia

- > **Military expenditure:** \$62.8 billion
- > **Expenditure as pct. of GDP:** 9.3% (2nd highest)
- > **1-yr. spending change:** 14.3% (16th highest)
- > **Total arms imports:** \$1.5 billion (4th highest)
- > **Total arms exports:** N/A

63 Bill. \$

Situated in an increasingly unstable region, Saudi Arabia hiked its military budget by 14.3% in 2013. Saudi neighbors include Iraq and Yemen, which are currently in turmoil. Saudi Arabia has also had historically poor relations with another neighbor, Iran, which could become an even bigger threat if it acquires nuclear capabilities. The large increase in military outlays is likely a direct response to these threats. The House of Saud aims to replace its current 20-year old weapon stores, including a heavy investment in missile defense systems. Like many of the countries with the biggest military budgets, Saudi Arabia benefits from one of the world's largest oil reserves. At 9.3%, the country's spending as a percentage of GDP was second only to Oman, another oil-rich nation in the Middle East.



The **economic dimension** of energy efficiency

Economic Cost Indicators

EU28:Reference scenario	2000	2015	2020	2030	2040	2050
Total Cost of Energy in billion €'10	1092.1	1905.3	2134.1	2406.4	2619.1	2825.6
Total Cost of Energy as % of GDP	10.20	14.42	14.98	14.44	13.68	12.88
Energy Related Expenses in Residential (€	1718	3080	3537	3907	4147	4324

Source: PRIMES 2013, EC

Energy system costs in 2050 are of the order of 2800 Billion Euro annually (EU28).

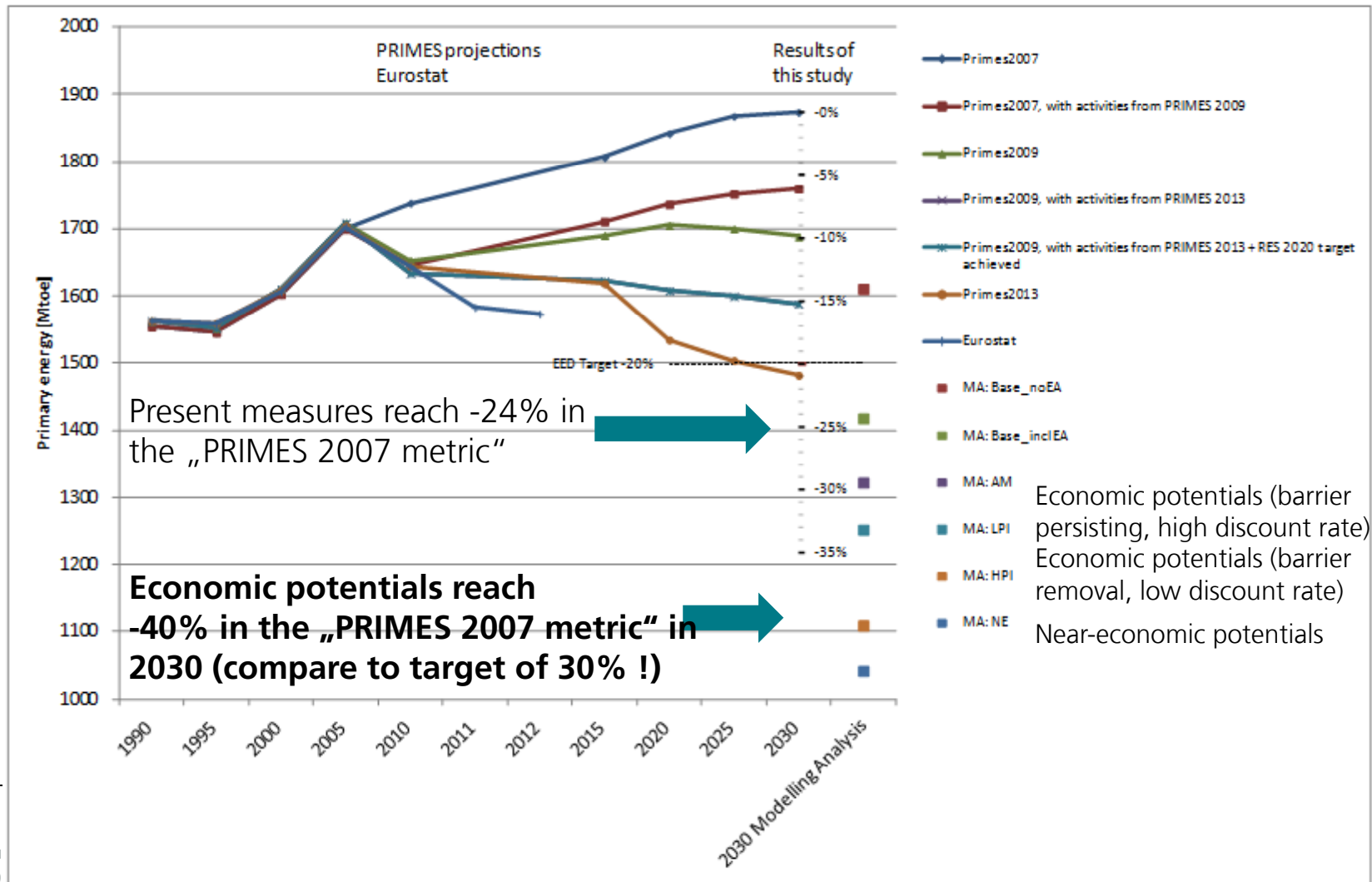
By saving half of our primary energy in 2050 we can save around 500 billion Euro annually in 2050 (and much more beyond...)

