Good Practices for Regional Sustainable Energy Solutions

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STYRIAN ACADEMY for Sustainable Energies

Why renewable energy ?

Social demands

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

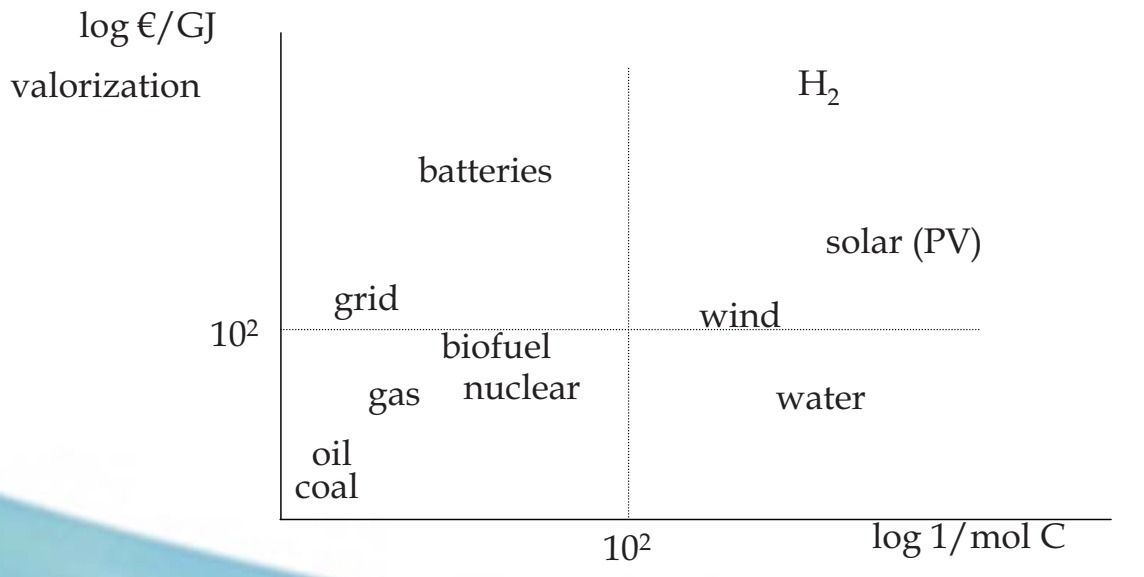
Technical issues

- 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.

Diversity of markets



Energy suppliers become more effective (decarbonisation)

Energy users are willing to pay a high price (valorisation)

