

The energy saving potentials and GHG emission reductions identified in the public sector ... and how they could be realised

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Joint Seminar
**FEDARENE / Rhônalpénergie-
Environnement**
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Overview

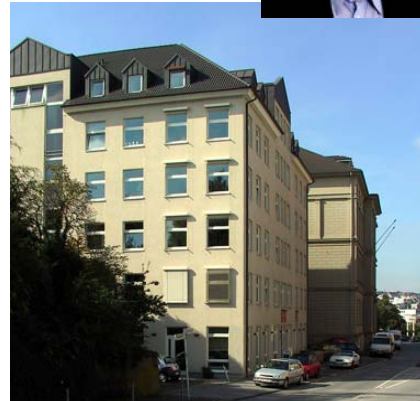
Scenarios, Potentials, Technologies, Activities, Support

- Comparison of different European scenario analyses
- Energy saving potentials in the public sector derived from scenario analysis
- Available technologies and their energy saving potential
- The difficult way from idea to broad implementation:
Experiences from different projects in the public sector
- Expected support for an increase in energy efficiency / GHG emission reductions in the public sector

Science Company Wuppertal Institute

Legal and financial status

- **President:** Prof. Dr. Peter Henicke
- **Vice President:** Dr. Manfred Fishedick
- **Setting up:** 1991 conducted by Prof. Dr. Ernst Ulrich von Weizsäcker
- **Legal form:** Ltd., Non-Profit-Organisation; Member of the Science Centre of North Rhine-Westphalia
- **Ownership:** State of North Rhine-Westphalia
- **Staff:** ca. 140 members from all disciplines
- **Projects:** 80 - 100 projects per year
- **Budget 2006:**
2.3 Mio. Euro basic funds from the state of North Rhine-Westphalia (strong decreasing trend)
> 6.0 Mio. Euro of third party funds (UN, EU, Ministries, Private Sector, NGOs)



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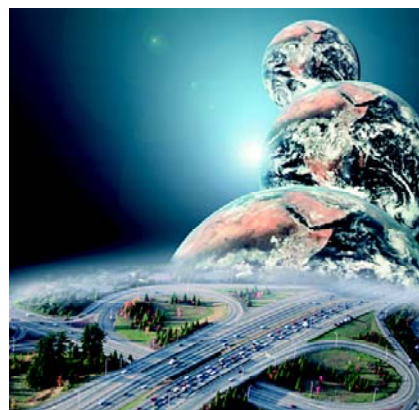
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Mission

Application-oriented Sustainability Research

- The Wuppertal Institute explores and develops models, strategies and instruments to support a sustainable development at local, national and international levels.
- Sustainability research at the Wuppertal Institute focuses on ecology and its relation to economy and society.
- Our research analyses and initiates technological and social innovations that decouple economic growth from nature use and wealth.



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Research Topics and Organisation

Research Groups, Focus Subjects, Cross Cutting Subjects

Future Energy and Mobility Structures

Focus subjects:

- New energy carriers and fuels
- Technologies and systems integration

RG1

Energy, Transport and Climate Policy

Focus subjects:

- Policy instruments especially for climate protection and energy efficiency
- Future energy and mobility services

RG2

Cross Cutting Subjects

- Globalization and Sustainability
- Eco-Sufficiency and Quality of Life
- Sustainability Scenarios

Material Flows and Resource Management

Focus subjects:

- Increasing resource productivity without problem shifting
- Integrated assessment of resources and land use

RG3

Sustainable Production and Consumption

Focus subjects:

- Resources and sustainability management
- Changing patterns of action in production and consumption

RG4

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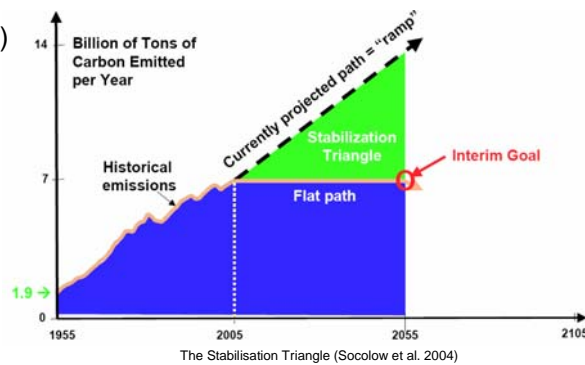
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The starting point for any scenario analysis

