Policy and business for sustainable innovations

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Policies, changes and uncertainties

Global environmental summits

- Utilitarian view in Club of Rome, 1972, Stockholm 1982: International agenda about environment.
- Stewardship view: WCED report 1987, Rio de Janeiro 1992: Agenda 21 agreement for changes.
- Development view, Various reports, Johannesburg 2002: Millennium Development Goals
- Stakeholders' views, Various reports, Rio de Janeiro 2012: stalemate about issues.

Political progress

- Growing gap between frontrunners and laggards across rich and poor countries, e.g. lagging “rich” US and progress in “poor” Chile
- Some countries embrace environment for their economic development, e.g. “rich” Sweden and “poor” Korea (“ecological modernisation”)
- Politicians matter. Progress in the EU thanks to e.g. Guy Verhofstad (Belgian liberal) and Helmut Scheer (German social-democrat)

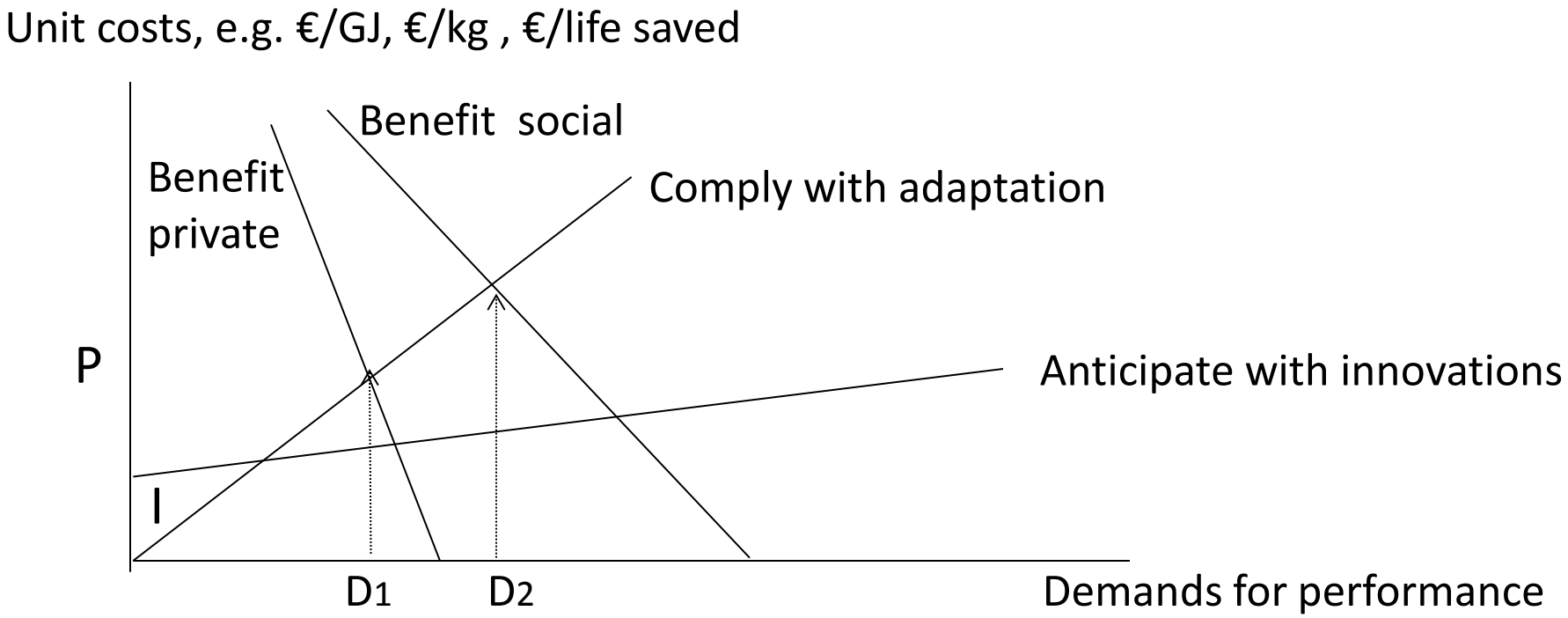
An impediment: policy cycle

Even a progressive policy has a cycle of 20-30 years

- Signalling: issuing hazards, 6-10 years
- Preparation: cost-benefit functions, 4-6 years
  - Innovations: some firms anticipate demands
- Policymaking: introduction instruments, 2-4 years
- Enforcing: implementing solutions, 6-12 years

Enforcing is laborious, a mix of policy instruments: direct (permit), economic (fees), social (agreement)