Valorisation of Solar Power

Flexible ? Whenever and whatever









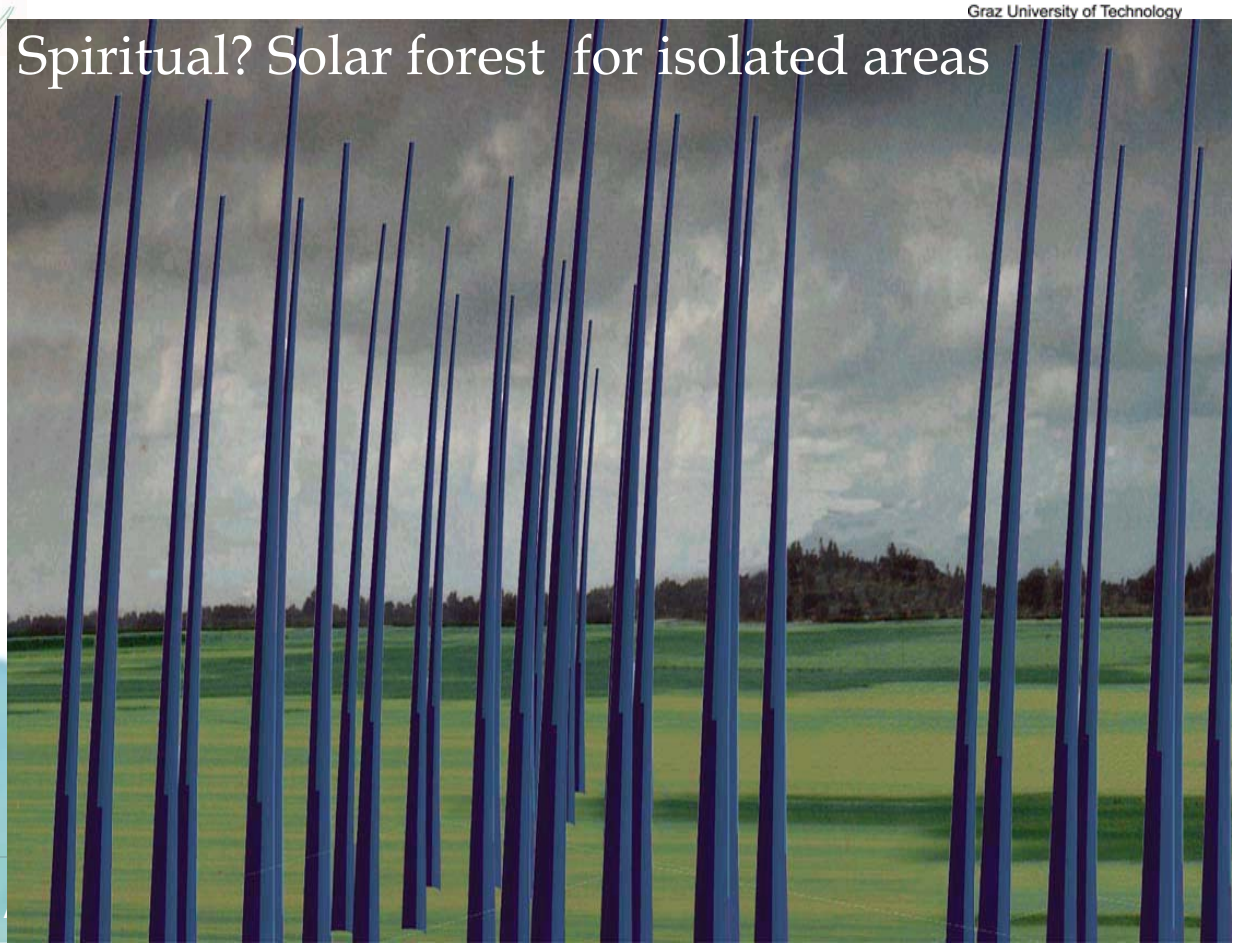
Valorisation of Solar Power

Free? Solar Power in winters for heating

Valorisation of Solar Power

Graz University of Technology

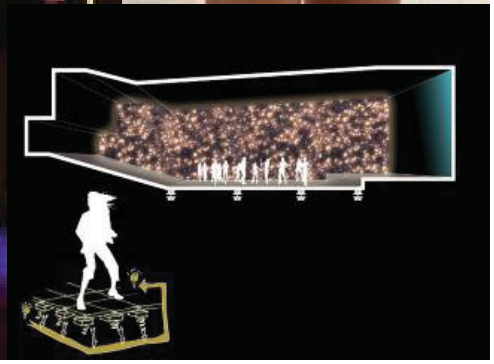
Spiritual? Solar forest for isolated areas



