Lecture at Lunch-Seminar
University of Neuchatel
Institut de recherches économiques (IRENE)

Economics and policy of energy-efficiency

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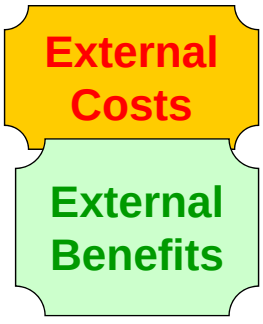
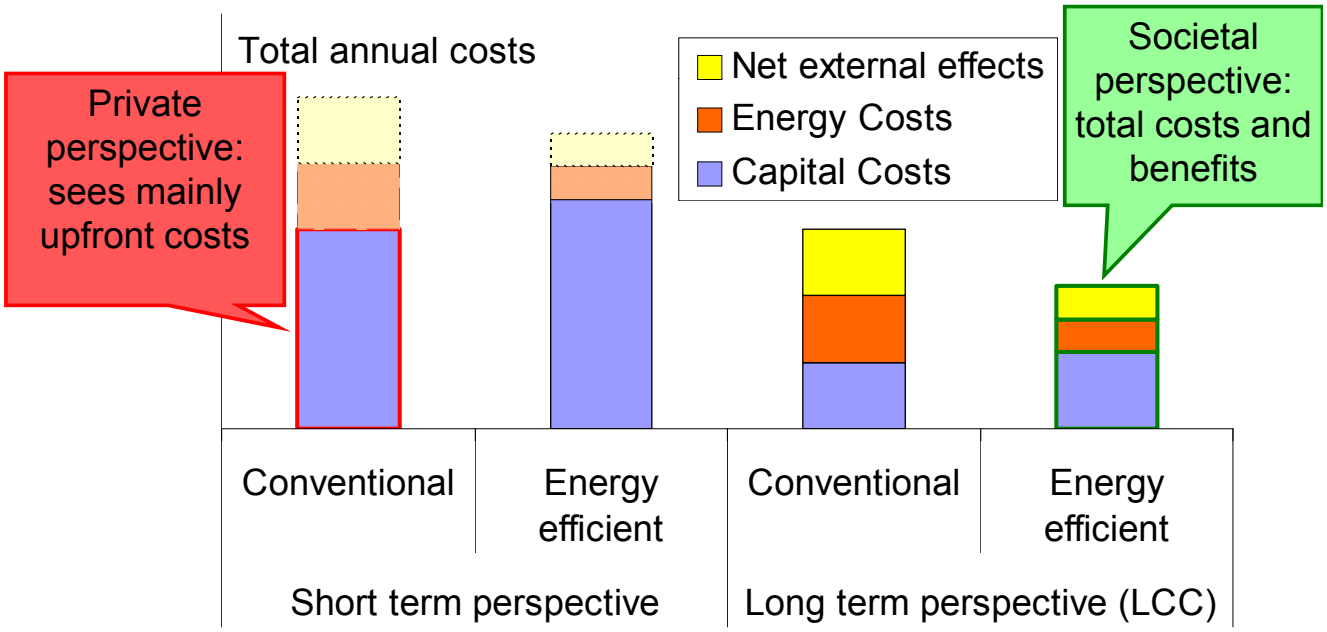
Private vs. societal perspective
time and scope

- **Time horizon of decision**
  - Companies: often 2 to 5 years, sometimes 10 to 15 years
  - Real estate investors: 5 to 20 years
  - Private owner-occupiers: 15 to 30 years
  - Society: 20 to 50 years or more (some politicians: 3 to 5 years)
- **Scope of decision (external effects)**
  - Local: Health, damages on crops, buildings,
  - Global: damage on crops, infrastructure, land use
  - Creating jobs, new products and business opportunities
  - Generating experience & information (useful for thirds)