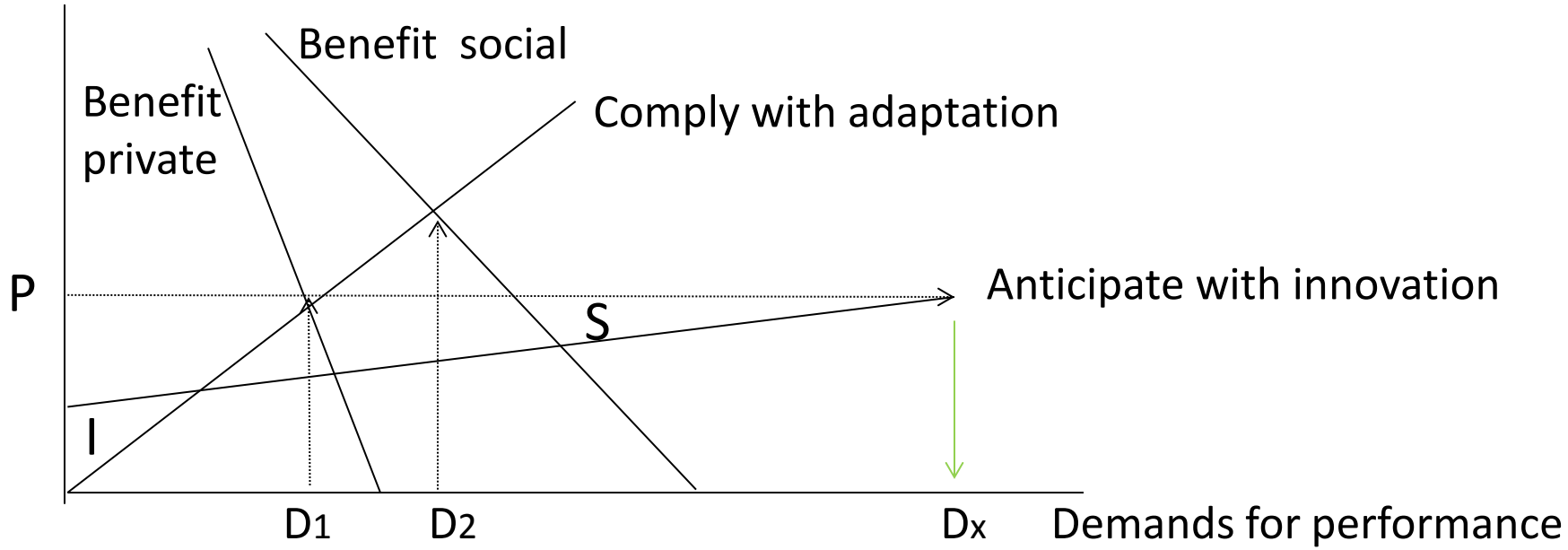
Private and Social Costs and Benefits



- Benefit private < social, e.g. less Energy < less Energy + Waste
- Cost compliance ≠ anticipation, e.g. fossil mix or renewable
- I investment to anticipate D2, e.g. R&D for CO_2 reduction

Direct or Market – based instrument

Unit costs, e.g. €/GJ, €/kg , €/life saved



D1 to D2 shift in direct regulation to accommodate social benefit
Price P at private benefit: extra incentive S, at investment I, effect Dx

Market instruments more effective and efficient than direct because stronger incentive to perform

Performance for common goods

Aim is cost-effective policy: large effect at reasonable costs (ALARA) with Best Available Technologies

- Cost in prices; Effects vary e.g. pollution reduction in kg, electricity in kW, mortality reduction in years, schooling rate in %