Valorisation of Solar Power

Graz University of Technology

Sexy? Sustainable Dance Floor, Sustain & Entertain



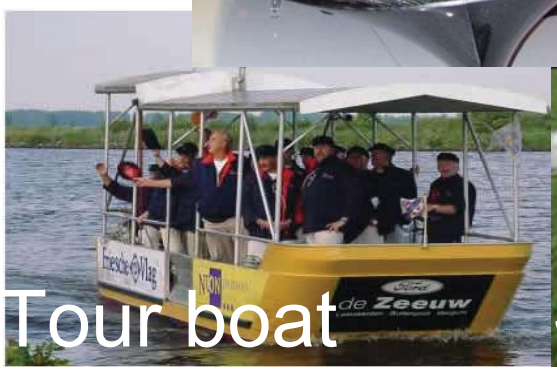
Valorisation of Solar Power

Sports, for example Frisian Solar Challenge

STYRIA

Emerging markets solar boats

DONG energy
Frisian Solar Challenge
World Cup for Solar Powered Boats



STYRIAN ACADEM

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

STYRIAN ACADEMY for Sustainable Energies

Renewables in electricity production

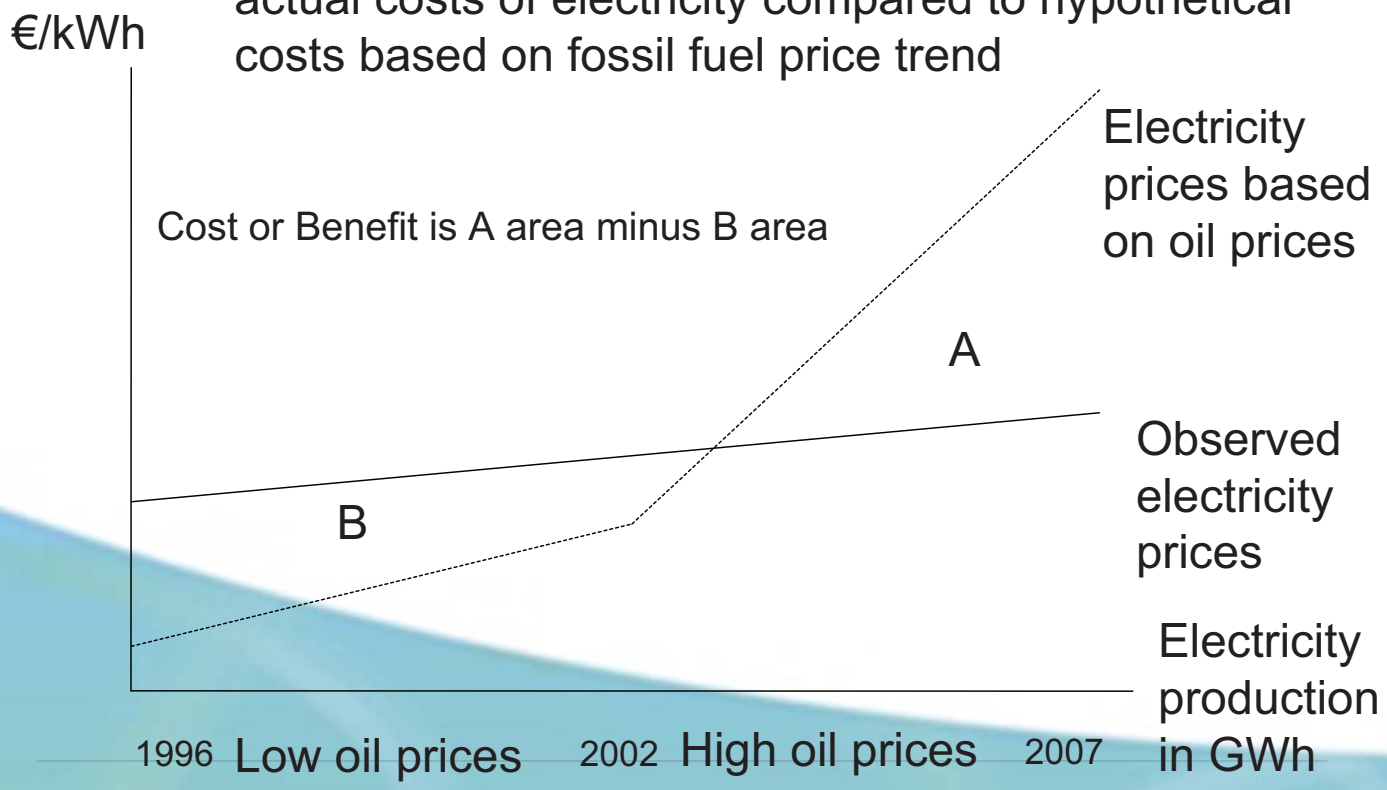
- Large scale hydro (renewable?) covers about 2/3 but it decreases, wind has the highest growth.
- EU 16% in 2007, but Austria (60%), Sweden (52%), Latvia (36%), Portugal (30%), Denmark (29%), Romania (27%), Finland (26%), Slovenia (22%), Spain (20%), Slovakia (17%)
- Average annual growth 2003-2007 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