Private vs. societal perspective



Private vs. societal perspective

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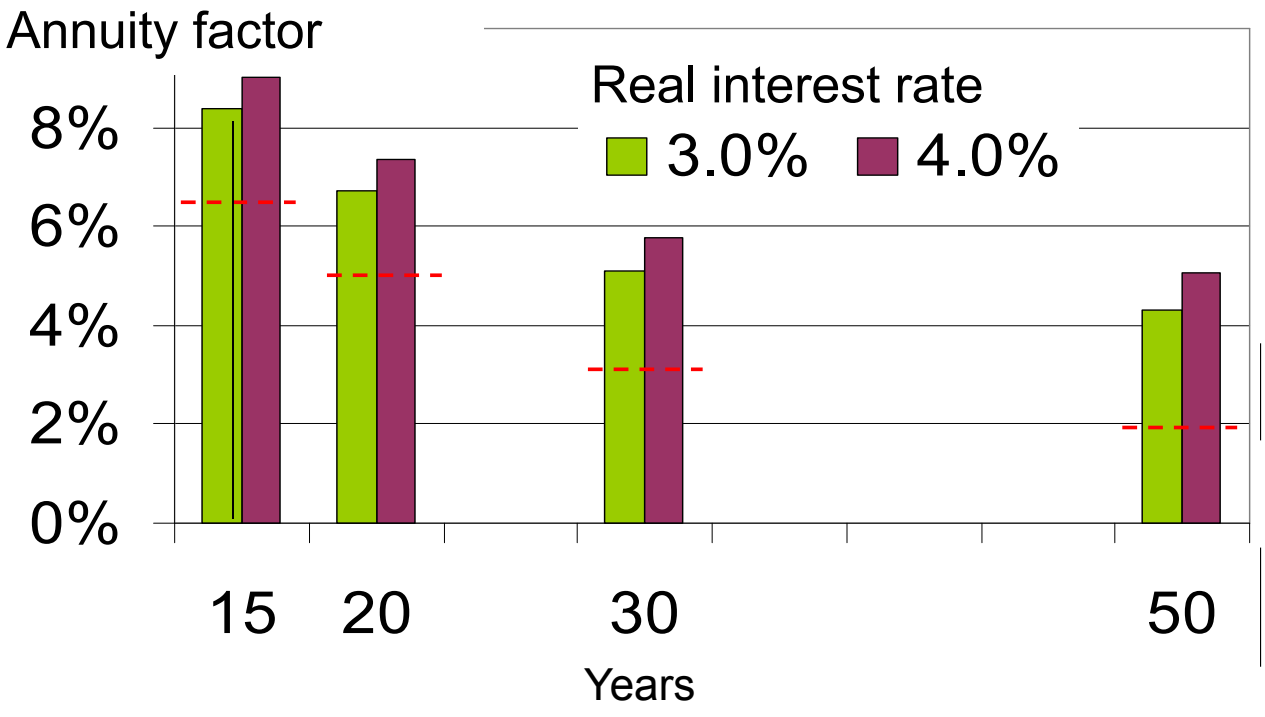
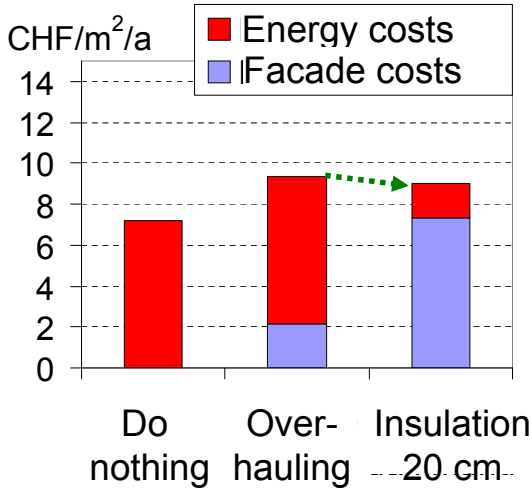