Source: Fraunhofer ISI 2012

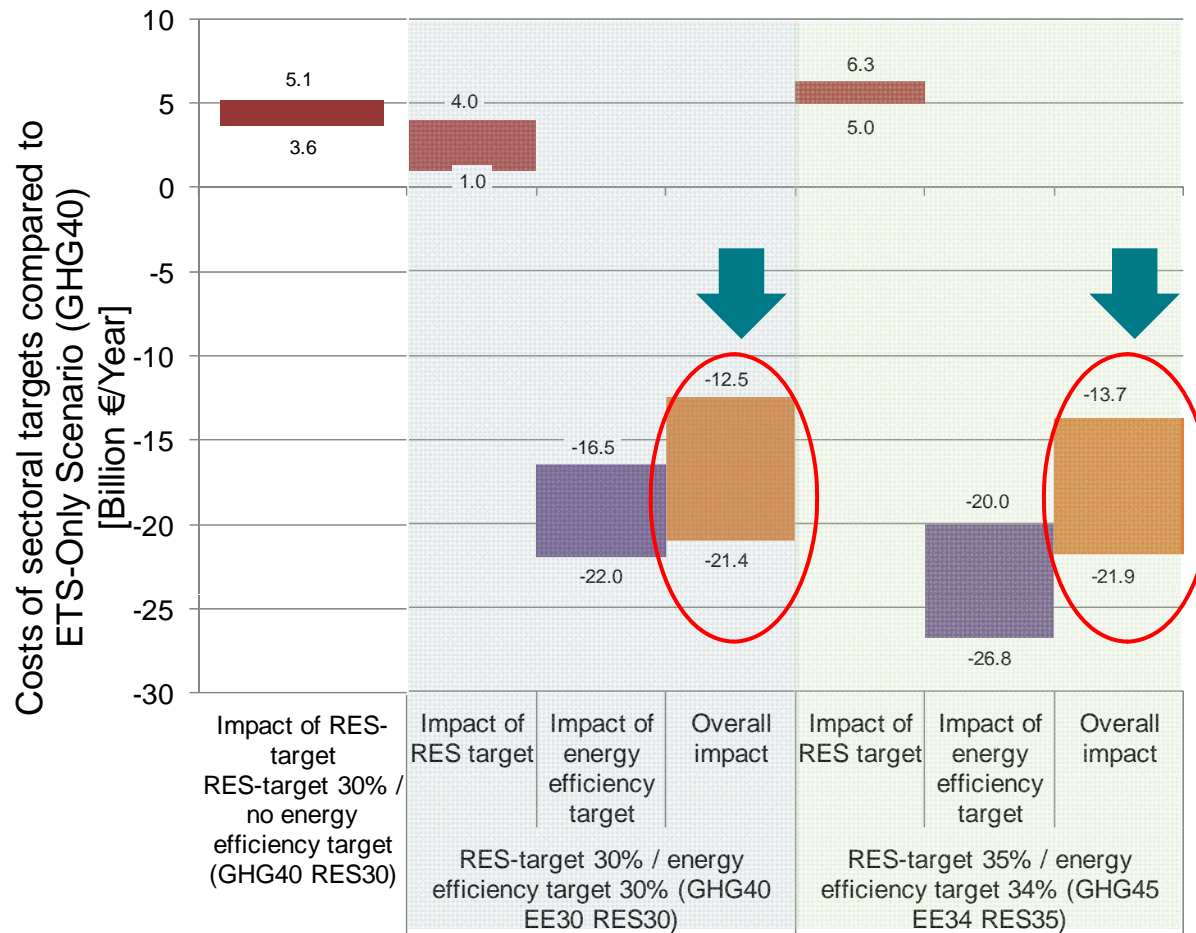


Upfront financing of investment in energy efficiency is an issue !!

The PRIMES 2007-metric for energy efficiency and economic Energy Efficiency potentials



Concerning additional cost: energy efficiency and renewables – together a winning team...



- Range from RES-targets and energy efficiency targets results from different policy measures
- Additional average annual costs for RES- targets are moderate amounting from EUR 1 – 4 billion for a combined target of 30% for RES and 30% for energy efficiency
- **Energy efficiency targets reduce costs of RES-targets and leads to overall economic savings ranging from -13 to -21 billion Euro**

The discount rate dispute...

Discount rates (in real terms)	Standard discount rates of PRIMES	Modified discount rates due to EED	
		2015	2020 - 2050
Power generation	9%	9%	9%
Industry	12%	12%	12%
Tertiary	12%	11%	10%
Public transport	8%	8%	8%
Trucks and inland navigation	12%	12%	12%
Private cars	17.5%	17.5%	17.5%
Households	17.5%	14.75%	12%

This boils down to the question in how far discount rates used to evaluate FUTURE policies shall reflect PRESENT individual decision making processes with rather imperfect mechanisms to include risk assessment into the discount rates.

PRIMES 2013/EC

PRIMES integrates **(perceived or existing) risks** into the discount rates to a large degree, our scenario approach essentially uses usual **capital costs, considering that there are instruments to mitigate the risks and the risk perception**

Sectors ^α	Scenarios ^α	Discount rates ^α
Household - space heating and hot water ^α	All ^α	3.1% to 3.7% ^α