  $e = e_{initial} - e_{after\ use}$

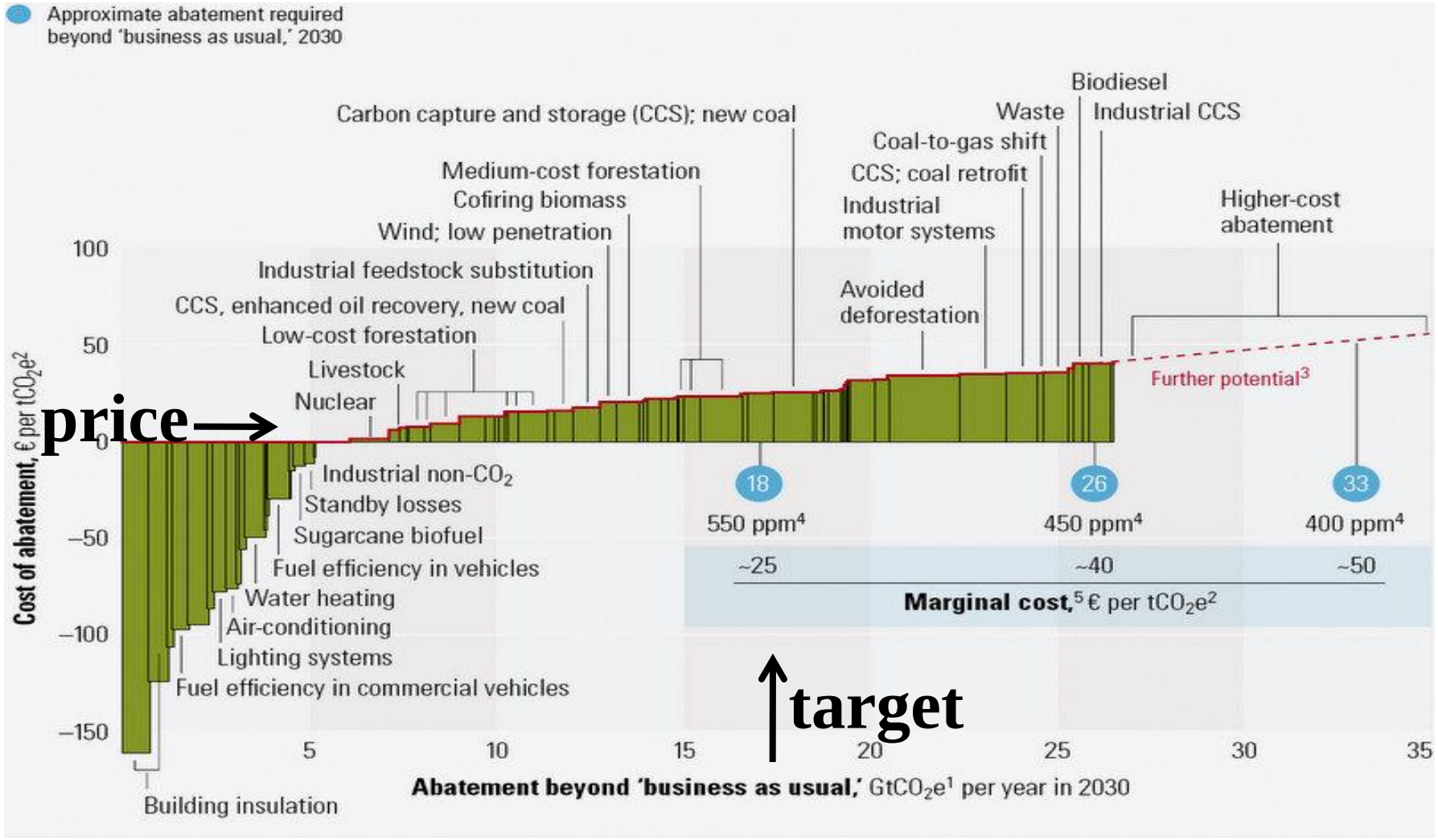
  c = marginal (unit) cost = C/e (total cost/effect)
- Eco-efficiency, a benchmark for policy making

  $e_t = [c_{(t+1)} - c_t)/(e_{(t+1)} - e_t) - 1] \times 100\%$

  2% for wastewater treatment to 25% for renewable energy, (why?)
- Cost - Benefit Assessment in US, effects in quasi-prices (laborious and disputed)

Performance cost function of CO_2 (for US)

McKinsey company, "Reducing U.S. Greenhouse emissions, how much at what cost," 2007



