

Implementation of Innovative Sustainable Energy System

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STYRIAN ACADEMY for Sustainable Energies



1. External independency; advantages of import substitution.
2. Lower vulnerability; diversity of sources in view of oil prices.
3. Reliability; self-management through community solutions.
4. Cleaner production; lower greenhouse and other pollution.
5. Resource availability; substitution of scarce fossil resources.

Self interest

Technical issues

- Supportive to supply chain management such as peak demand coverage, balancing supply prices.
- Efficiency increase when transformation of heat to motion is substituted by electricity to motion.
- Reduction of transmission losses when generated in a localized manner (no losses when passive solar use).
- Adds functionalities in products such as flexibility in tourism, independence in mobility.

Socio-economic issues

- Lower costs of fuel use during high international oil prices.
- Community development due to know-how and business growth
- Social inclusion, jobs and better environment in communities.

“But the crude material generally forms so small a portion of the total cost, that any tendency which may exist to a progressive increase in that single item, is much over-balanced by the diminution continually taking place in all the other elements; to which diminution it is impossible at present to assign any limit” (Mill, 1848, 1985:64).

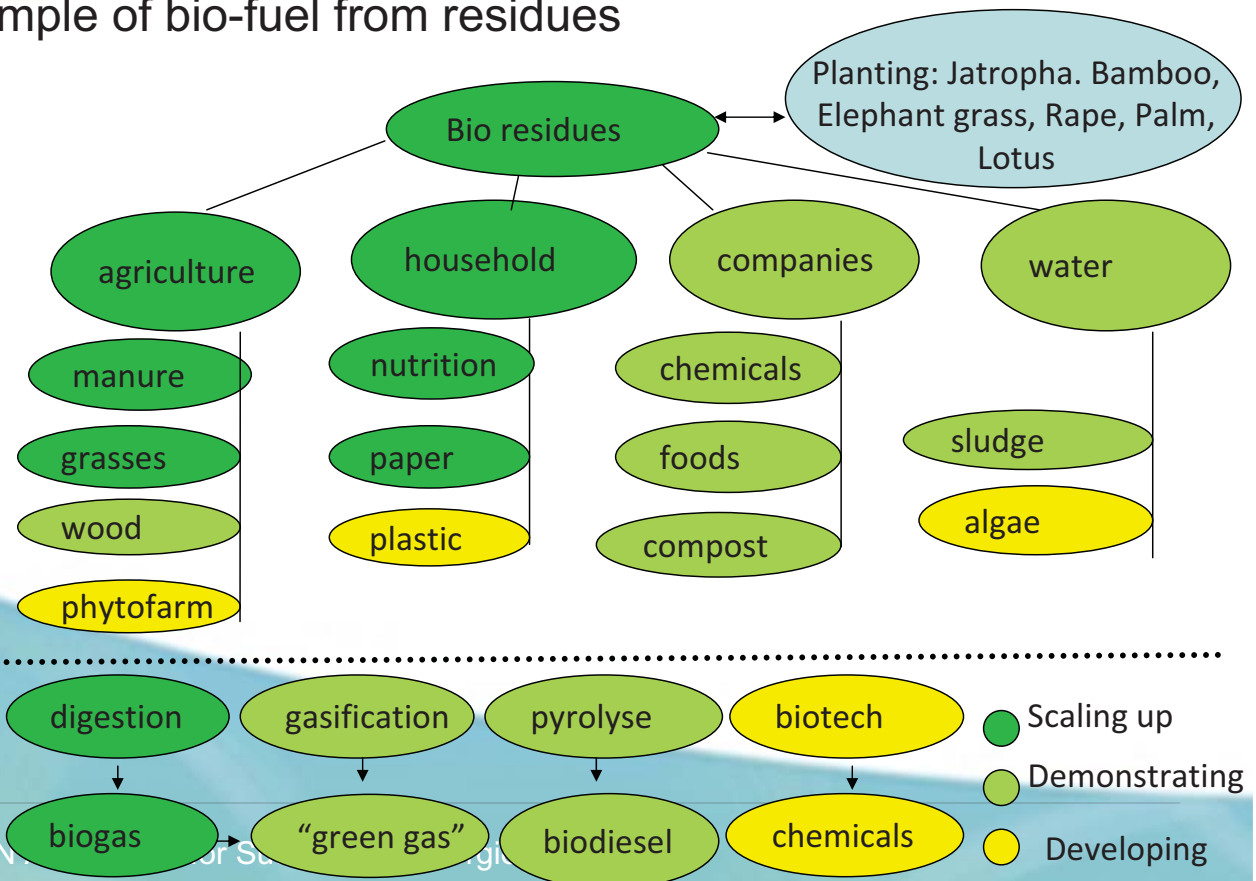
Downward trend in resource prices

Race between the downward trend in the resource prices and the cost of technology