- The end of cheap fossil energy is approaching
- EU-27 is increasingly relying on energy imports
- Climate change is becoming increasingly significant
 - Stabilization below doubling (450-550 ppm) is the century-scale carbon management goal recommended by many environmental scientists
- Window of opportunity in EU electricity sector



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BAU (Business as Usual) is insufficient DG TREN baseline projection (PRIMES)

- Kyoto target for the EU-25 won't be met:
 - 3.3% GHG emissions by 2010 vs. 1990
 - +1.2% GHG emissions by 2020 vs. 1990
- Energy intensity development insufficient
- Increasing emissions caused by rising transport emissions (+59%)
- Increasing energy related CO₂ emissions (+7%)
- Import dependency:
 - +1.10%/year
 - (to 70% in 2020)



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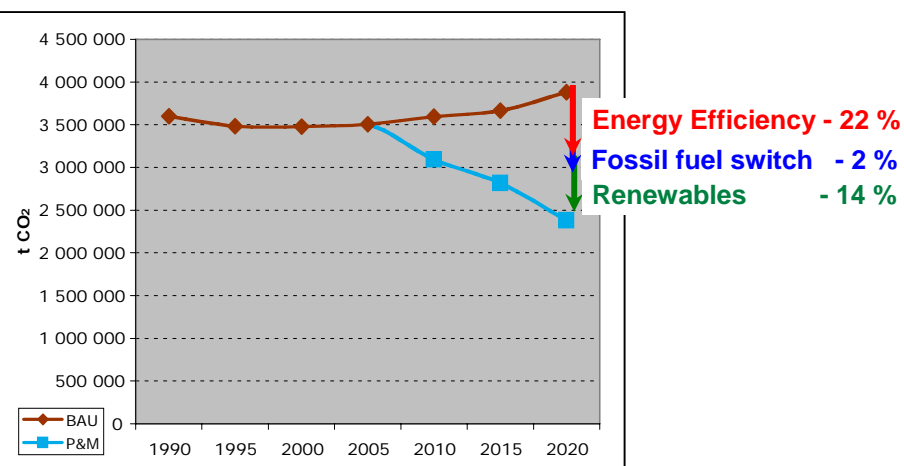
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"Target 2020", Wuppertal Institute on behalf of WWF Europe, 2005

CO₂ reduction by strategy
Emission reductions P&M vs. BAU



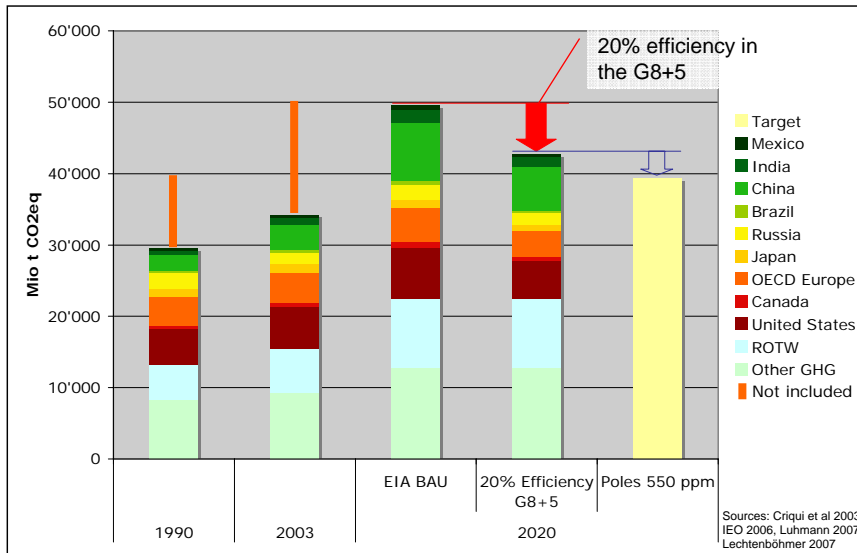
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The potential relevance of energy efficiency for climate mitigation