Tertiary - space heating and hot water ^α	All ^α	4.7% to 5.4% ^α
Household - Appliances ^α	Potential_2030_LPI ^α Potential_2030_HPI ^α Potential_2030_NE ^α	Typically 6% [¶] (discount rates vary between different countries, appliances) ^α 2% [¶] (assuming removal of barriers from 2020) ^α
Tertiary - Appliances ^α	Potential_2030_LPI [¶] Potential_2030_HPI [¶] Potential_2030_NE ^α	15% [¶] 5% [¶] 5% ^α
Industry ^α	Potential_2030_LPI [¶] ← ← Potential_2030_HPI [¶] ¶ Potential_2030_NE ^α	Payback up to 2 years accepted by 50% of companies; heating systems 15% [¶] Payback up to 5 years accepted by 60% of companies; heating systems 15% [¶] Companies accept longer payback periods ^{3)←} heating systems 3% ^α
Transport ^α	N/A ^α	N/A ^α

The impact of such high discount rates on investment decisions is dramatic...

- Case that a standard individual house is replaced with a passive house building: Such a building may cost 300000 Euro and the additional costs for passive house standard are around 8% or **24000 Euro**.
- The original house may use 30000 kWh/year and the passive house 90% less energy. We assume 25 years lifetime for the investment.
- With a gas price of 5.5 centsEuro/kWh and a 17.5% discount rate the net present value of the energy saved is around **9800 Euro**.
- With a discount rate of 12%, this would reach around **13000 Euro**, with 9% around **16000 Euro**,
- On the other hand we may use typical capital costs of 2-4% as applied in our modeling. With 3% the net present value of the savings in the above example would be nearly **27000 Euro** over the 25 years lifetime assumed.