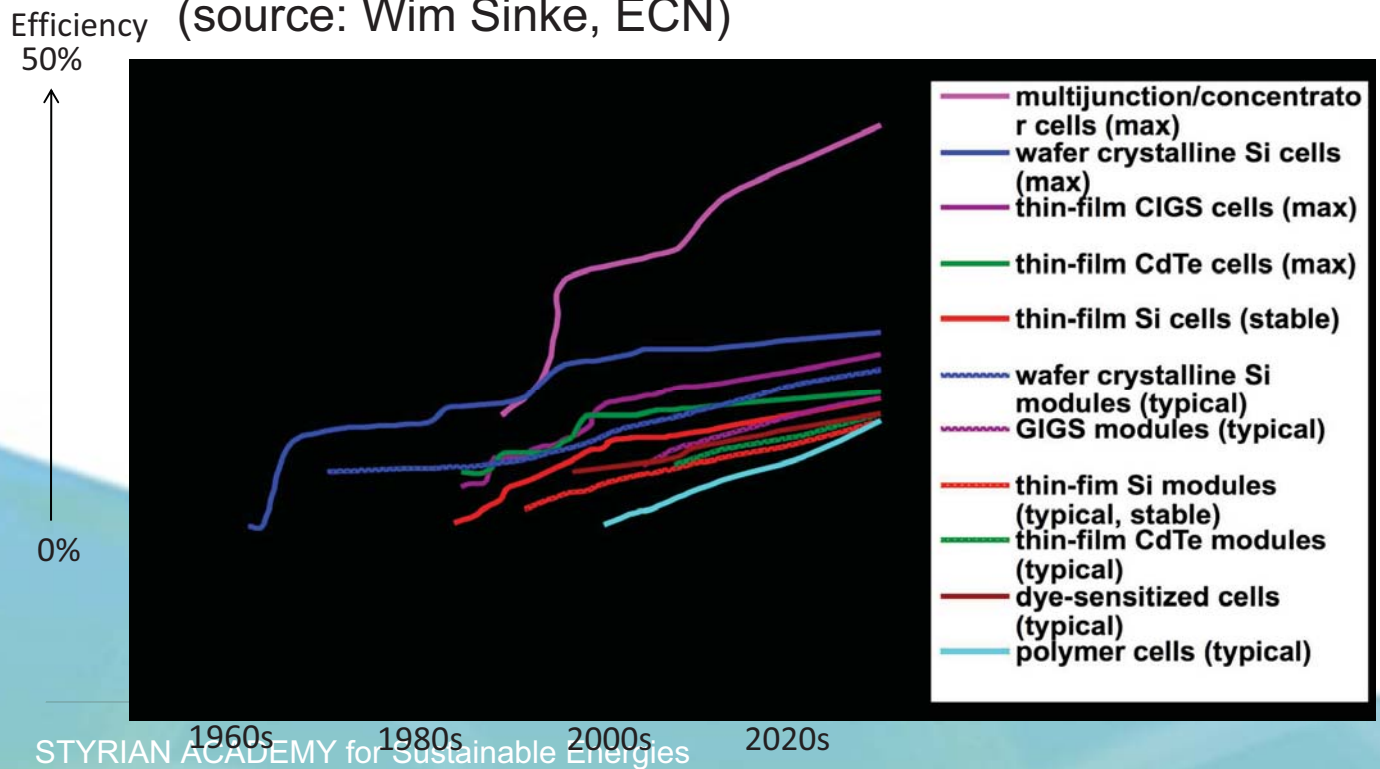
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Driver: diversification

Example of bio-fuel from residues



Example PV development: selected cell (maximum) and module (typical) efficiencies; energy parity in 10-15 years (source: Wim Sinke, ECN)