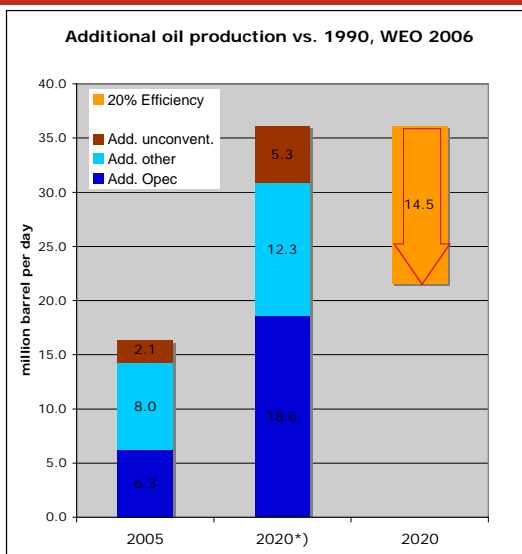
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The potential contribution of energy efficiency to energy security



- Mitigation of increasing oil demand
 - 3/4 of increase needed in BAU will be „supplied“ by efficiency
- Reduced concentration on Middle east and Russia
- Lower pressure on unconventional resources and CTL
- Additional benefits:
 - Reduced vulnerability to oil price shocks
 - Reduced costs for importing countries
- Exporters revenues might still be significantly higher than today

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Are 20% primary energy savings by 2020 achievable? Hypotheses

Definition of the target (EU): 20% primary energy savings vs. Baseline by 2020

- Global level:
 - IEA/WEO 2006 Alternative policy scenario:
 - **10%** primary energy savings **by 2030**
 - Faster savings might exceed reinvestment circles
 - Ecofys for Greenpeace 2007:
 - **25%** primary energy savings on a global scale **by 2020**
- EU25 Studies:
 - DG TREN (2006) combined high efficiency and renewables target:
 - **13.4%** primary energy savings **by 2020** (20% by 2030)
 - WI (2005) for WWF
 - **20%** primary energy savings **by 2020**
 - derived mainly from sectoral studies and German research
 - Eco Institute (2006) for EU Greens
 - **19%** primary energy savings **by 2020**
- Bottom up research for Germany: WI/EON study (2006)
 - 27% savings potential by 2015
 - analyses of 69 cross cutting energy saving technologies (res., com. & ind. sector)

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Are 20% primary energy savings by 2020 achievable? Plausibility estimate



- About **30 – 40%** of **energy consuming stock** in 2020 will be invested over the next twelve years
- About **+50%** of the **now existing stock** will be reinvested or refurbished by 2020
 - Lifetime of 20 years on average
 - Window of opportunity in the power plant and building sector
- Potential:
 - New technology about 20% better than BAU
 - Refurbishments save 40% vs. old technology
 - This would lead to **final energy savings of 20%**
- Consequences:
 - Best available technology has to become market average soon (particularly in +5 countries)
 - Reinvestments have to be supported and need to use best available technology
 - Minimisation of lost opportunities



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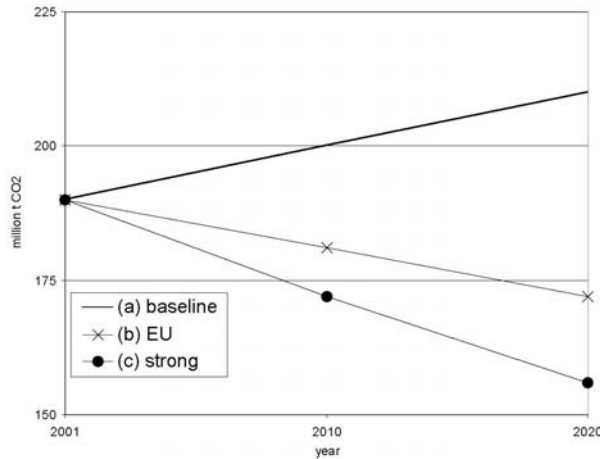
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Is it Kyoto that drives the Public Sector?

Results from the EU study „PROST“ (2003)



- 5 to 10 % of national energy use
- 20 percent savings potential in energy (heat and electricity)
- Former goal by European Commission of 1,5%/year efficiency increase in public sector (b)
- Additional 0,5%/year efficiency improvement possible (c)

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Is it up to 10 billion Euro / year?

