

R.E.S. INTEGRATION

RURAL SUSTAINABLE DEVELOPMENT THROUGH INTEGRATION OF RENEWABLE ENERGY TECHNOLOGIES IN POOR EUROPEAN REGIONS

Specific Targeted Research Project (FP6-509204)

WORK PACKAGE 2: Identify schemes for IRES implementation

Project Acronym	R.E.S. INTEGRATION	
Project Full Title	Rural sustainable development through integration of renewable energy technologies in poor European regions	
Contract number	FP6-509204	
Type of action	Specific Targeted Research Project	
Project duration	1 st November 2004 – 31 st October 2007	
Project coordination	AUA – Agriculture University Of Athens, Greece	
Contact persons Italy	Ing. Stefano Capaccioli Piazza Savonarola,10 50132 Florence, ITALY T. +39-055-5002174 F. +39-055-573425 stefano.capaccioli@etaflorence.it www.etaflorence.it	Ing. Antonio Berni Piazza Savonarola,10 50132 Florence, ITALY T. +39-055-5002174 F. +39-055-573425 antonio.berni@etaflorence.it www.etaflorence.it
Document's title	Deliverable n. 3: RES inventory CML – Review of national situation	
Date	12 October 2005	
Notes	National overview of the technologies to be adopted, as by D5-Table 1	

Project supported by the European Commission
within the 6th framework Programme



Specific measures in support of
International Co-operation - Western Balkan Countries (INCO-WBC)

<http://www.cordis.lu/fp6/inco.htm>

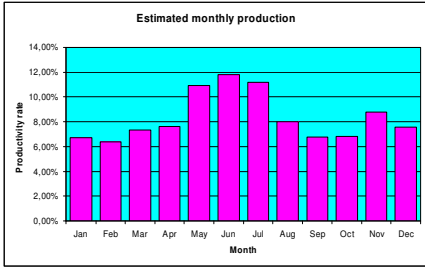


BIOMASS ENERGY		NATIONAL SITUATION
General description of the technology		<ul style="list-style-type: none"> • Electricity production: 330 MW in 31 plants • The most widespread technology is the condensing Rankine's cycle (25% efficiency) • Thermal production: 200 MW, mainly in district heating • Cogeneration systems
General information of the resource to be exploited		<p>Even with a growing forestal component (about 22,7% of country's surface), and with lots of agricultural areas not operating due to community rules regarding farm surplus, a detailed report on real entity and amount of biomass sources is not available</p> <p>Rough estimates point out to 23 Mtoe (100 TWh) as yearly biomass potential</p>
Possible application and routes	Estimated power to be installed	See below
	Estimated energy production	<p>The target stated by the national white paper of renewable energies is:</p> <ul style="list-style-type: none"> • 3,88 Mtoe (16,83 TWh) in electricity before 2010 • 6,12 Mtoe (26,56 TWh) in heat before 2010
	Estimated energy distribution all year round	Not Available
General data on costs		<p>Quite elevated investment costs (2.200 €/kW for electric generation; 930 €/kW for cogeneration systems)</p> <p>As a consequence, unit costs for energy production are higher than systems using fossil fuels</p>

Energy objectives	Whole production of renewable energy shall reach 22% (now 16%) before 2010
Environmental & sustainability issues	<p>Pros:</p> <ul style="list-style-type: none"> • Rational management of forestal and agricultural resources • Preservation of hill and mountains regions from hydrogeologic disruption <p>Cons:</p> <ul style="list-style-type: none"> • Difficult balance in biomass demand/offer • Difficult coordination of different subjects involved in biomass chain • High transport costs
Socio-economic benefits	<p>The investments in biomass systems are rewarded both in the “green” and in the “white” certificate market</p> <p>Involvement of agricultural subjects in energy market</p> <p>Diversification and development of income resources in agricultural sector</p> <p>Realization of a new field of business in rural and depressed areas, generating workforce demand</p>