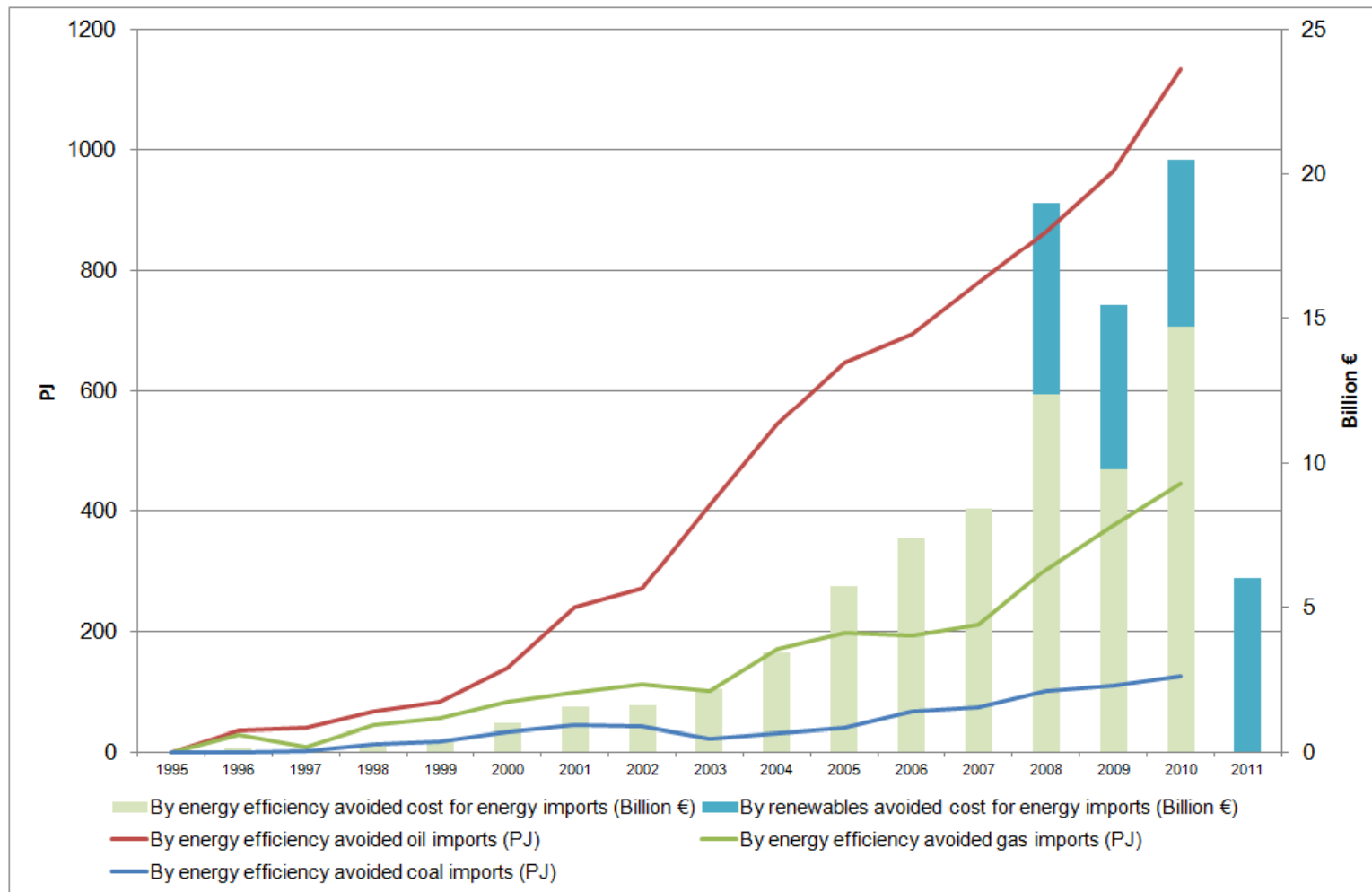
Energy efficiency policies in the EU: in particular **stable** policies for up-front financing of investments needed!