Results of the EU-SAVE study „PICOLight“ (2005)

- **Total final energy demand of public sector in EU-25:**
 - o about one third of tertiary / commercial sector demand
 - o 6 - 8% of total final energy demand (not including transport)
 - o i. e. about 182 - 239 TWh_{el}/year and 371 - 488 TWh_{th}/year (based on RELIEF and PROST studies 2003/2004)
 - o i.e. about **26 - 35 billion Euro energy costs / year**
- **Energy cost reduction potential** in public sector in EU-25:
7.7 - 10.0 billion Euro/year in total by 2020
(compared to BAU scenario)
- ... of which **a large part could be realised via energy services** offered by third parties (EPC - Energy Performance Contracting and other services) or internally (PICO - Public Internal Performance Commitments)

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Is it the opportunity for wider market transformation? Public sector could lead by example

Computers are an example

- 13% of public sector electric savings could come from IT equipment
- 600 000 PCs purchased every year by the European public sector, or 12 million computers in 20 years
- They are worth ~1 billion Euro/year
- ...so, common criteria would help to create one "virtual buyer"



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Technology options in the German tertiary sector Results from Wuppertal Institute study (2006) on behalf of E.ON

Technology or end-use area	CO ₂ reduction potential [t/a]	Net electricity savings [TWh/year]	Net fuel savings [TWh/year]	Net benefit for society [Mio. Euro/year]	Net benefit for customers [Mio. Euro/year]	Pay-back time for customer [years]	IRR for customer [%]
TRADE, COMMERCE, AND SERVICES							
Air conditioning of mobile phone base stations	880,631	1		61	116	0.9	376.0%
Reduced standby electricity consumption in ICT's	2,403,365	4		77	204	1.8	53.2%
Pumps	3,638,068	6		175	374	2.2	51.7%
Indoor lighting	6,115,493	9		325	656	2.7	61.2%
Ventilation and air conditioning	1,504,589	2	1	72	136	3.2	44.7%
Cooling / freezing	2,528,431	4		90	210	3.9	31.0%
Process heat (substitution, fuel savings)	5,461,394	1	16	168	211	5.1	21.9%
Cooking (substituting electricity by gas)	411,380	1	-1	6	33	6.5	18.7%
Street lighting and traffic signal lighting	584,071	1		0	21	6.9	14.8%
Hot water (substituting electricity by gas)	305,926	1	-1	-6	15	9.6	12.8%
Heat recovery	1,155,030		5	39	20	10.6	11.5%
Thermal insulation + renewal of edificial heating system	3,616,294		16	198	104	13.1	37.3%
Total	28,604,671	29	35	1,204	2,099		

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How can we make it happen in time?

The power of technology diffusion

„Humanity can solve the carbon and climate problem in the first half of this century simply by scaling up what we already know to do“.

(Pacala / Socolow 2004)

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Summing up the „therefores“

The public administrations / governments should lead the way

“Leadership by Example”

MARKET TRANSFORMATION

- Technology options are largely available
- Public sector has a significant share in total procurement (about 200 billion Euro of energy-related equipment purchases)

KYOTO COMMITMENT

- Large savings potential

SAVE MONEY

- Efficient use of resources: taxpayer’s money - in effect OUR money

Harnessing the Power of the Public Purse
Year report from the European Union study on energy efficiency in the public sector



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Why isn't this happening?

Wrong perceptions

"It is not allowed,
I must buy the cheapest product"

WRONG

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Current procedures of public procurement and building management: real and perceived key hurdles & obstacles

- **Insufficient priorities**
- **Split incentives**
- **No investment culture**
- **Complex** public procurement and building management **routines:**
 - conflicting policy objectives
 - extensive regulation,
 - variety of pressures
 - *perceived* barriers
- **Insufficient transparency** about energy consumption and costs
- **Budget problems:** lack of financial means and personnel even for profitable investments; limits to bank credits
- **Lack of information and motivation** of staff



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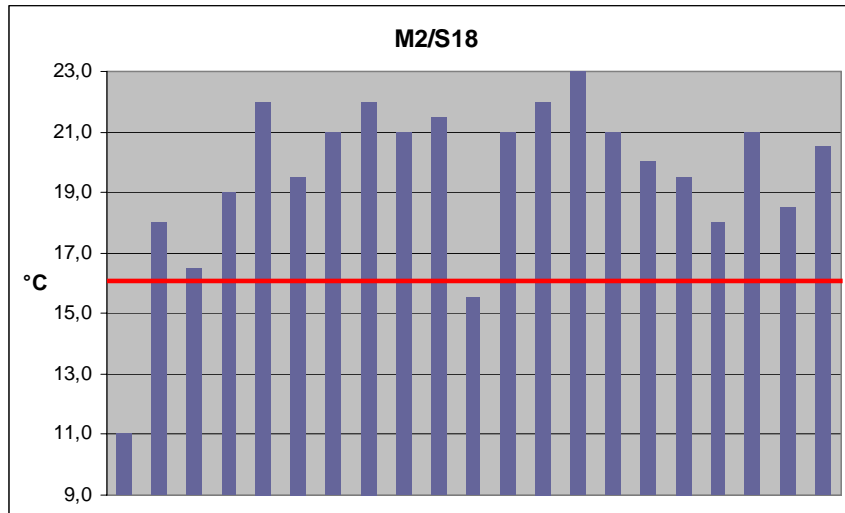
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Typical bad practice example in German school