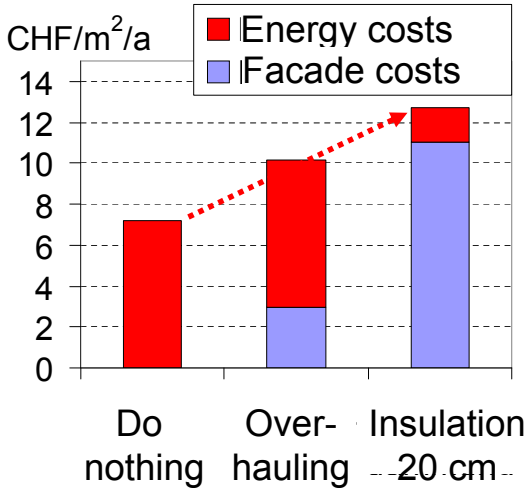
Example Facade Insulation

Real interest rate 3.5%, „low“ energy price
44 Euro/100 lit, 4.4 ct./kWh

Longterm economic perspective, 40 years



Private (short-term) perspective only 20 year

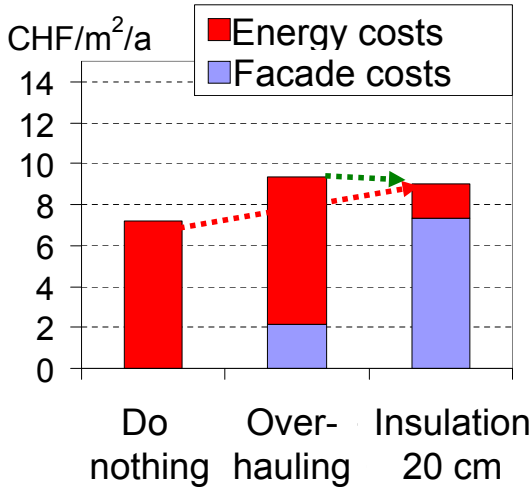


Quelle: TEP Energy, Zürich, September 2008

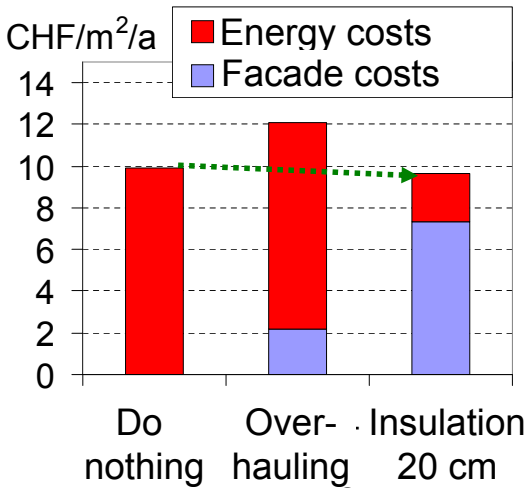
Example Façade Insulation

Real interest rate 3.5%, perspective 40 years

„Low“ energy price 44 EURO/100lit, 4.4 ct/kWh



„High“ Energy price 63 EURO/100lit, 6.3 ct/kWh



Quelle: TEP Energy, Zürich, September 2008

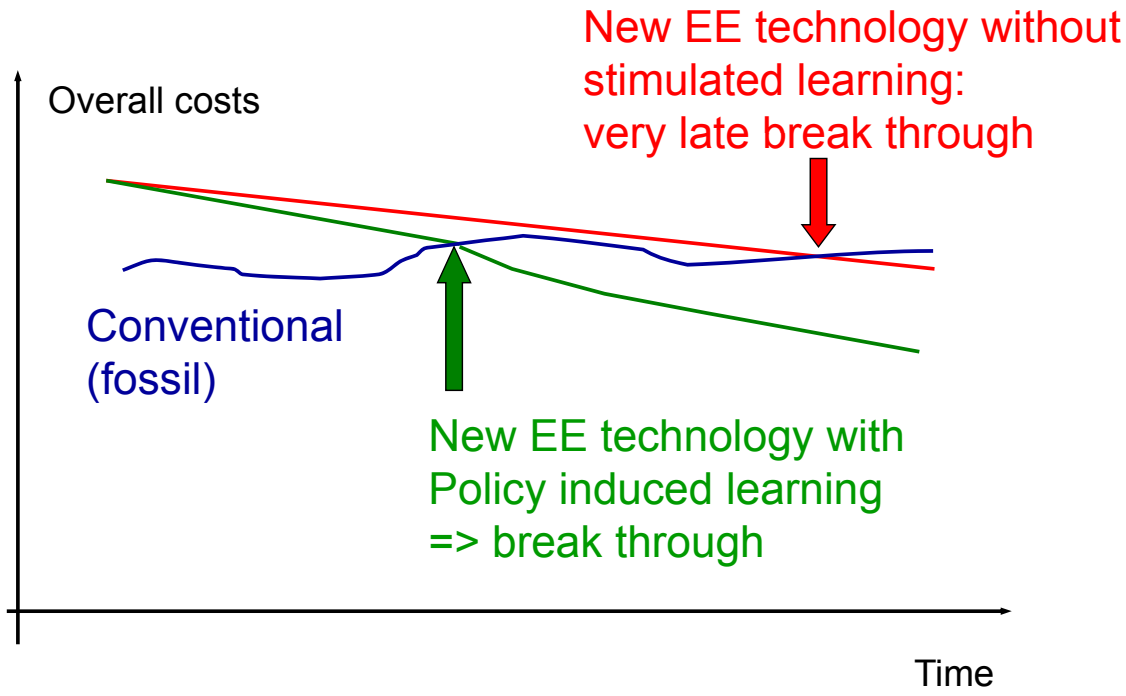
Static vs. dynamic perspective

- **Static view: dead lock situation**
  Private actor: “Energy efficiency is more expensive”
  Public: “Well, that’s the market situation”
  Private actor: “I do not invest in EE, I choose conventional”

- **Dynamic view: Overcome**
  Private actor: “Energy efficiency is more expensive”
  Public today: “Ok, let’s finance learning and experience”
  Private actor today: “Well, EE is promoted I invest”

  Private actor tomorrow: “Oh, EE is reasonably priced I invest”
  Public tomorrow: “Oh, don’t need to promote anymore, goal is reached!”