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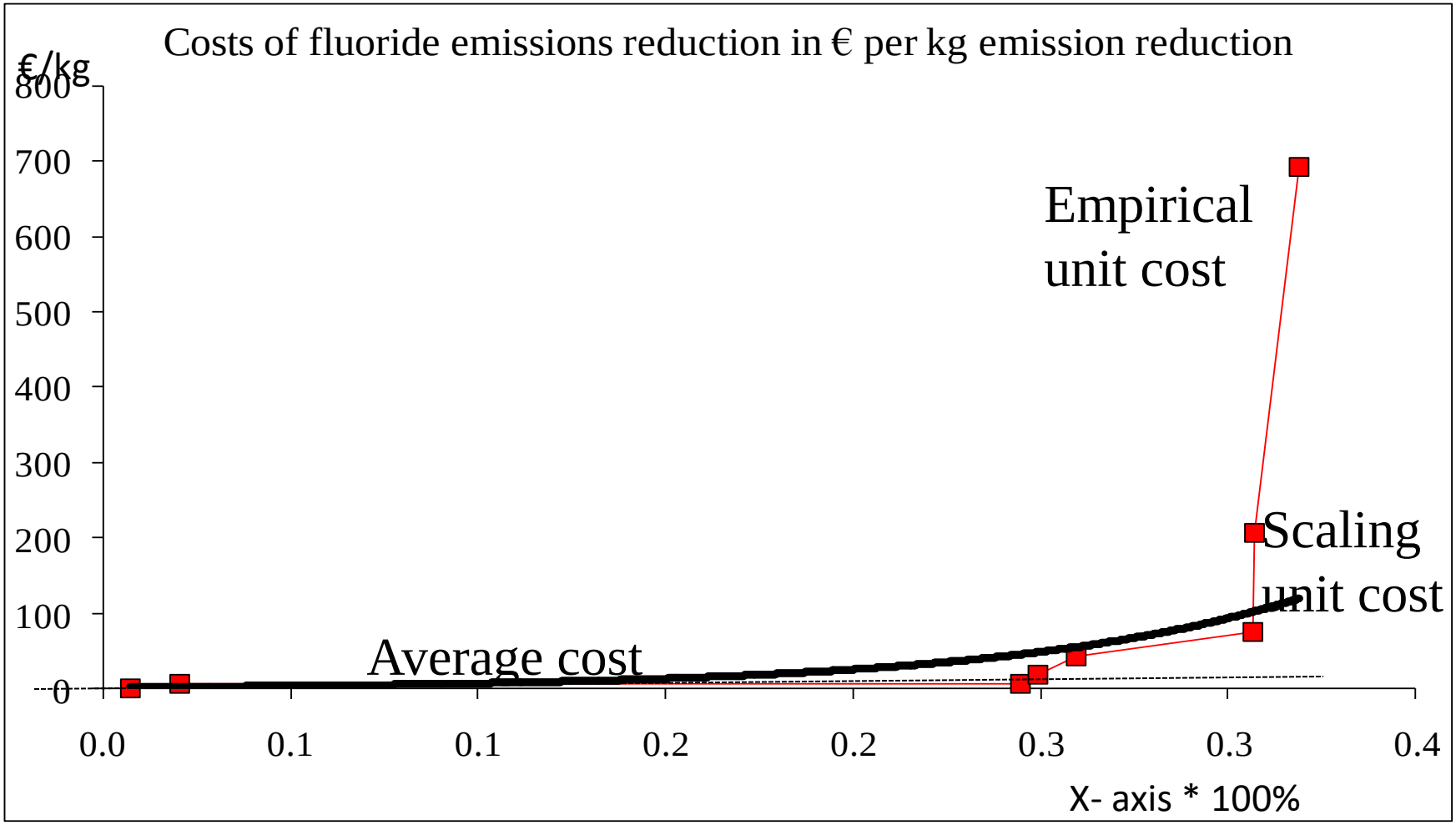
Scaling a performance cost function

Scaling when few empirical data (Krozer, 2008)



Public demands in business decisions

- Option 1. Public demands enforce standards. Firms must comply. Lay back but costly.
- Options 2. Public demands with a fee threat. Firms can anticipate. Uncertain but a benefit.

Uncertainties in the policymaking

- Stakeholders demand various issues
- Environment is dynamic and data imperfect
- Location conditions vary and people change

Illustration: uncertainty has a cost

If you deliberate a wastewater treatment plant for 0.1 mln people ≈ € 100 mln investment, depreciated linear 20 years at interest 0% - demand certain, or 10% - demand uncertain.

Capital cost: 0% = € 100 mln/20 = € 5 mln/year;
Capital cost: 10% annuity = € 11,75 mln/year
Operational costs: 1 high, 3 middle,15 low personnel ≈ USD 0.55 mln + energy (0.5 MWh/year) + others ≈ € 0.05 mln

Annual costs: if certain ≈ € 5.6, if uncertain = € 12,4 mln;
Capital, 94% of all cost, must be assessed 20 years ahead,
1% less uncertainty is ≈ € 0.8 mln a year less payment

Business decision making

Effective business decisions

- Output function factorial inputs Cees van Leeuwen '89):

  $N_o = (N_i !+ 1)$

  3 inputs can provide 7 outputs N_o=3!+1= 3*2*1+1

  6 out of 7 are unintended: ineffective or losses;

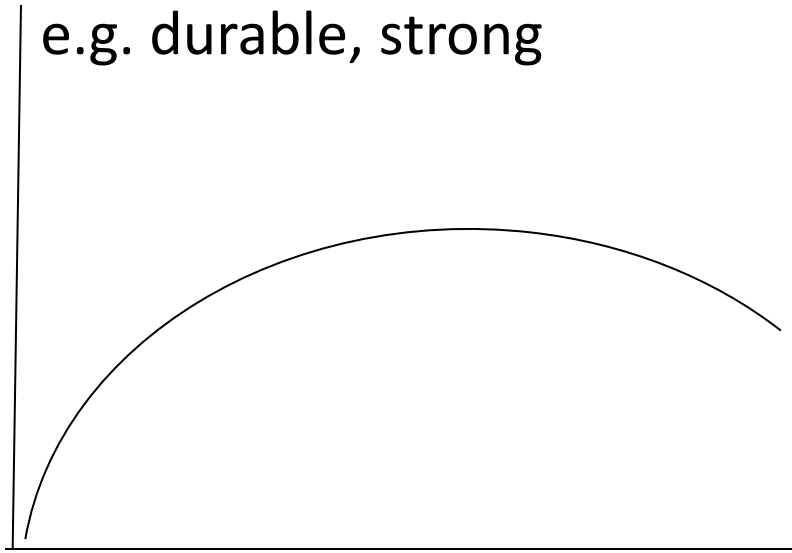
  e.g. serving Dutch, Basil or Indian coffee, (+sugar, +milk)

  4 inputs 24 out of 25, etc.;
- Practices: output related to demands
- Many inputs: each loss is a cost (how to avoid it?)
- Much technological progress aims loss prevention.