Even the temperature reduction at night does not work



Source: Margit Fluch, 2005

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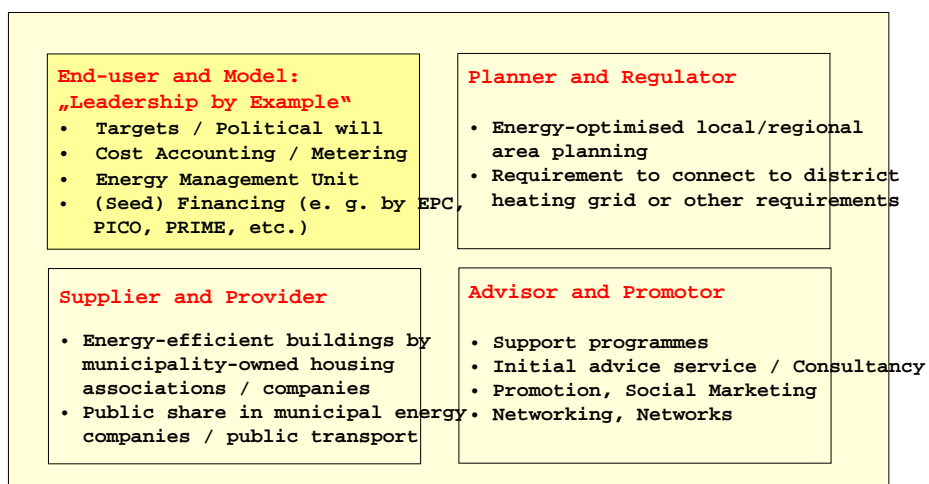
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Role of local/regional authorities

Economic actor & Interface between government and end-user



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Potential Support by the Market or Internally

Green Procurement, Audits, EPC, PRIME and PICO

- **Green procurement** is becoming an issue for local, regional and national governments – make it energy efficient / GHG emission reducing!
(cf. EU PROST study 2003, guidebooks e.g. by ICLEI, information and links on <http://ec.europa.eu/environment/gpp> for detailed recommendations)
- **Energy Audits / Energy Management:**
 - Article 12 of the Directive on Energy End-use Efficiency and Energy Services asks for energy audits for all final customers including public administrations
 - Empirical evidence: Public authorities with energy management unit have 20% lower energy and water costs (including behavioural changes)
- **Energy Performance Contracting (EPC)** can often overcome problems like split between operating and investment budget, lack of personnel capacities, lack of finance, etc.
 - Experiences from EPC projects mixed: Many good projects; But: problems of public administrations with tenders, sometimes insufficient contracts, suboptimal solutions, cherry-picking, high transaction costs
- **PRIME Idea:** EPC with private investment from citizens
- **PICO Idea:** kind of in-house alternative to EPC

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The PRIME idea: Private Investment Move Ecopower

- **Participatory approach** for profitable investment by private citizens and other local stakeholders in a profitable package of energy efficiency, renewable energy and cogeneration measures
- Focus on **integrated RUE & RES investments in public buildings**
- **Examples in German schools** (accompanied by educational measures in the schools):
 - Staudinger Comprehensive School, Freiburg, started in 1998/99 (Dieter Seifried, ECO-Watt GmbH)
 - 4 Solar & Save projects in schools in North Rhine-Westphalia since 2000 (Kurt Berlo, Solar & Spar GmbH / Wuppertal Institute; „100,000 Watts Solar Initiative for Schools in North Rhine-Westphalia - Energy School 2000+“)
- Running EU-IEE project PRIME co-ordinated by Climate Alliance shows difficulties of implementation

Zur Anzeige wird der QuickTime™
Dekompressor, TIFF (LZW)
benötigt.