Cost-Benefit in the EU

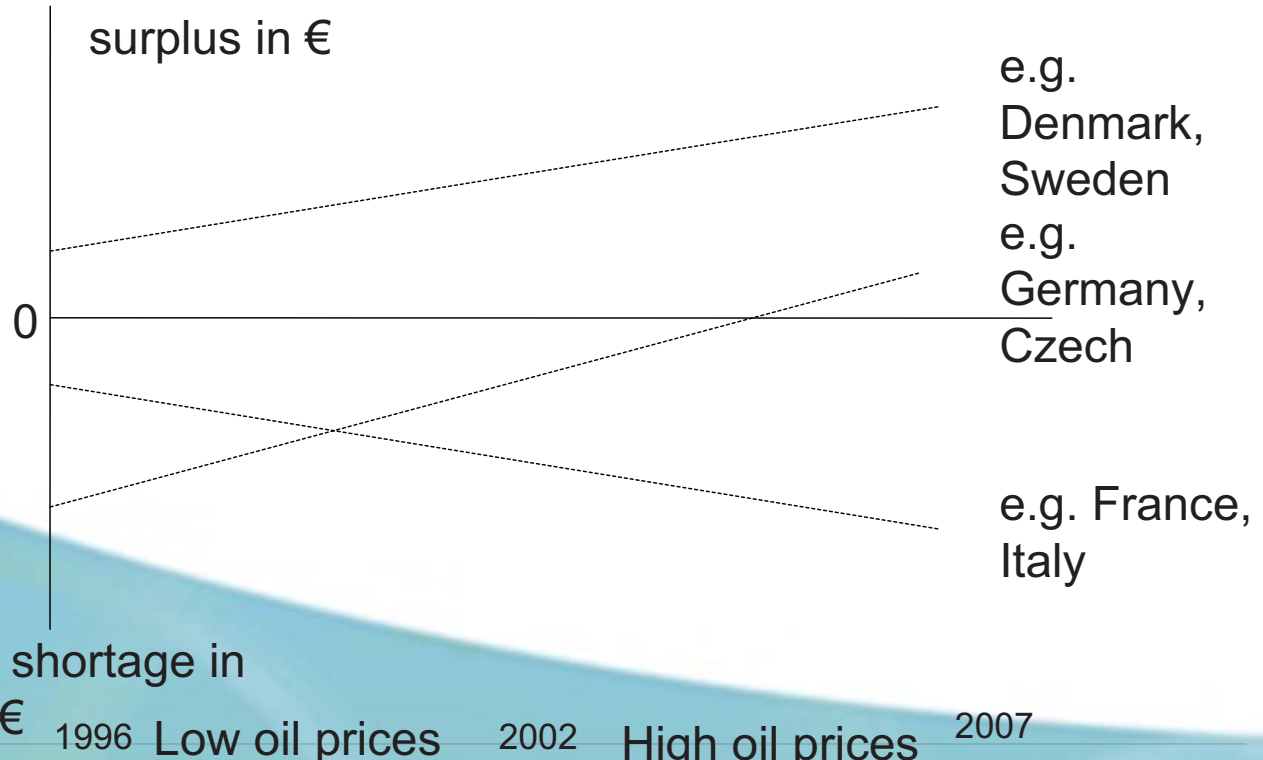
actual costs of electricity compared to hypothetical costs based on fossil fuel price trend



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

Renewables production – consumption



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.

Renewable Energy Regionalisation

Energy use converges

Energy intensity in the EU: consumption ton oil equivalent (t.o.e.) per € mln GNP			
EU countries		Energy intensity decrease; use in t.o.e./€ mln GNP (annual average 1996—2006)	
		<3%	>3%
Energy consumption 2006	>300	Czech, Greece	Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia
	<300	Belgium, Denmark, Germany, Spain, France, Italy, Cyprus, Luxemburg, Malta, Netherlands, Austria, Portugal, Slovenia, Finland, Sweden, United Kingdom	Ireland

Renewable energy production diverges

Changes of fossil fuel and renewable energy production in % annual average growth			
EU countries *no data on renewable energy		Renewable energy production (annual average 1996 - 2006)	
		<5%	>5%
Fossil fuel production	Increase	France, Austria	Greece, Spain, Italy, Slovakia
	No change or Decrease	Belgium, Bulgaria, Czech, Denmark, Germany, Estonia Cyprus, Latvia, Luxemburg, Malta* Lithuania, Poland, Portugal, Slovenia, Finland, Sweden	Ireland, Hungary, Netherlands, Romania, United Kingdom

Countries' renewable performance diverges

EU average annual growth and standard deviation of growth among countries						
All 27 EU countries are included. All data are percentages	Growth annual average			Standard deviation		
	1996-2006	1996-2002	2003-2006	1996-2006	1996-2002	2003-2006
Intensity (t.o.e. per € mln GNP)	-1.4	-1.6	-1.1	1.7	1.8	2.2
Fossil fuel primary production	-1.3	-0.4	-2.8	5.9	4.4	3.6
Renewable production total	4.2	2.3	6.8	20.6	20.2	21.4
Biomass & Waste	5.1	3.0	8.1	21.5	21.7	22.2
Hydro	-0.3	-0.3	-0.3	29.2	33.7	29.0
Geothermal	5.0	2.6	8.5	63.6	67.6	72.9
Solar	13.8	10.1	19.0	53.3	54.5	55.8
Wind	31.7	37.2	24.0	62.8	76.3	64.7