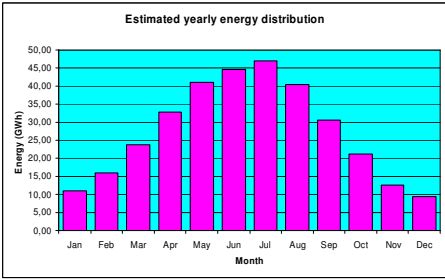


HYDROELECTRIC		NATIONAL SITUATION
General description of the technology		<ul style="list-style-type: none"> • Power plants are equally distributed in: flowing water / reservoir / basin technology • 80% of yearly production (49.900 GWh) is covered by > 10 MW plants; less than 20% by 1-10 MW plants; the rest by <1 MW plants
General information of the resource to be exploited		<p>21.000 MW of hydroelectric generating stations are globally installed at the end of 2004, mainly in the north of the peninsula.</p> <p>Electricity production through waterpower has covered 48.9% of the 2004 green certificates market.</p> <p>The most significant hydric resources result to be nearly fully exploited, while recent reports point out to interesting scenarios of implementing minor hydric power plants, which could teoretically satisfy up to 60% of global energy needs.</p>
Possible application and routes	Estimated power to be installed	The calculated maximum installable power amounts to 27 GW. The target stated by the national white paper of renewable energies was 14.000 MW, to be installed by 2010. This target has now been achieved.
	Estimated energy production	The calculated maximum installable power amounts to 65 TWh .The target stated by the national white paper of renewable energies is 34.000 GWh, to be installed by 2010. This target has now been achieved.

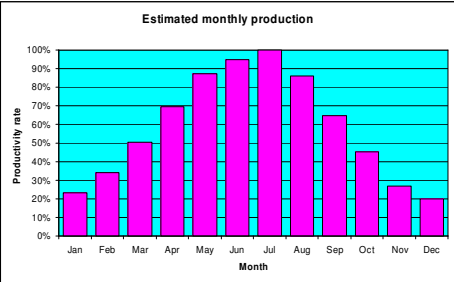
	<p>Estimated energy distribution all year round</p>	 <p>(Table based on long-term projection of 2004 productivity data)</p>
<p>General data on costs</p>	<p>Installation costs: 3.000-3.500 €/kW (depending on site's morphological characteristics), with a payback time of nearly 8-9 year. Life expectancy of hydroelectric systems is about 30 years.</p>	
<p>Energy objectives</p>	<p>Whole production of renewable energy shall reach 22% (now 16%) before 2010</p>	
<p>Environmental & sustainability issues</p>	<p>Major plants involve some negative aspects, as acoustic pollution, aesthetics, possible impact on ecosystems; On the contrary, small systems can be more easily implemented with a reduced environmental impact.</p>	
<p>Socio-economic benefits</p>	<p>The investments in water generation are rewarded in the "green certificate" market. Small hydro systems can satisfy energy needs of local communities and isolated facilities in rural areas.</p>	



PHOTOVOLTAICS		NATIONAL SITUATION
General description of the technology		<ul style="list-style-type: none"> • Multicristalline silicon pv modules – 12% efficiency - largely widespread • Monocristalline silicon pv modules – 15% efficiency - less than 10% of whole installations • Amorphous silicon pv modules – 5% efficiency – not significantly adopted
General information of the resource to be exploited		<p>25 MW of pv systems are globally installed at the end of 2003</p> <p>The country benefits from relevant solar irradiation data, increasing from 3,5 kWh/sqm to 5,0 kWh/sqm north to south (daily irradiation on horizontal plane). Thus specific productivity of pv systems varies from 1000 to 1350 kWh/kWp installed</p>
Possible application and routes	Estimated power to be installed	The calculated maximum installable power amounts to 115 GWh. The targeted total power to be installed before 2015 amounts to 300 MW, as stated by the recent feed-in tariff act (28 July 2005)
	Estimated energy production	The calculated maximum energy amounts to 126 TWh. The targeted energy production to be reached before 2015 amounts to 330 GWh/y, as stated by the recent feed-in tariff act (28 July 2005)