Dead lock vs. break through

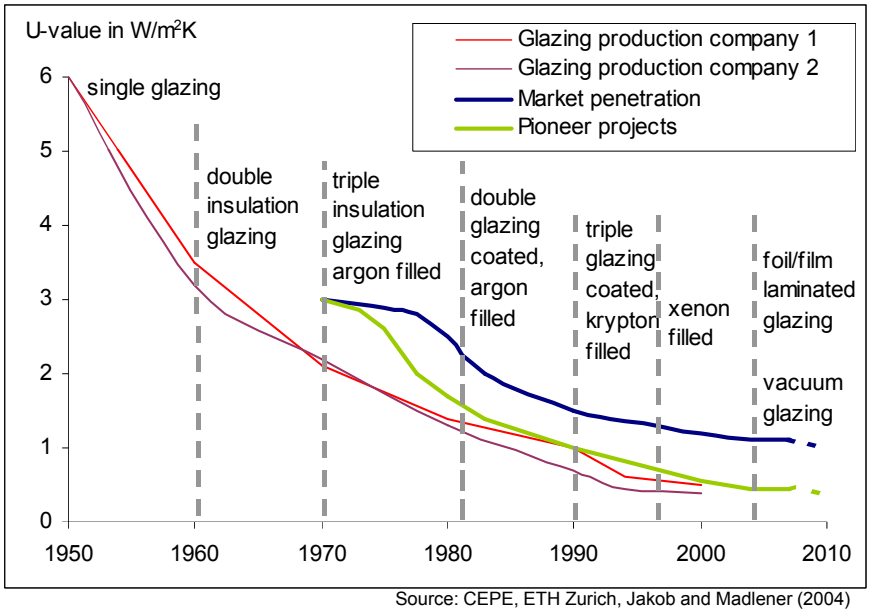


Case 1

Window glazing

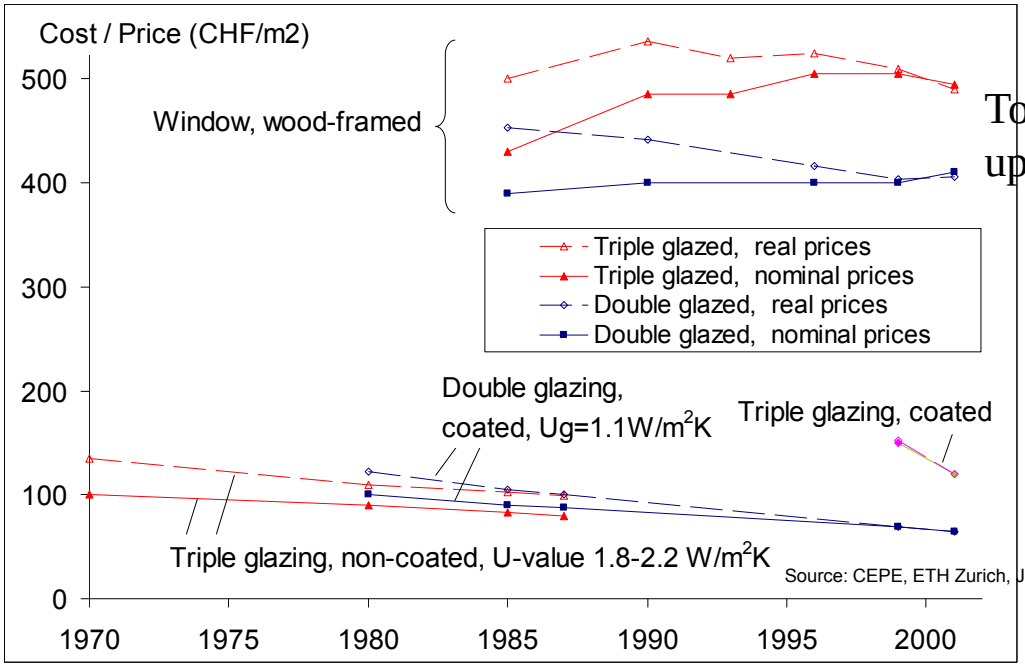
Techno-economic progress of window glazing (Switzerland)

- Significant decrease of thermal transmittance (U-Value) since 1950s
- Price decrease of low-e double glazing from 110 to <70 Euro/m²: -35% between 1984 and 1997



Source: CEPE, ETH Zurich, Jakob and Madlener (2004)

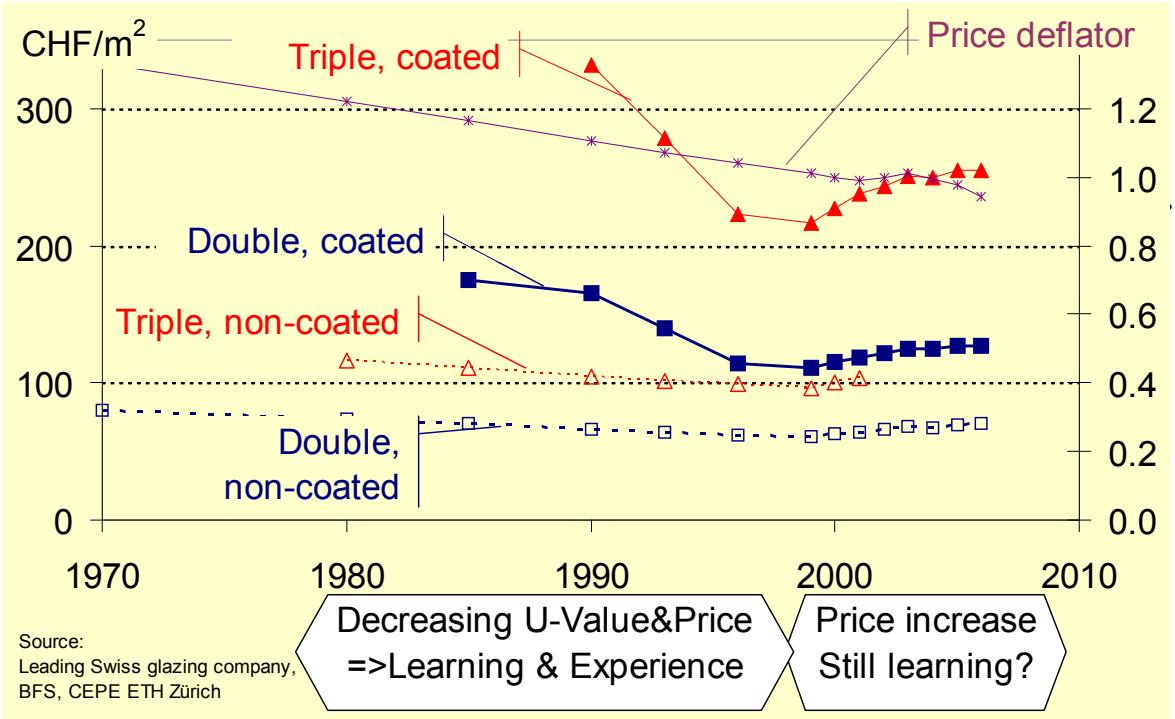
Cost/price development of glazing and windows