Costs and benefits of implementation

EU renewable energy production, 2007

Fuels in the EU	Production in 2007	Average growth 1996-2006	Debated issues in addition to costs
Renewables in all energy	16%	4.2% (total fuel use -1%)	fossils to renewables
Resources in renewable total			
Biomass & waste (biogas)	69%	5.1%	space, food
Hydro (small scale <10MW)	21%	-0.3%	ecology, displaced
Geothermal	4%	5%	aquifers, safety
Solar	1%	14%	design, space?
Wind	6%	32%	landscape, birds

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Costs and producers in the EU, 2008

Source policy doc	Production €/MWh 2007	Production €/MWh 2020	Producers by % in the EU total
COM (2008) 781			
Fossil fuels (coal)	45-55	70-80	Poland, Germany
Resources in renewable total			
Biomass/gas	50-215	50-200	Germany, France
Hydro (all)	35-145	30-140	Sweden, France
Geothermal	-	-	Italy
Solar	520-800	270-460	Germany, Greece
Wind (on-shore)	75-110	55-90	Germany, Spain

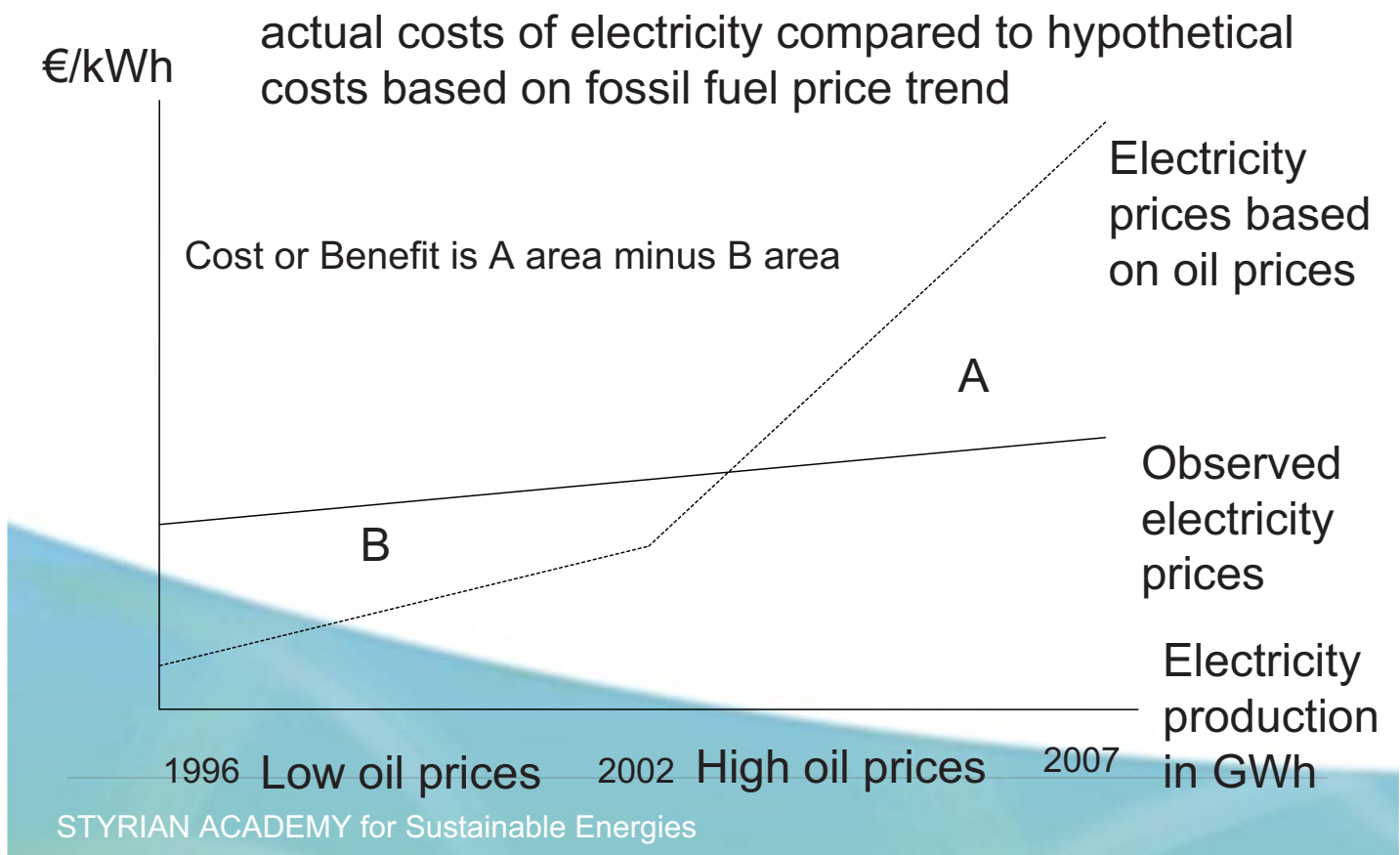
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Renewables in electricity production