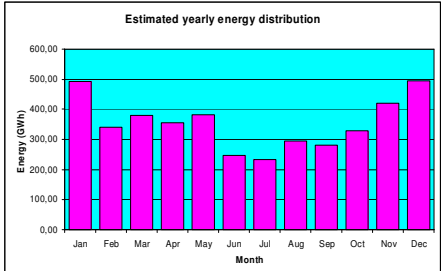
	<p>Estimated energy distribution all year round</p>	<div data-bbox="807 232 1254 510" data-label="Figure">  <table border="1"> <caption>Estimated yearly energy distribution (GWh)</caption> <thead> <tr> <th>Month</th> <th>Energy (GWh)</th> </tr> </thead> <tbody> <tr><td>Jan</td><td>12.00</td></tr> <tr><td>Feb</td><td>15.00</td></tr> <tr><td>Mar</td><td>22.00</td></tr> <tr><td>Apr</td><td>32.00</td></tr> <tr><td>May</td><td>40.00</td></tr> <tr><td>Jun</td><td>45.00</td></tr> <tr><td>Jul</td><td>48.00</td></tr> <tr><td>Aug</td><td>40.00</td></tr> <tr><td>Sep</td><td>30.00</td></tr> <tr><td>Oct</td><td>20.00</td></tr> <tr><td>Nov</td><td>12.00</td></tr> <tr><td>Dec</td><td>10.00</td></tr> </tbody> </table> </div> <p>(Table based on monthly irradiation data in centre Italy)</p>	Month	Energy (GWh)	Jan	12.00	Feb	15.00	Mar	22.00	Apr	32.00	May	40.00	Jun	45.00	Jul	48.00	Aug	40.00	Sep	30.00	Oct	20.00	Nov	12.00	Dec	10.00
Month	Energy (GWh)																											
Jan	12.00																											
Feb	15.00																											
Mar	22.00																											
Apr	32.00																											
May	40.00																											
Jun	45.00																											
Jul	48.00																											
Aug	40.00																											
Sep	30.00																											
Oct	20.00																											
Nov	12.00																											
Dec	10.00																											
<p>General data on costs</p>	<p>6.000 – 7.000 €/kW for standard installations (depending on the size of the system)</p>																											
<p>Energy objectives</p>	<p>Whole production of renewable energy shall reach 22% (now 16%) before 2010</p>																											
<p>Environmental & sustainability issues</p>	<ul style="list-style-type: none"> • Largely accepted implementation in urban and also rural areas • Reduced maintenance costs <p>Cons:</p> <ul style="list-style-type: none"> • High energy amount required to produce pv modules • High material costs 																											
<p>Socio-economic benefits</p>	<p>With the feed-in tariff coming into force, relevant parameters of the investments are expected to significant improvement (7-8 years payback time; 7-8% internal rate). Development of a high technological sector, with occupational and economic consequences</p>																											



SOLAR THERMAL		NATIONAL SITUATION
General description of the technology		<ul style="list-style-type: none"> • Glass shielded plate collectors - largely widespread • Vacuum collectors – less adopted • 450-530 kWh/sqm (30-35% efficiency)
General information of the resource to be exploited		<p>The country benefits from relevant solar irradiation data, increasing from 3,5 kWh/sqm to 5,0 kWh/sqm north to south (daily irradiation on horizontal plane). Thus solar thermal systems can satisfy up to 80% needs of hot water and 30% of heating</p> <p>At the moment 480.000 sqm of solar thermal collectors are installed</p>
Possible application and routes	Estimated power to be installed	The targeted total surface of solar thermal collectors to be installed before 2010 amounts to 3 million sqm
	Estimated energy production	The targeted average energy production to be reached before 2010 amounts to 1,8 GWh/y
	Estimated energy distribution all year round	 <p>(Table based on monthly irradiation data in centre Italy)</p>
General data on costs		700-900 €/sqm (turn-key installation)
Energy objectives		Whole production of renewable energy shall reach 22%