Source: CEPE, ETH Zurich, Jakob et al. (2002)

To be updated…

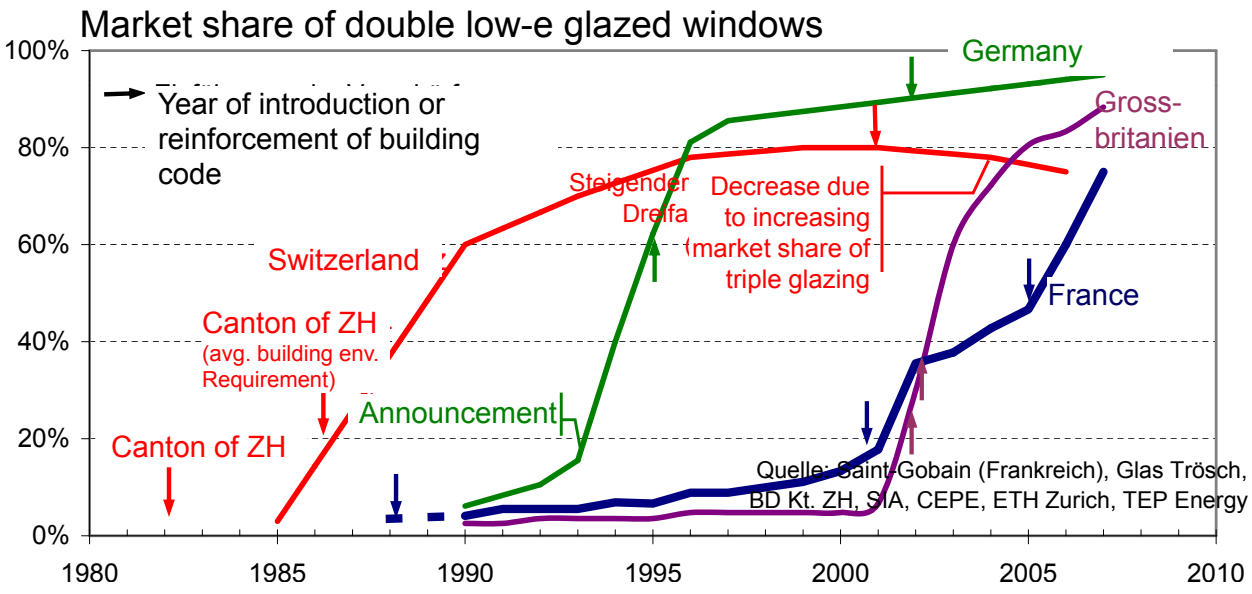
Cost/price development of glazing and windows



Source:
Leading Swiss glazing company,
BFS, CEPE ETH Zürich

Diffusion of coated double glazing

Ambitious codes => rapid diffusion and market transformation



Case 2

Building envelope insulation

Long-term technical progress of envelope insulation in Switzerland

- Continuous increase of insulation thickness (cf. table)
- Easier to install (e.g. due to glues)
- Development of insulated elements (window sill / breast / reveal)
- Reduction of thermal bridges (e.g. fixings)
- More recently: lower λ (thermal conductibility): compound materials: ≤ 0.03 W/mK, vacuum insulation: < 0.01 W/mK

Example: Rock wool insulation in Switzerland

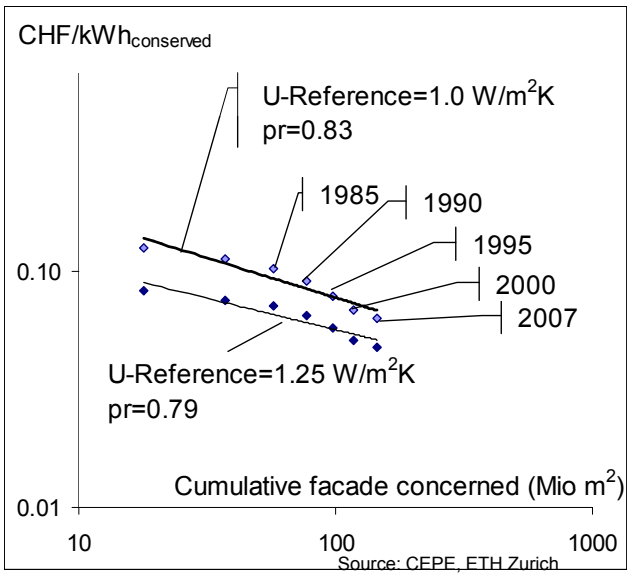
	< 1960	1961-1965	1966-1970	1971-1975	1980	1985	1990	1993	1995	1997	2000	2003	2007	*2012*
Incl. roof			50	75	90	100	105	117	129	129	135		160	*180*
Façade					60-80	75	84		91	96	108	120	140	*200*
Flat roof	30	40	50	60-80	80-100		110		120		140			
Bas. ceiling				20	30		40							