- Overarching: **Energy Efficiency Directive EED from 2012**
 - (Predecessor: Energy Service Directive 2006)
 - Art. 7 of EED: **Energy Saving Obligations** or equivalent other instruments
 - **2030 Target Frame**

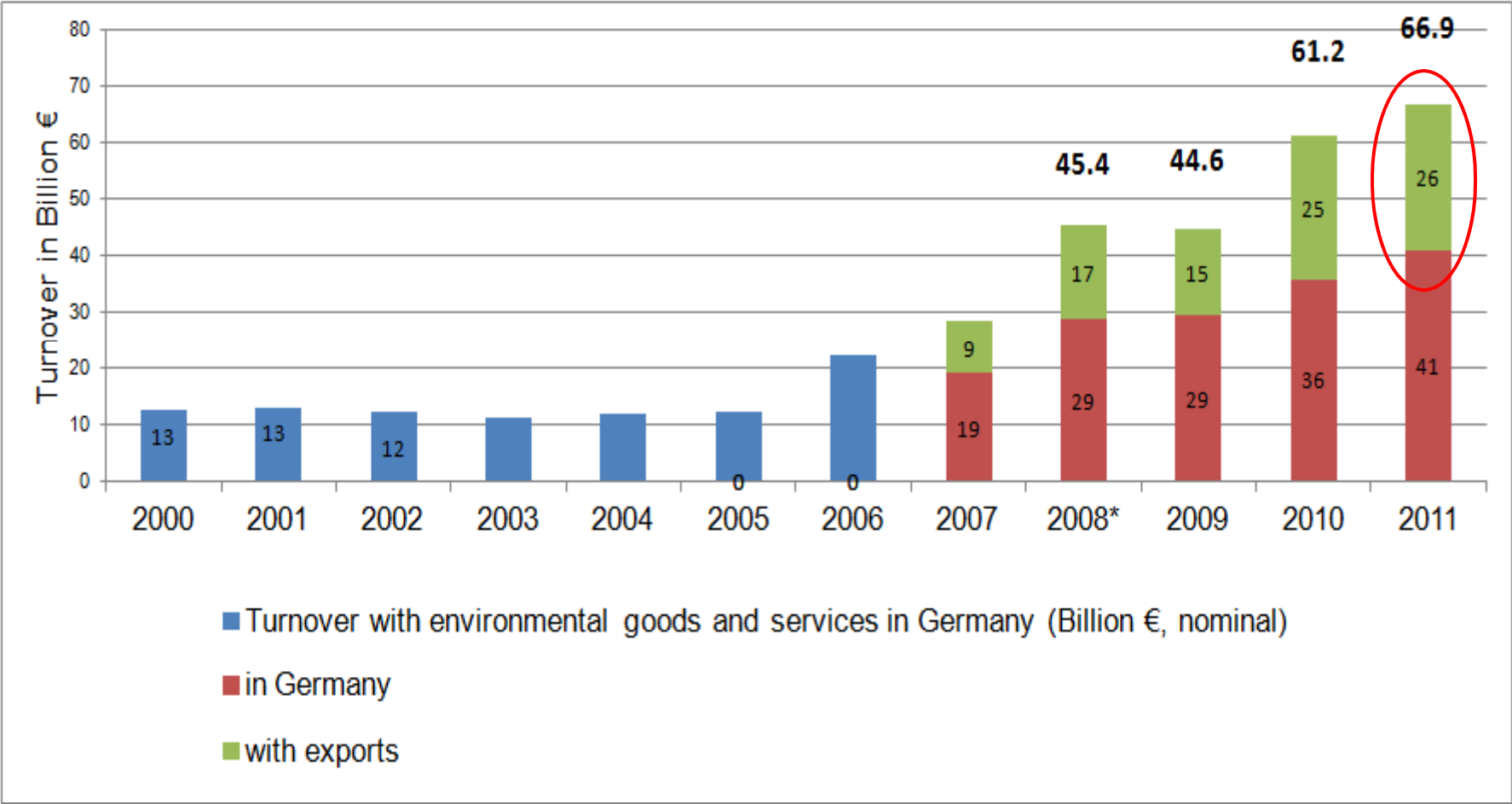
 - **Buildings:** Energy Performance Directive for Buildings EPDB (Nearly Zero Energy Buildings, existing buildings??) / Building Certificates
 - **Appliances (residential, services, industry):** Ecodesign-Directive / Labelling
 - **Transport:** CO2 Standards cars, light-duty vehicles
 - **Industry:** Emission Trading Scheme ETS

 - **National policies:** subsidy schemes, tax reduction, Learning Networks for Energy Efficiency in Industry,.... (**Odyssee-MURE project on energy efficiency indicators and policies: www.odyssee-mure.eu**)
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Germany: Imports avoided by energy efficiency and renewables (15-20 billion € avoided imports!)