Regional performances in a country differ

Ratio region to country	Denmark	Germany	Netherl-ands	Sweden	United Kingdom
	Nordjylland	Schleswig Holstein	Fries land	Västra Göta	Aberdeen shire
million people	11%	2%	4%	31%	0.3%
€/capita	0.89	0.88	0.80	0.96	1.02
Energy use	0.98	1.42	0.78	0.44	1.52
Renewable use in grid	0.67	0.76	0.88	1.64	2.55
Renewable production	0.83	0.99	0.40	0.28	2.08
Biomass	0.65	0.41	0.19	0.38	1.70
Hydro	-	0.01	-	0.10	-
Geothermic	-	-	-	-	-
Solar	0.61	0.20	0.88	-	-
Wind	1.66	5.35	2.20	0.15	7.95

Periphery regions underperform, except for wind

Various regional innovative networks

Region	Goal	Initiator(s)	Driving force	Instrument	Others
Kaindorf, Austria	CO2 local products	A network of citizens	TU and small companies	Working groups	Focus on bio-fuel
Navarra, Spain	Regional economy	Green Peace party	Politics, public-private firms	Feed-in, low region tax	Wind and solar
Emden, Germany	Managers' awareness	Local/public energy and water works	Initially social interest, now politics	Feed-in and local fees	Wind and geothermal
Freiburg, Germany	Regional economy	Citizens' group and politics	Local politics, local/public energy works	Feed-in and regional fee	Solar, wind and biomass
Friesland Netherland	Regional economy	Citizens – innovators	Policymakers and innovators	Various per case	Housing and mobility

Economic opportunity, Friesland case

Present

- the Dutch average the EU use: 205 GJ/person
- Now 4% of all uses are from local renewables,
- Aims for 2020 are 20% saving, 20% renewable

Agreement Government – North Netherlands provinces

- Aim 2011: 50 PJ renewable, 5 mln ton less CO_2
- Case Friesland covers about 30% of the aim

≈ 100.000 zero energy houses

Possible actions

based on several workshops with about 70 firms and experts

Italic: only CO_2 ; ( ) investment

Users

Households
- *Isolation existing houses (447),*
- Heat-exchange pumps& storage (98),
- Sun boilers (56),
- *Micro co-generator (63),*
- Photovoltaic energy (157),
- *Light economy* (17),
- CO_2 low/neutral new houses (168)

SME's
- Wind on industry parks (70)
- Greenhouses (68)
- Others (11)

Mobility & producers

Transport * *total arbitrarily divided*
- *Fifty bio-fuel & gas stations (15),*
- Hybrid cars (81),
- *Natural gas for fossil fuel (244),* (*)
- SNG for fossil fuels (244), (*)
- CBG for fossil fuels (244), (*)
- Bio-diesel for diesel (49),
- *EU CO2 standard (98).*

Biowaste to bio-fuel production
- Incinerator: electricity& heat (150)
- Digester, Pyrolysis, Gasifiers (331)
- Others (5)

Costs and benefits

Summary	Fossil PJ		Less CO_2	Investment	Ann. costs
In € mln	Total	Renew.	mln ton	€ mln	( ) is revenue (*)
Housing	8,1	4,2	0,48	1.016	110 (-10)
Mobility	16,3	9,1	0,94	974	136 (**110**)
Industry	3,8	3,8	0,22	70	28 (**20**)
Greenh.	0,2	0,2	0,02	68	10 (-8)
Subtotal	28,4	17,3	1,66	2128	275 (**112**)
Bio-waste				481	46 (-3)
Total				2609	321 (**108**)
Import	-9,0	-9,0	-0,50*	Groningen projects	
*** net revenues are bold, but assumed 0% interest!**					

benefits: 27,000 jobs in 5 years, 0.8 billion for the local business

Challenge: how to achieve low interest on capital?

Subsidies, or low risk

Summary	15% interest & subsidies		5% interest & no subsidies	
In € mln	Capital	Revenue	Capital	Revenue
Housing	179	-117	102	-41
Mobility	194	13	126	81
Industry	14	-3	9	14
Greenhouse	14	-15	9	-10
Subtotal	400	-122	246	44
Bio-waste	77	-56	39	-18
Total	477	-178	285	26

Low risk is cheaper than subsidies

Option 1: public regional and community energy services

Option 2: policy arrangements for “first movers”