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Advantages of the PRIME approach

- Investors receive a reasonable payment of interest (about 5 percent)
- School and community save on renovation and running costs
- Teachers and students experience practical climate protection
- Less maintenance work for caretakers
- Local tradesmen receive word orders
- Thousands of tons of carbon dioxide emissions per year are prevented



Aggertal High School, Engelskirchen



New CHP plant



New energy-efficient circulation pumps

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The PICO idea

- **The dream:**
A „perpetual motion“ finance mechanism for public authorities by which, once triggered, energy efficiency savings fund new investments in an upward virtuous cycle even in times of tight budgets
- **The idea:**
Public Internal Performance Commitments (PICO) as a way to continuously manage and finance energy efficiency measures in public administrations consisting of 3 elements:
 - **Specific commitment or target** describing the level of future energy efficiency investments or savings
 - A way of **(seed) funding** the continuous implementation of energy efficiency measures: revolving fund or budget line, etc.
 - Capable **energy management unit**



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Results from 7 PICOLight case studies

- Often a long way from idea to implementation, even if part of the public administration is really committed to PICO
- PICO solutions differ very much from case to case -> adaption of the principal scheme to specific situation of the public administration and its public procurement and buildings investment routines needed
- Important, but still difficult: finding a way to continuously finance and manage energy efficiency measures
- PICO can particularly help smaller or very specific energy efficiency investments not implemented by ESCOs because of transaction costs, and it reduces cherry-picking

Package 2		PICO			
Initial installation costs		before			
initial installation costs (only additional costs compared to the reference case)					
+ material (Euro)	82.809				
+ labour (Euro)	70				
+ design (Euro)	7.875				
+ transaction (Euro)	2.100				
+ total (Euro)	92.854				
annualised additional installation costs					
+ installation costs/year (Euro/a)	7.714				
Running costs		before		after	
lifetime running cost (real terms)					
+ energy (Euro)	199.038			89.381	
+ power (Euro)	67.101			34.094	
+ transaction (Euro)	0			1.470	
+ maintenance (Euro)	107.149			103.178	
+ total (Euro)	373.288			228.124	
+ annualised running cost savings/year (Euro/a)					
				11.818	
cost-effectiveness of the investment		without design and transaction costs		including design and transaction	
simple payback (a)		6,9		7,8	
benefit/cost ratio		1,8		1,5	
net present value (Euro)		63.755		52.310	
internal rate of return %		12%		9%	

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Rule of thumb for decision between external EPC and internal PICO in the City of Freiburg i.Br.

- Buildings with energy costs > 75,000 Euro/year: Energy Performance Contracting with external contractor
- Buildings with energy costs 50,000 < x < 75,000 Euro/year: EPC with pooling of buildings in tender considered
- Buildings with energy costs < 50,000 Euro/year: PICO (Public Internal Performance Contracting)



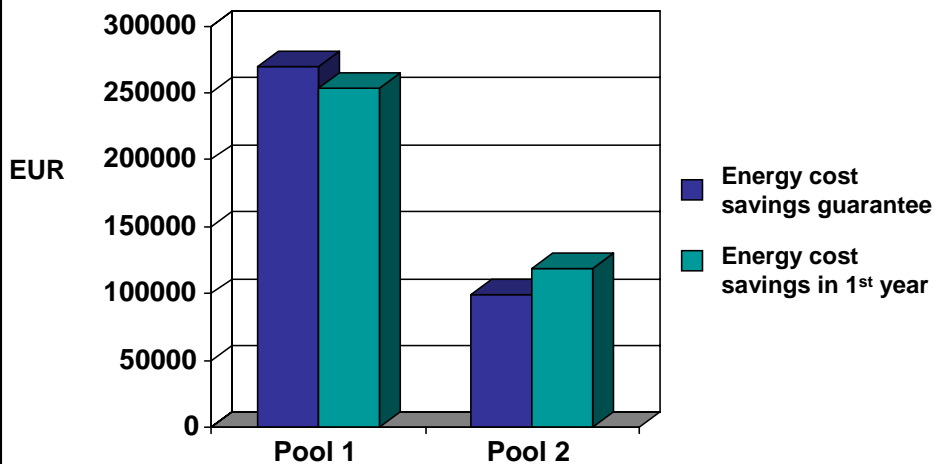
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EPC in the City of Freiburg i.Br.



