Drivers and Dynamics of the Growth of Renewable and Distributed Energy in the Electricity Market

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Core Message

- Don't underestimate
 - The need for RES and DER
 - The current and future speed of growth
 - The potential
 - The impact and challenges ahead
- We need to do this together
 - Science
 - Industry
 - Government
 - Including regulators
 - NGOs





Drivers of EU Energy Policy

K Ecology (Kyoto)
 L Economy (Lisbon)
 M Supply Security (Moscow)





"Kyoto"

60 World Population: 1950-2050 50 East Asia 9 Billion 8 Billion Eastern Europe and 40 Central Asia 7 Billion - Latin America 6 Billion 5 Billion 30 Middle East and North Africa 4 Billion South Asia 3 Billion 20 Sub-Saharan Africa 🗕 World 10 2010 020 2000 2030 2040 0200 Year 0 `*_*% ्रके ,के ,के ,के ,के ,के ,के ,क 080 Source: II.S. Censos Barnau, International Data Base, July 2007 version. °°,



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9

Population (billions) to 2 2 2

0

850

- be guided by IPCC science (which calls for emission reductions by industrialized countries with a range of 25-40% below 1990 levels by 2020)



Percentage living on less than \$1 per day



"Lisbon"







FROM THOUGHT TO FINISH.TM

HIGH STAKES IN THE EUROPEAN UTILITIES POKER GAME



"Moscow"







EU Policy	National policy measures
Biofuels Directive	Tax exemptions, obligations to mix
RES-E Directive	Feed-in tariffs, quota systems, cost incentives
Large Combustion Plants Directives	Standards
CHP Directive	Possibility for financial incentives, obligations
Buildings Directive	Standards, other measures
ACEA agreements on cars	Voluntary agreements
Series of Labelling Directives	Market transparency
IPPC Directive	Best Available Technologies
Directives on energy efficiency for boil- ers, refrigerators and ballasts for fluo- rescent lighting	Standards
Directive to limit CO ₂ emissions by improving energy efficiency (SAVE)	Drawing up and implementation of Member-State programmes
Energy Star Programme	Voluntary labelling programmes
National Emission Ceilings Directive	Emission limitation
ETS Directive	Emission limitation
Energy Taxation Directive	Harmonization of minimum excise tax rates on energy products

EU directives

- RE targets

 12% in 2010
 - 20% in 2020
- CO₂ targets
 - Minus 6% in 2010
 - Minus 20% in 2020
- Policies MS
 - Feed in tariffs
 - Trade instruments
 - Quota green energy
 - Quota CO₂ in Emission Trading System



Liberalisation process

- First round of Directives 1996-2000
 - Large players must be able to choose
 - Third parties must be allowed on the grid
- Second round/package 2001-2003
 - All consumers must be able to choose
 - Grid activities must be managed separately from production and retail activities.
 - Regulator obligatory
- Third package (September 2007) (proposal)
 - International cooperation needed for further technical and market integration
 - Between transmission system operators
 - Between regulators: new agency created
 - Grid activities to be unbundled form other activities



Support policies for renewable energy in Europe



SOURCE: "Monitoring and evaluation of policy instruments to support renewable electricity in EU member states"; Final report; Fraunhofer, ISI, EEG, 2006.

2 september 2008

From Drivers and Policies to Market Dynamics





Dynamics: wind

FIG 2.1: Global cumulative wind power capacity 1990-2007 (in MW)





Wind is a major market

With a 500% increase in wind turbine production since 2004, GE expects its wind business revenues to exceed **\$4 billion** this year (2007).

GE Energy is one of the world's leading suppliers of power generation and energy delivery technologies, with 2006 revenue of **\$19 billion**.





Wind energy potential



- Class 3 and more could provide 4 times current world energy use.
- Theoretical potential, but no offshore included







FIG 3.3: Advanced Scenarios for 2010, 2020 and 2030 (in GW)

Source EWEA



Future wind electricity share

	LOW			REFERENCE			HIGH		
	Onshore	Offshore	Total	Onshore	Offshore	Total	Onshore	Offshore	Total
2007 share EFF				3.5%	0.1%	3.7%			
2007 share BAU				3.5%	0.1%	3.7%			
2010 share EFF	4.9%	0.3%	5.2%	4.9%	0.4%	5.2%	4.9%	0.4%	5.3%
2010 share BAU	4.6%	0.3%	4.9%	4.6%	0.4%	5.0%	4.6%	0.4%	5.0%
2020 share EFF	8.5%	2.3%	10.8%	10.3%	4.09	14.3%	12.1%	4.6%	16.6%
2020 share BAU	6.9%	1.9%	8.8%	8.4%	3.29	11.6%	9.8%	3.7%	13.5%
2030 share EFF	12.5%	4.7%	17.2%	14.1%	14.1%	28.2%	15.6%	17.6%	33.2%
2030 share BAU	9.2%	3.5%	12.7%	10.4%	10.4%	20.8%	11.5%	13.0%	24.5%

Source EWEA





ÉVOLUTION DE LA PRODUCTION MONDIALE DE CELLULES PHOTOVOLTAÏQUES (EN MWC) Evolution of Worldwide Photovoltaic Cell Production (in MWP)



COMPARAISON DE LA TENDANCE ACTUELLE AVEC LES OBJECTIFS DU LIVRE BLANC (EN MWC) Comparison of the present trend with the white paper objectives (in MWP)



Solar Energy Potential



 Each of the orange areas could provide total primary energy use EU by electricity from PV (8% efficiency assumed)



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Figure 1: Historical development of cumulative installed global and EU PV capacity



And in addition to this there is...

- Micro-CHP
 - Seen as the follow up of the high efficient condensation boiler
 - Will start with a Sterling Enging
 - About 1 kWe
 - Possibly followed by fuel cells
 - About 5 kWe





Expected market of microCHP in NL

Year	Annually installed	Cumulative _
2007	1000	1000
2008	5000	6000
2009	12.000	18.000
2010	20.000	38.000
2011	45.000	83.000
2012	75.000	158.000
2013	90.000	248.000
2014	110.000	358.000
2015	140.000	498.000
2016	170.000	668.000
2017	200.000	868.000
2018	230.000	109.8000
2019	260.000	1.358.000
2020	300.000	1.658.000

at least 1600 MW, in the Netherlands and 1000 MW adding each year
 For Europe this means about 20 GW in 2020 and adding about 15 GW each year
 Could be another 5%-10% electricity share in 2030

Source Smart Power Foundation





Conclusion: supply following RE and distributed (uncontrollable?) CHP might produce up to about 50% of EU electricity in 2030

Before that time, at hotspots, larger penetration rates can be expected.





Are we in a boiling frog situation?