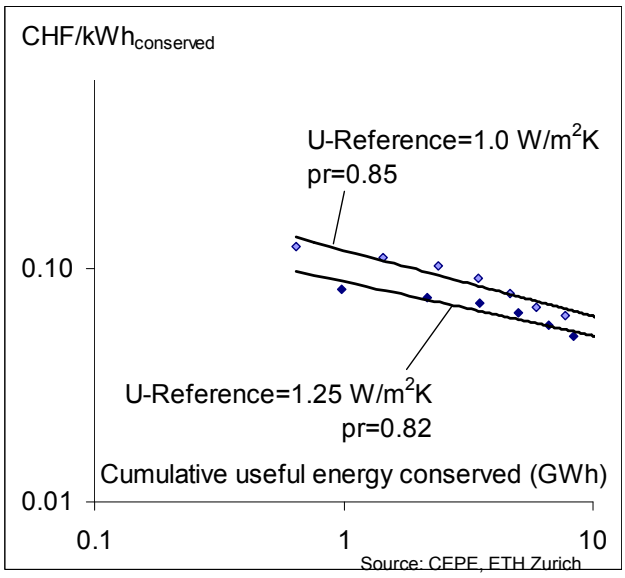
Source: Flumroc/CEPE ETH Zurich, *TEP Energy*

Progress ratio of standard compound façade insulation (PS)

Development since 2001:

- Updates (2008) confirm results of Jakob and Madlener (2004)

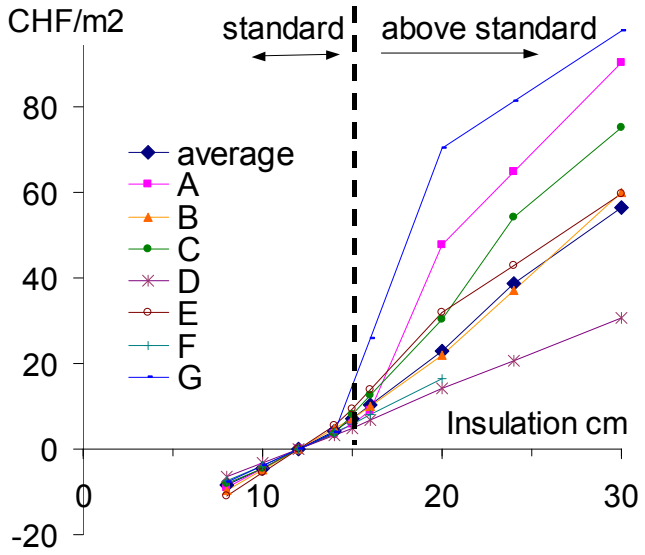




Add-on Prices of Facade Insulation

as Compared to Reference 12 cm (CHF/m²)

Compound façade (2001/2001)



New market

- Pioneer market pricing
- Pricing learning costs
- Security surcharge
- Benchmark?

Source: Jakob and Madlener 2004

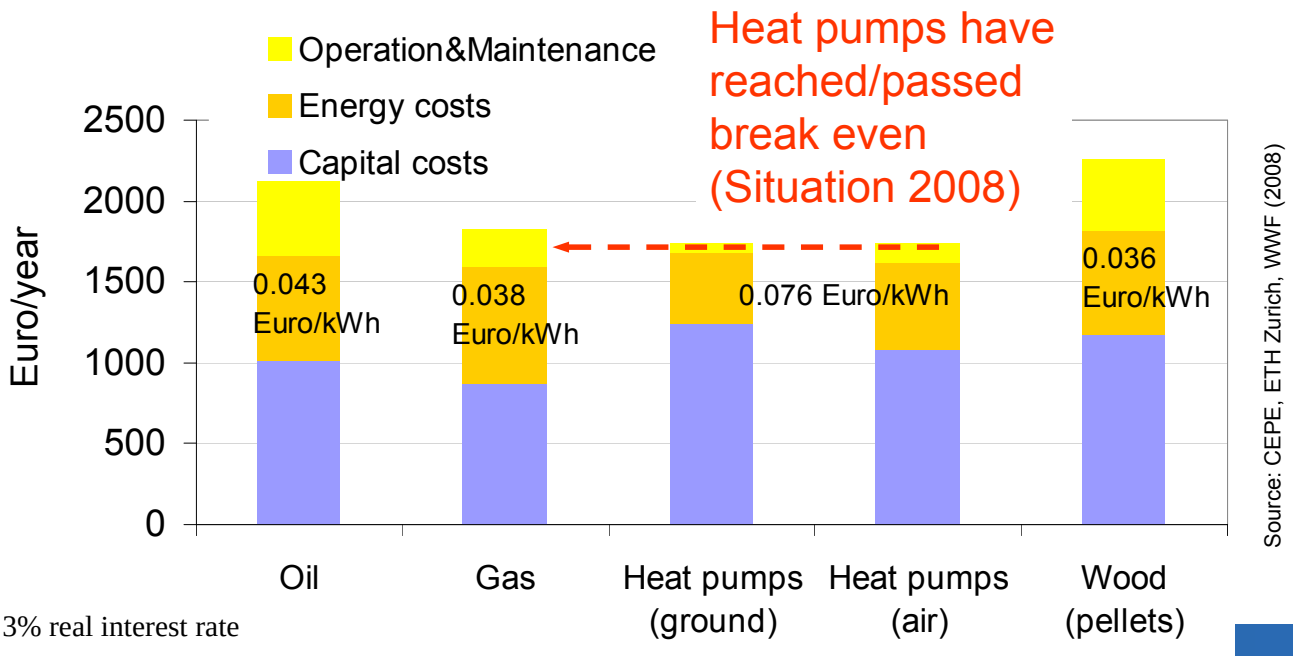
Conclusion of cases window glazing and building envelope