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PICO in the City of Freiburg i.Br.

- PICO scheme applied: **Public Internal Performance Contracting**
- **Results 2004/2005** (PICO scheme started on 1 Jan 2004):
 - about 50 single measures which were implemented quickly and without big planning effort
 - 180,000 Euro sum of investment
 - 40,000 Euro/year energy cost savings



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PRIME in the City of Freiburg i.Br.

- One project in **Staudinger Comprehensive School** (1,200 students)
- (Difficult) Start of PRIME project: **1998/1999**
- ESCO: **ECO-Watt GmbH** (Dieter Seifried, Ö-quadrat)
- Energy and water costs in **baseline**: 250,000 Euro
- **Investment**: 250,000 Euro, of which 200,000 Euro were collected from private investors (minimum of 500 / 2,500 Euro per share)
- Energy and water cost **savings**: 65,000 Euro (**23.2%**)
- **Contract duration**: 8 years
- **Interest rate** for private investors: 3 - 6 %
- **School** receives 2,500 - 10,000 Euro/year
- **Savings for the municipality** after expiry of contractual term: 400,000 - 600,000 Euro



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Preconditions for EPC, PRIME, PICO, and further activities

- **Cost accounting** based on individual metering by department or building and simple measurement and verification procedures
- **Energy management unit**, technical expertise (small public administrations: co-operative solution)
- **Political will** to provide seed money and to start energy efficiency improvements / investment culture
- **Compatibility to national regulations**
- **Supporting policy mix needed!**



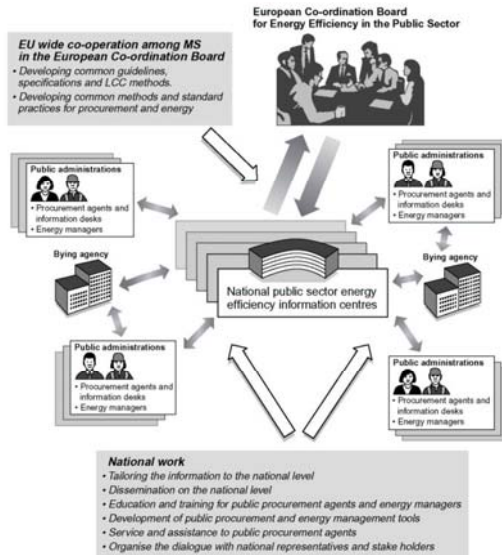
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Potential Support by National and European Policy Public Sector Energy Efficiency Centres



Cf. EU PROST study (2003), guidebooks e.g. by ICLEI, <http://ec.europa.eu/environment/gpp>, and links mentioned on this website

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Potential Support by National and European Policy Facilitating the broad implementation

- **Promotion** of the use of EPC, PICO, PRIME approaches
- Support for **energy management** and general framework for energy efficiency measures in public administrations - no complete outsourcing of these tasks
- Provision of (part of) **seed funding** - Proposal by Wuppertal Institute (2006) on behalf of Hans Boeckler Foundation:
 - Seed funding as one of 12 programmes of a potential German EnergySavingFund
 - Seed funding for energy management, enabling EPC and/or PICO
- In some countries needed: **clarification of formal and legal aspects** with regard to EPC / PICO / PRIME and public dept management / budgetary codes / supervising authorities
- **EU institutions:** Leadership by example

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Potential Support by implementation of the ESD

Make it happen now!

Implementation of Article 5 of the Directive on Energy End-use Efficiency and Energy Services (Energy Service Directive - ESD): Member States shall ...

- ... ensure that the public sector fulfills an **exemplary role**
- ... facilitate and enable the exchange of **best practices**
- ... publish guidelines on energy efficiency and energy savings as a possible assessment criterion in competitive **tendering** for public contracts
- ... use at least **two of the following measures**:
 - requirements concerning the use of EPC and other financial instruments that stipulate the delivery of measurable and pre-determined energy savings
 - requirements with regard to public procurement of equipment and vehicles (life-cycle cost approach) (2 measures)
 - requirements to replace or retrofit existing equipment and vehicles
 - requirements to use energy audits and implement recommendations
 - requirements to purchase or rent energy-efficient buildings, or to replace or retrofit buildings or part thereof
- ... assign to new or existing **organisation** the responsibility for integrating energy efficiency improvement requirements

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Many thanks for your attention !



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