- Large scale hydro (renewable?) covers about 2/3 but it decreases, wind has the highest growth.
- EU 16% in 2007, but Austria (60%), Sweden (52%), Latvia (36%), Portugal (30%), Denmark (29%), Romania (27%), Finland (26%), Slovenia (22%), Spain (20%), Slovakia (17%)
- Average annual growth 2003-2007 in EU 5%, but much higher in Hungary, Estonia, and Belgium.
- EU 2007 renewables production and consumption is roughly in balance, but large imports before

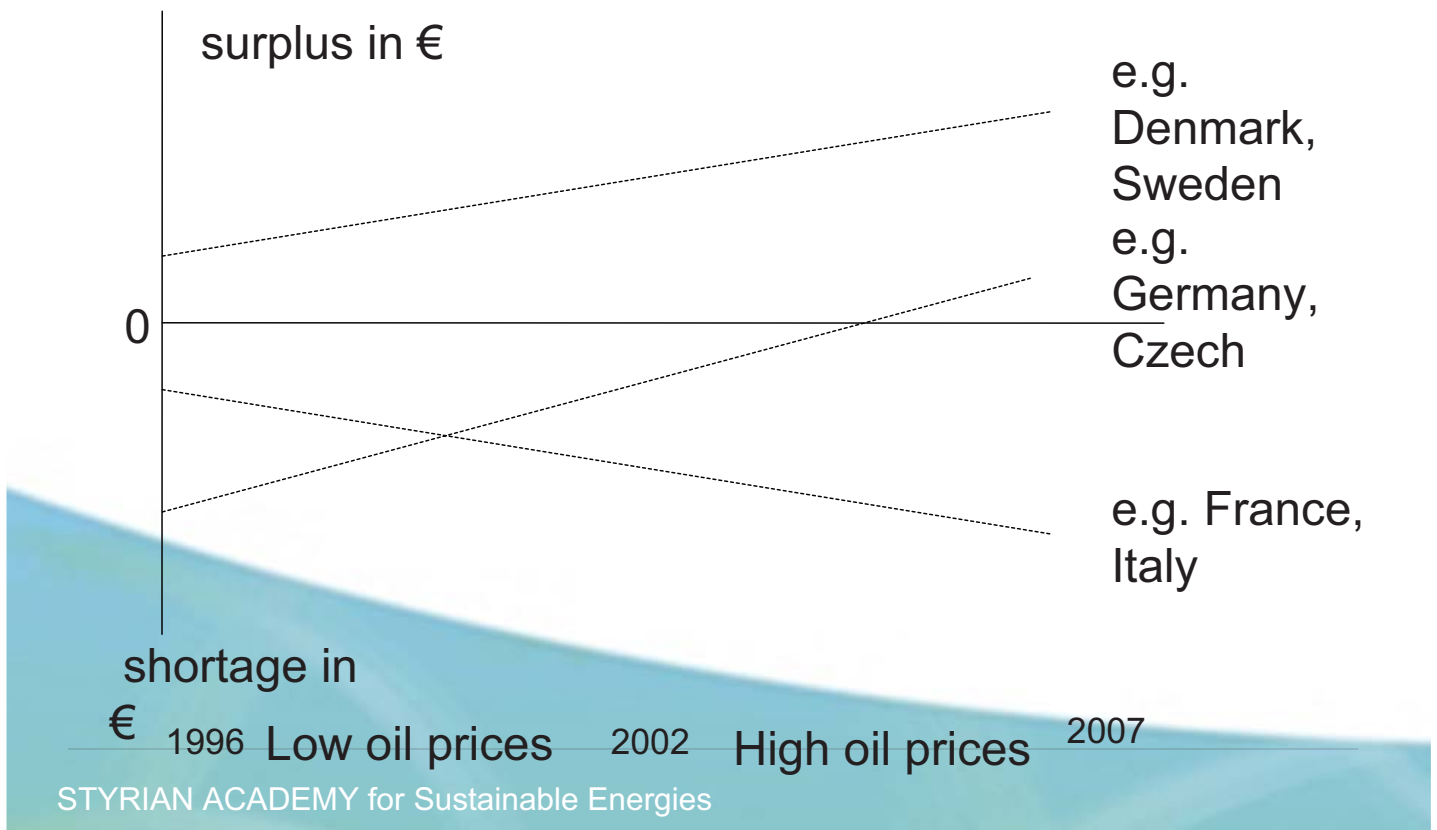
Benefit of the backstop of oil prices

- Correlations: EU countries' consumers electricity prices with renewables use 2007, and with the annual growth renewable in electricity for 2003-2007 and 2005-2007.
- Correlation of the high share with electricity prices is low positive or negative in 2003-2007, high negative in a few countries 2005-2007
- Indication of positive effects of (additional) renewable energy use on consumers' electricity prices during high oil prices



Assessment results

- Assumptions :
 - 1996-2002 low oil price and 2003-2007 high oil price
 - 2002 break-even fossil fuels and renewables prices for electricity
 - alternatives are imports and renewable resources
- 1996-2002. Total transition cost 18 billion euro.