- ❑ Codes and standards enable market transformation
- ❑ Diffusion from new buildings to existing ones
- ❑ EE ok, low retrofit rates still a problem

Case 3

Heat pumps in (new) single-family houses

Economics of renewables (new single-family houses)



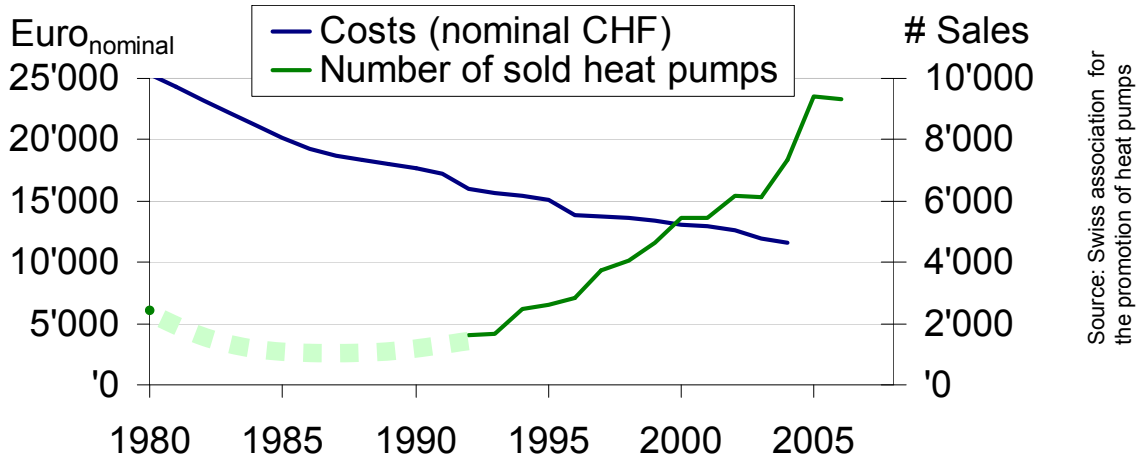
3% real interest rate

How did we come here:
Heat pumps success factors

- Research and development of motivated actors from the 1970s
- Association for the promotion of heat pumps (1993) manufacturers, installer electricity industry, authorities
- Quality assurance (education, COP, noise reduction) test-centre (since 1993) and field tests (since 1994)
- Strong and coherent advertising
- Economic incentives from electricity sector (special tariffs)
- Incentives from building codes in some cantons ("20%-rule")
- Incentives also through Minergie-label (weighting of energy)
- D-A-CH quality seal (Germany, Austria, Switzerland): 2001
- Motivated private clients of new SFH building

Heat pumps success indicators

- Increasing number of sales and market share (mainly new SFH, since 2004 also existing ones)
- Strongly decreasing investments costs, increasing COP
- => Significant techno-economic progress



Source: Swiss association for the promotion of heat pumps

Case 4

Minergie
EE and comfort housing label

Minergie-Label and its success factors

- Creation 1997/1998, supported by cantonal and federal governments
- Registered trade mark
- Improved insulation and housing ventilation system
- Final energy for heating, hot water, ventil. < 42 kWh/m^2/yr
- Performance based => optimisation between renewables and energy-efficiency (EE) including heat pumps
- **Promotion through comfort & EE**

Benefits of energy-efficient building envelope

1) Reduced energy costs and
   Hedging against energy price risks
2) Improved thermal indoor comfort
   - Well-being of occupants
   - Increased useful floor area
3) Reduce structural damage risks (mold, fungi)

=> Hence: positive impact on economic value of building

Manifold benefits of insulation

Insulation
- Decreases Temperature differences between air and wall
- Increases wall surface Temperature

  => Improves thermal comfort
  => Reduces condensation and building damage risks

- ❑ Buy down investments with reduced energy costs and hedge against energy price risks
- ❑ Improved thermal indoor comfort => Increased useful floor area
- ❑ Reduce structural damage risks (fungi)

=> Hence: potentially positive impact on economic value of building (some evidence, but more needed)

Economics of Minergie labelled houses

Housing (comfort) ventilation systems (new buildings)		
	Costs	Benefit
Single family houses	2.5% to 3.5%	5% to 8% (WTP) 3% to 10% (Hedonic)
Rented Flats	4% to 6%	4% to 11% (WTP)

Source: Ott, Jakob et al. (2006), Banfi et al. (2008)

Willingness to pay (WTP) and impact on purchase price larger or equal to costs for a significant segment
=> develop market