Consumers regarding demands

Functional private,

e.g. durable, strong



Functional and Ethical values can go hand in hand but much ethical can degrade functionality

Functional ethical (social),

e.g. honest, safe

e.g. lamps: functional (lumen a Watt), ethical (safe) www.vibavereniging.nl		Index functional values	
		High	Low
Index ethical values	High	LED	Bulb
	Low	TL	Saving

Linking ethics with functionality

"Engineers translate ethics in techniques" (after Cees van Leeuwen, Unilever)

Methodologies of Total Cost Assessment (all imperfect)			
Technique Approach	Corporate risks	Targets to attain **(DESC)**	Multi-criteria
Social interest prevails	Liability	Control cost	Value to Impact
Private benefit prevails	Contingent valuation	Life cycle costing	Quality Certificate

A model for business decisions

Assume all societies pose demands, pay or tax it:

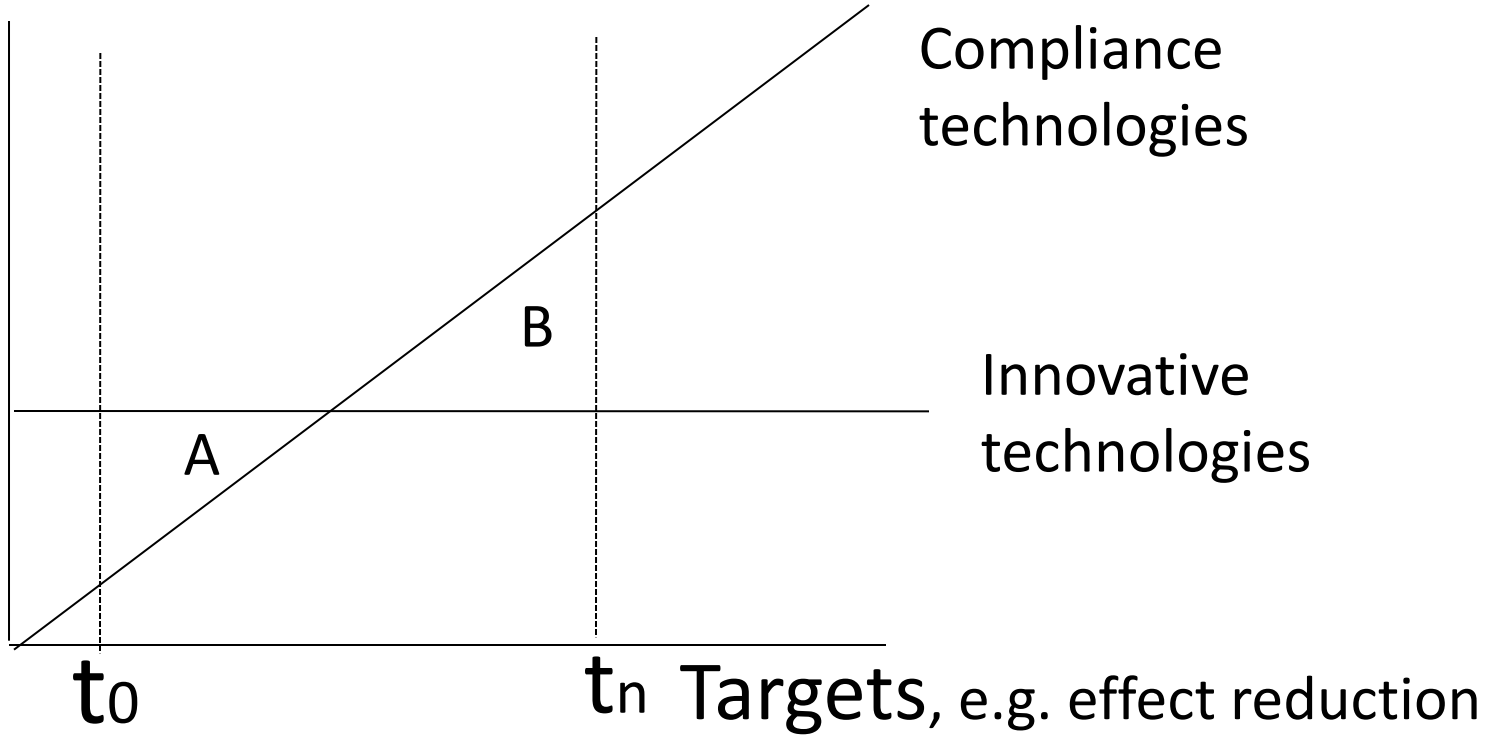
- Policies follow the demands with a time-lag
- Demands disseminate fast across globe
- Cost-effective actions can be deliberated