	(now 16%) before 2010
Environmental & sustainability issues	<ul style="list-style-type: none"> • Largely accepted implementation in urban and also rural areas • Reduced maintenance costs
Socio-economic benefits	<p>The investments in solar thermal systems are rewarded in the “white certificate” energy efficiency market</p> <p>Due to current prices of conventional fuels, interesting values of payback time can be reached (4-5 years compared with electric heating; 8-9 years compared with gas)</p>



WIND ENERGY		NATIONAL SITUATION																									
General description of the technology		<ul style="list-style-type: none"> • Average power of wind generators installed: 600 kW • Three-blade rotor wind turbine represent 80% of the total • The general trend is oriented to install more powerful generators (up to 2 MW each) 																									
General information of the resource to be exploited		<p>1300 MW of wind farms are globally installed at the end of 2004</p> <p>The wind intensity is mitigated by the mediterranean sea, and by different geographical characteristics of various regions</p> <p>Acceptable values of wind speed are exploitable in some mountains and coastal areas, as well as in almost all the islands</p>																									
Possible application and routes	Estimated power to be installed	The calculated maximum installable power amounts to 15 GW. The target stated by the national white paper of renewable energies is 2500-3000 MW, to be installed by 2010																									
	Estimated energy production	The calculated maximum energy amounts to 24 TWh. The target stated by the national white paper of renewable energies is 4000-4800 MWh, to be installed by 2010																									
	Estimated energy distribution all year round	 <table border="1"> <caption>Estimated yearly energy distribution (GWh)</caption> <thead> <tr> <th>Month</th> <th>Energy (GWh)</th> </tr> </thead> <tbody> <tr><td>Jan</td><td>500.00</td></tr> <tr><td>Feb</td><td>350.00</td></tr> <tr><td>Mar</td><td>380.00</td></tr> <tr><td>Apr</td><td>360.00</td></tr> <tr><td>May</td><td>390.00</td></tr> <tr><td>Jun</td><td>250.00</td></tr> <tr><td>Jul</td><td>230.00</td></tr> <tr><td>Aug</td><td>300.00</td></tr> <tr><td>Sep</td><td>280.00</td></tr> <tr><td>Oct</td><td>330.00</td></tr> <tr><td>Nov</td><td>420.00</td></tr> <tr><td>Dec</td><td>500.00</td></tr> </tbody> </table>	Month	Energy (GWh)	Jan	500.00	Feb	350.00	Mar	380.00	Apr	360.00	May	390.00	Jun	250.00	Jul	230.00	Aug	300.00	Sep	280.00	Oct	330.00	Nov	420.00	Dec
Month	Energy (GWh)																										
Jan	500.00																										
Feb	350.00																										
Mar	380.00																										
Apr	360.00																										
May	390.00																										
Jun	250.00																										
Jul	230.00																										
Aug	300.00																										
Sep	280.00																										
Oct	330.00																										
Nov	420.00																										
Dec	500.00																										

	(Table based on long-term projection of 2004 productivity data)
General data on costs	<p>Installation costs: 900-1300 €/kW (depending on site's morphological characteristics)</p> <p>Production costs: 0,045-0,075 €/kWh (with a targeted reduction to 0,03 €/kWh)</p>
Energy objectives	Whole production of renewable energy shall reach 22% (now 16%) before 2010
Environmental & sustainability issues	Even if highly economically and environmentally sustainable, implementation of wind energy on a large scale suffers faunistic and landscape-preservation complaints, who have stopped a widespread implementation
Socio-economic benefits	<p>The investments in wind generation are rewarded in the "green certificate" market</p> <p>Wind farms can satisfy energy needs of local communities, involving a direct participation of local workforce and stakeholders</p>