Economic implication

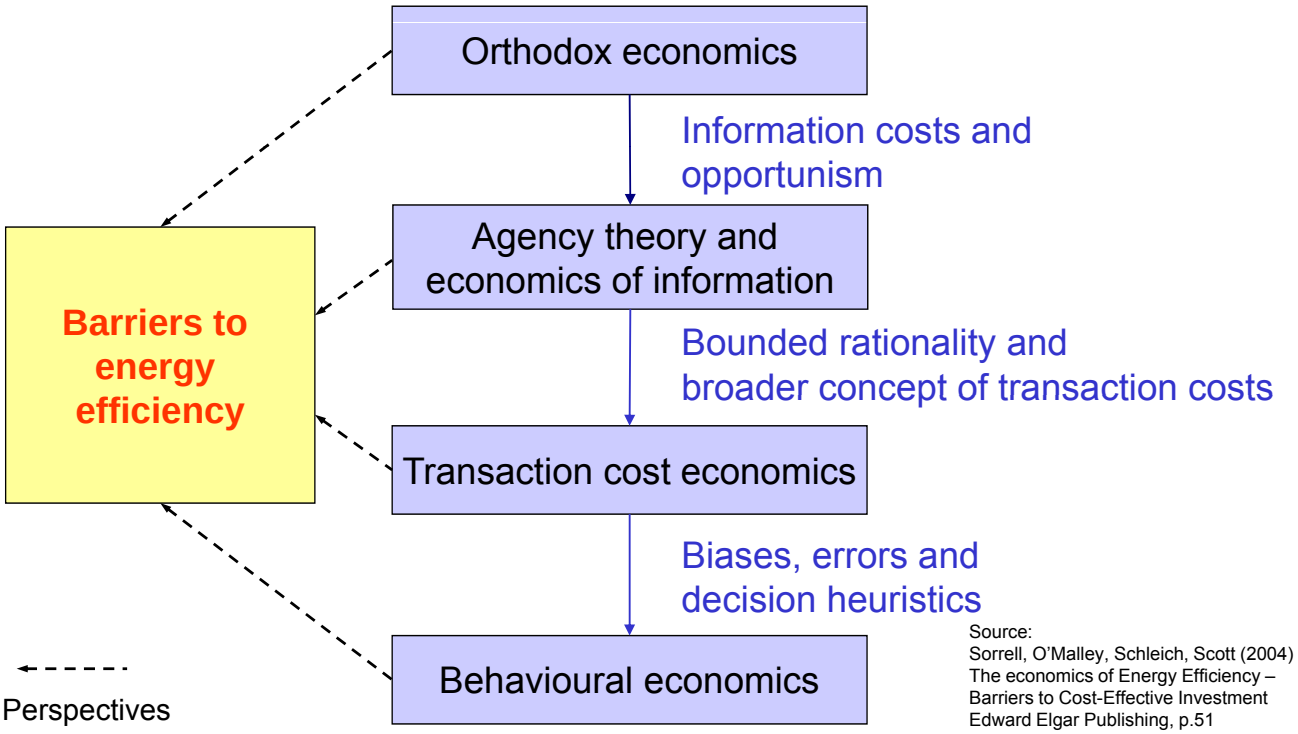
Willingness to pay for energy-efficient buildings

Source: Banfi, Farsi, Jakob et al. 2006

	Rental flats in apartment buildings		Single family houses	
Attribute	WTP	Sig.	WTP	Sig.
Enhanced insulated window (as compared to standard insulated windows)	*1%*	*n.s.*	*1%*	*n.s.*
Enhance facade insulation (As compared to standard insulation)	3%	*	2%	*
New windows (as compared to medium old ones)	13%	***	10%	***
Standard facade insulation (as compared to facade painting)	6%	**	5%	**
facade painting (as compared to old unpained facade)	*3%*	*n.s.*	*2%*	*n.s.*
Housing ventilation system (new buildings)	8%	***	9%	***
Housing ventilation system (existing buildings)	8%	***	*2%*	*n.s.*

Sig. = Significance level: (***)= 0.1% level, (**) =1%-level, (*) = 10% level, n.s. = not significantly different from 0 on the 10%-level

Concept of barriers



Source:
Sorrell, O'Malley, Schleich, Scott (2004)
The economics of Energy Efficiency – Barriers to Cost-Effective Investment
Edward Elgar Publishing, p.51

Successful deployment of EE

Multi-dimensional, simultaneous barriers

Motivations, WTP

=> Comprehensive policy approach

- Aim at market transformation
- Improve economic viability
- Market transparency: "catchy" information
- Address risk and quality of new technologies

Design comprehensive set of instruments

Types of policy instruments

- **Codes and standards:** for envelope and appliances
- **Economic incentives:** subsidies, energy price taxes, tax credits (rather than deduction from taxable income), preferential loans, ESCO
- **Information/communication**: campaigns, labels, certificates and audits, P&D, education
- **Quality assurance:** address risk & quality of new technologies
- **Combinations**: white certificates, subsidies subject to minimal performance standards, HP promotion programme…..

Conclusions and recommendations

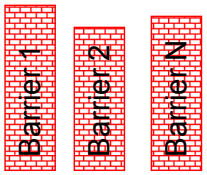
Comprehensive policy approach =>Success (diffusion, techno-economic progress)

- Ambitious codes for new buildings to achieve market transformation and decreasing costs
- Improve economic viability
- “Catchy” info: energy-efficiency and quality labels
- Link economic incentives to standards and labels
- Address risks and quality of new technologies

Concluding remarks

- Economic energy efficiency potentials available (ST & LT)
- Private actors:
  Time horizon and scope of decision
- Chain of actors, bundle of barriers
- Bundle of policy measures needed (Portfolio)
- Sufficient intervention level necessary
- Remove barriers needed, but not enough:
  Encourage, support and stimulate
  Motivated, smart and visionary actors
  (first movers)
  => will wake up enthusiasm of others

External Effects



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Thank you for your attention!

Questions?

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