- 2003-2007. Total benefit 224 billion euro, out of it 29 billion euro due to renewable energy
- Annual consumers surplus 1996-2007 due to renewable energy implementation is 2.4 billion



Who gained and lost?

- Production – consumption = export, divided into the periods 1996-2002 and 2003-2007
- Additional export 2003-2007 to 1996-2002 means gaining productive capacity.
- High gains: Austria 1.5 billion euro, Denmark 1.2 billion euro, Latvia 1.0 billion euro etc.
- High losses: France 16 billion euro, Spain 11 billion euro, etc.

Policy implementation

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EU Member	2005	2020 Target	% To cover:
EU	8.5%	20%	12%
Austria	23%	34%	11%
Belgium	2%	13%	11%
Bulgaria	9%	16%	7%
Cyprus	3%	13%	10%
Czech rep.	6%	13%	7%
Denmark	17%	30%	13%
Estonia	18%	25%	7%
Finland	29%	38%	10%
France	10%	23%	13%
Germany	6%	18%	12%
Greece	7%	18%	11%
Hungary	4%	13%	9%
Ireland	3%	16%	13%
Italy	5%	17%	12%
Latvia	35%	42%	7%
Lithuania	15%	23%	8%
Luxembourg	1%	11%	10%
Malta	0%	10%	10%
Netherlands	2%	14%	12%
Poland	7%	15%	8%
Portugal	21%	31%	11%
Romania	18%	24%	6%
Slovakia	7%	14%	7%
Slovenia	16%	25%	9%
Spain	9%	20%	11%
Sweden	40%	49%	9%
Un.Kingdom	1%	15%	14%