In the managerial decision making

- Life cycles (process and product) face demands
- Costs to comply with the demands in all steps
- Prioritize eco-efficient actions across life cycles

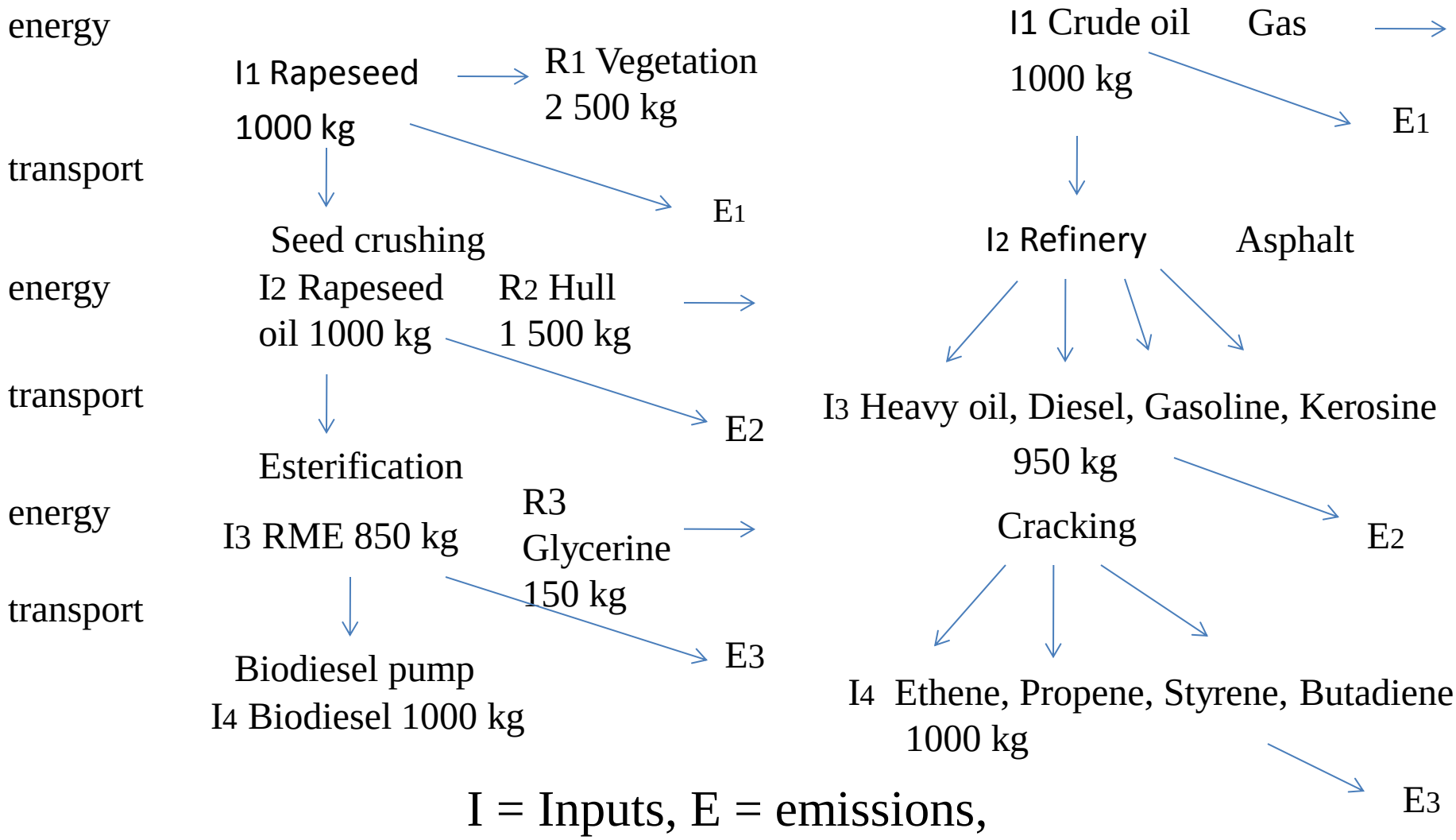
Social demands in business decision

Decision model for Environmental Strategies of Corporations –DESC
Increasing social demands (horizontal), unit costs (vertical axis)



Innovations are efficient if area B > A

A supply chain; part of a life cycle



I = Inputs, E = emissions,

Life cycle costing (LCC)

- Materials and energy streams
- Expected performance targets
- Costs and effects of technologies
- Calculate costs to attain the targets
- Envisage changes in the chain
- Assess eco-efficiency of the changes