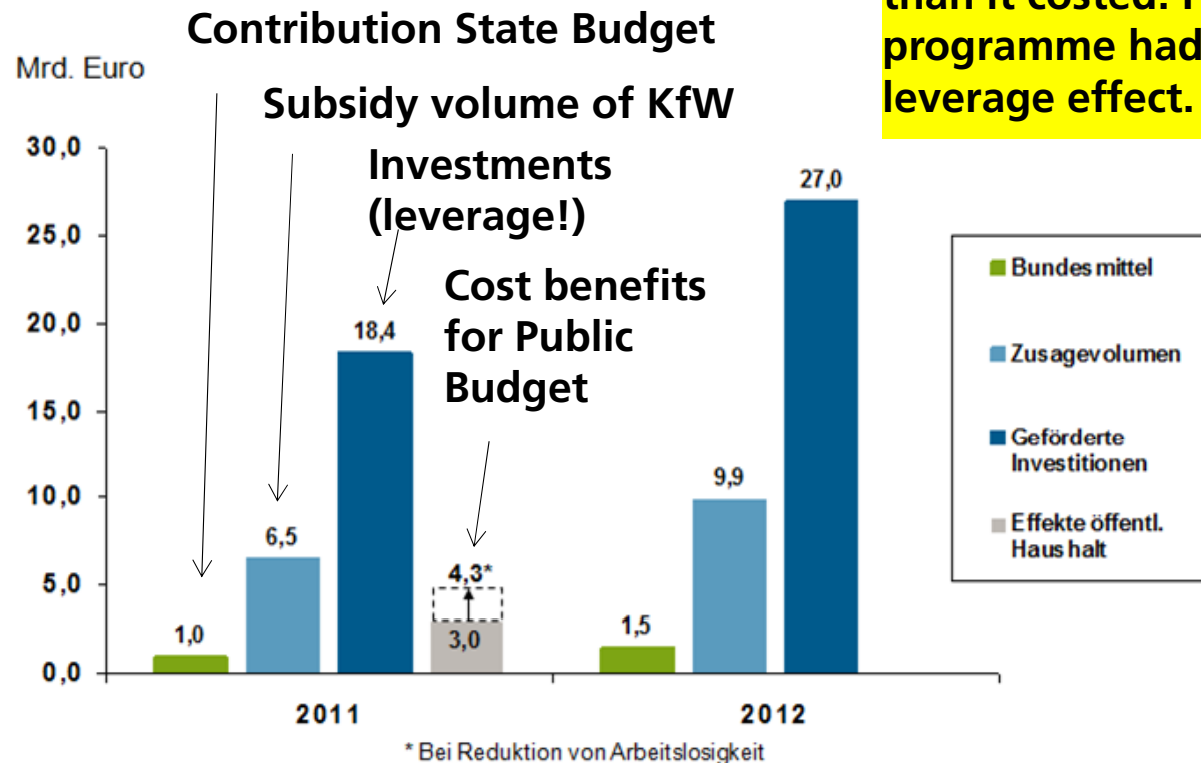
Germany: Turnover with environmental goods in Germany and for export



Investments in the German KfW Programme for building renovation and impacts on public budgets and employment

»» Hebelwirkungen auf private Investitionen
Energieeffizient Bauen und Sanieren

The KfW generated more income for the German budget than it costed. Further the programme had a very high leverage effect.



Source:
KfW,
2013

KfW Workshop BMWi Instrumente Endenergieeinsparungen, 21.-22.3.2013, Impulsvortrag K.L. Brockmann

11

Conclusions

- Supply dependency on fossil fuels is a permanent threat for our economies (in economic, in military and in policy terms)
- Economic energy savings may reach -40% in 2030 in primary energy terms
- Pay attention to the discount rate debate when reading about “least cost solutions” !
- Renewables and energy efficiency combined still lead to substantial cost benefits
- Energy Efficiency Policies need to concentrate on a stable long-term financing for upfront investments
- Benefits from energy efficiency in the form of innovation, employment and business cases