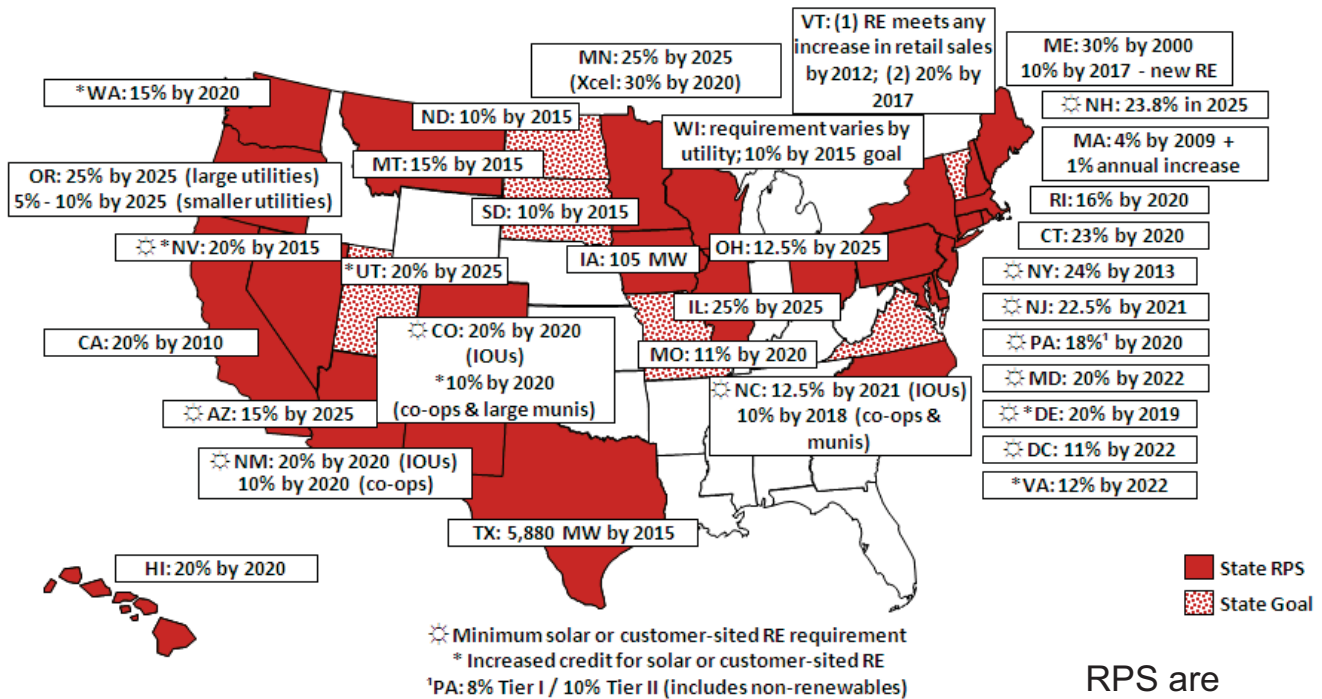
EU Policy

1. Target for the EU total is 20% renewable energy in its total energy use.
2. Every Member State has a target, (see table)
3. CO2 emission trading for large energy producers (grandfathering past emissions)
4. Policy formulation is country-specific (subsidiarity principle)

But

- **subsidies for fossils exceed ones for renewables (EEB, 2004)**

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Main (inter-) national instruments

Major consideration: balance profit and consumers surplus, price parity fossil and renewables, market conformity

- Emission trading large sources; quota's (certificates) for users in UK, Poland, Sweden, Romania, and Belgium
- Grants for R&D on renewable energy
- Tax incentives for investments in renewables (Finland)
- Feed-in tariffs (with procurement obligation) for the operators.
- Burden sharing: user charge for renewable electricity production

Variation in tariffs with respect to (Klein et al, 2008):

- Type of technology (country-specific band-width)
- Periodic revision (from yearly to maximum 5% change)
- Reference (average) costs for the tariff (stepped or flat)
- Location, scale and fuel use of the renewable plant(s)
- Technological progress (percent of the learning curve)
- Premium for low market prices (dimming fluctuation)
- Bonus for self-supporting (net metering small scale)
- Others: product integration, repowering, demand profile, local acceptance, grid integration, planning

Policy arrangements, examples

Financing instruments

- regional infrastructure, e.g. de-central grid network
- press on public enterprises, e.g. sludge processing
- differentiate local taxing system, e.g. house property
- regional development companies, e.g. low interest
- regional finance innovation, e.g. creative with regulations
- grants for social groups, e.g. dissemination know-how
- funds vocational schooling, e.g. upgrading work skills

Regulatory instruments

- strict criteria for procurement, e.g. in public utilities,
- services specifications, e.g. public transport, lease
- contests and awarding, e.g. sustainable entrepreneurs
- differentiate local fees, e.g. park fees, clean properties
- promotional activities, e.g. labels, quality scans
- public education and marketing, e.g. campaigns
- enforcement legislation, e.g. flexibility in licensing

Darker: more productive Ring: past
growth engine
("European banana")

Thank you for your patience