Calculation					
Activities in the chains		Demands		Demanded control cost	
Material flows	Price	Effect red %	Red. kg	Unit cost	Total cost
Production Distribution Use Disposal					

LCC example

Life Cycle Costing of a television in euros		
Steps in the chain	Private costs	Extra costs for pollution reduction
Production: design, assemble, package	703	46
Distribution: transport, wholesale, retail	767	12
Consumption: energy, packaging, repairs	377	106
Disposal: collection, shredding, recycling	13	16 (22)
Total	1 849	180 (186)

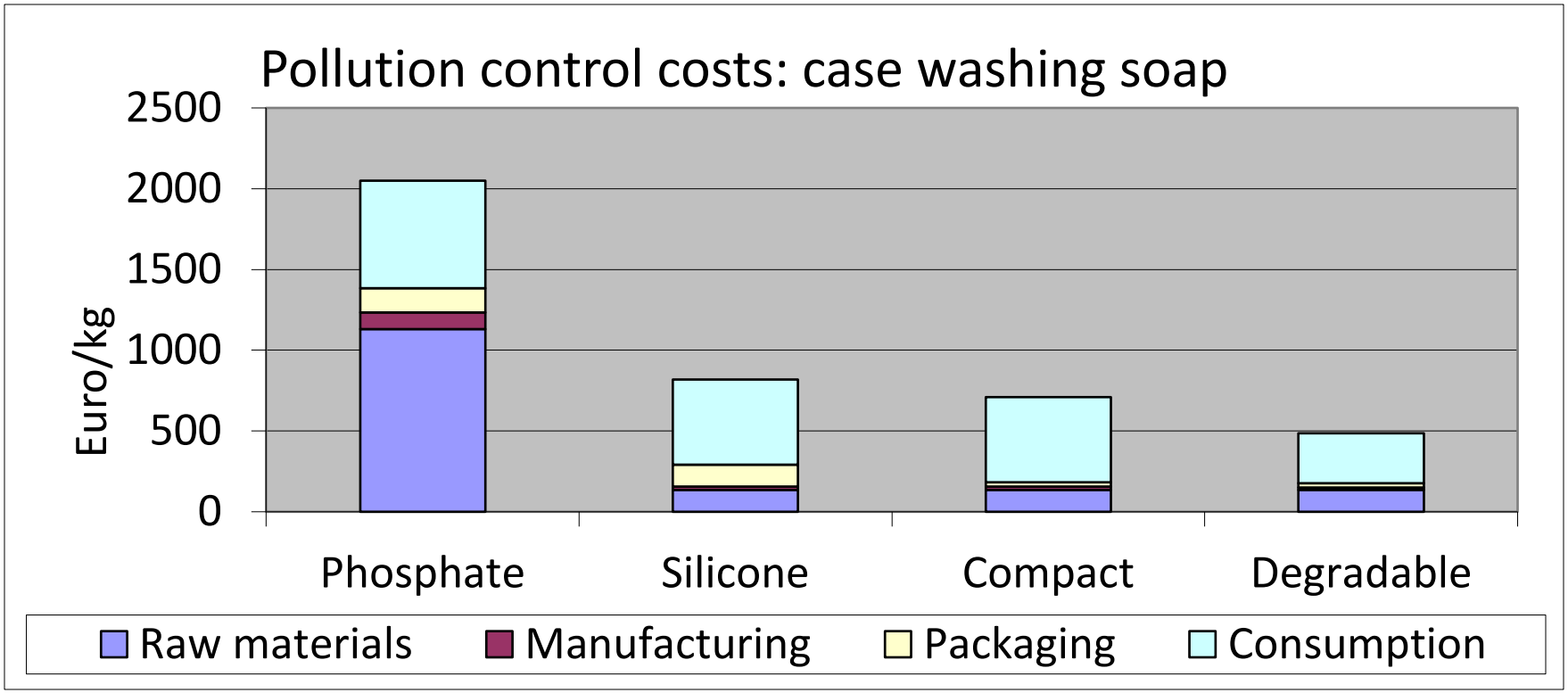
- Social demands cause high energy and repair costs (consumers pay)
- Energy saving and low repairs are eco-efficient (“green TV”),
- Strict policy on end-of-life is not worrisome (take-back is low cost)

LCC Cases

Life cycle costs (€) and potential efficiency increase (Krozer 2008)						
Chain	Unit	Price	60 - 80% pollution reduction			
			Extra cost	% of the price	Cost factor	Efficiency increase
Plant fat	Kg	1,6	0,1	4%	Fertilisers	52%
Tomato	Kg	0,5	0,2	32%	Energy	93%
Animal fat	Kg	0,7	0,2	27%	Disposal	81%
Cotton cloth	Piece	4,2	0,4	11%	Printing	78%
Wash soap	Kg	2,2	0,4	18%	Cleansing	62%
Armchair	Piece	122	3,5	3%	Disposal	97%
New car (km)	0,13 mln	10 642	1451	14%	Fuel use	93%