Policy implementation

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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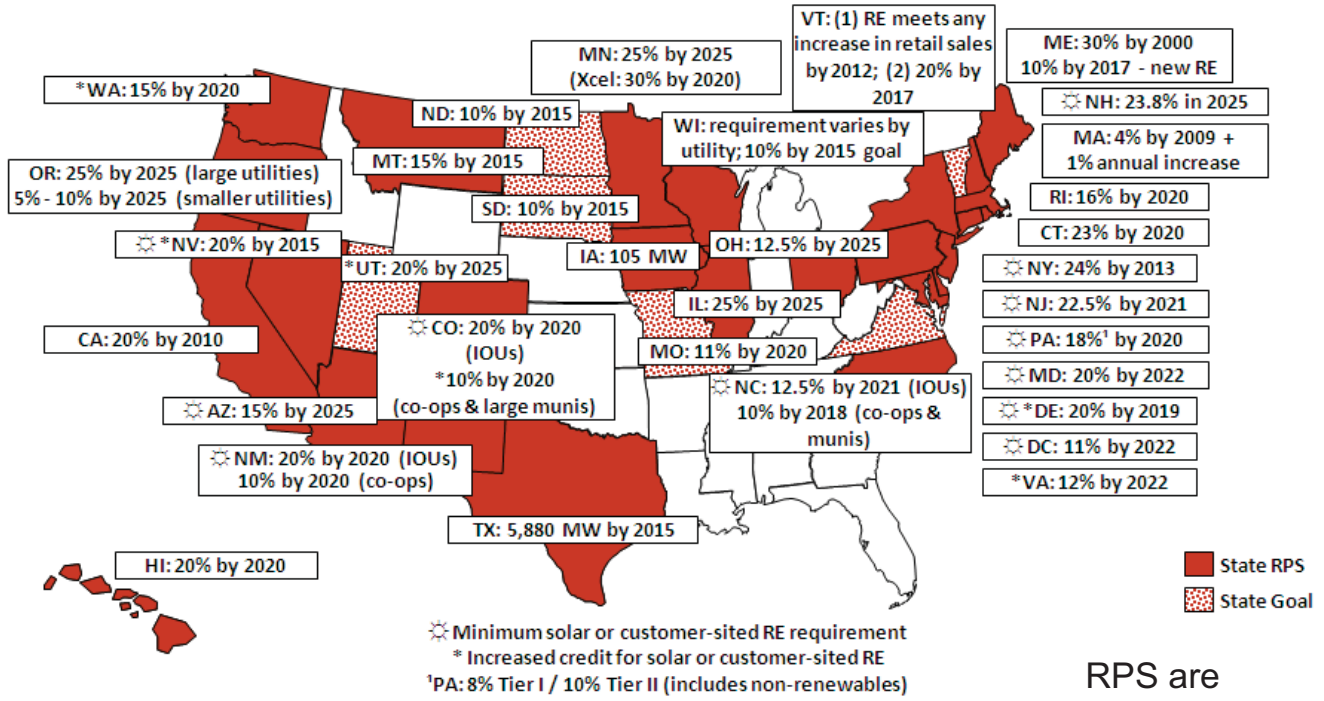
U.S. renewable targets

Rickerson et al. 2008



RPS are mandatory

Main (inter-) national instruments

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

- Emission trading 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

Feed-in tariffs

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

Regional regulations examples

Financing instruments
- infrastructure, e.g. de-central grid network
- public enterprises, e.g. sludge processing
- differentiated taxes, e.g. house property
- development coporation, e.g. low interest
- financing innovation, e.g. new regulations
- grants groups, e.g. dissemination know-how
- schooling, e.g. upgrading work skills

Regulatory instruments
- procurement criteria, e.g. in public utilities,
- services, e.g. public transport, lease
- awarded contests, e.g. sustainable entrepreneurs
- differentiate fees, e.g. park fees, clean properties
- promotional activities, e.g. labels, quality scans
- public marketing, e.g. campaigns
- enforced legislation, e.g. flexibility in licensing

Some fruitful business options

- customize energy service (downscaling technologies).
- integration energy, water and waste technologies
- industrial area-oriented energy efficiency (exchange)
- monitoring progress decentralized implementation
- capacity building renewable energy practices
- innovative challenges in renewable energy (example DONG – Frisian Solar Challenge)

Conclusions

- Benefits of renewable energy can be pinpointed
- Renewable energy is available and progresses
- Implementation of renewable energy regionalizes
- Forerunners benefit a lot during oil price upswing
- Instruments for the implementation are available
  - national instruments
  - regional instruments
- A lot depends on entrepreneurial and political will

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

Thank you for your patience