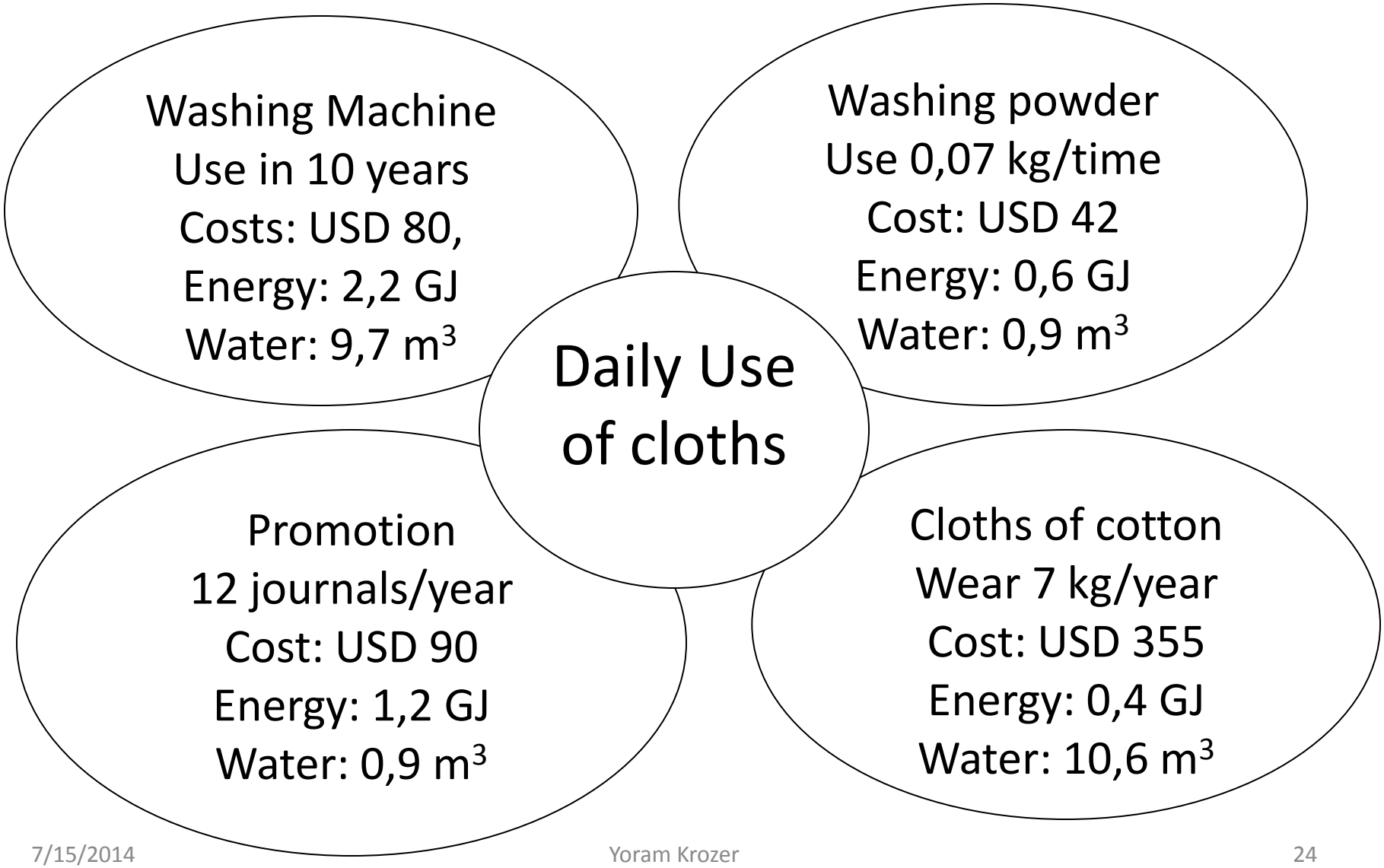
- Social cost increase at a few specific steps in the life cycles
- Efficiency-increase achievable through a few focused actions
- Many low cost actions possible ; anticipation often economic

LCC and innovations in time



- The expected additional cost in the life cycle are much reduced
- These costs were high in the supply chain but now end-of-life

Integrating into a system



Attempts for change in washing

Examples	Improvements	Barriers
Washing Machine	Water saving	Lower effect powders
	Ultrasone	Tear of some cloths
Washing powder	Low temperature	Tear of some cloths
	Less ingredients	Outlook degradation
Cloths	Mono-materials	Tear in machine
	Natural dyeing	Colouring by powders
Promotion	Natural cloths	High price, less outlook
	Degradable powders	Lower effect washing

Despite of huge efforts little success, so far

Workshop: what do you need to start
15 minutes