METREX
The **network** of
European Metropolitan Regions and Areas

Dangerous climate change and urban decarbonisation

A metropolitan response

Technical Appendices 1-18

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** The socio-economic data used readily available from the Eurostat web site. The web site of the UN Economic Commission for Europe (UNECE) provided data on employment sectors. The data is generally for 2012, with some information for 2011 or 2010 where the differences are not material to the margins in the calculations. Europe's Energy Portal provided energy data.*

Technical Appendices 1-18

1 Population and households 2012-2030

Population and household change

There is expected to be only a 4% increase in Europe's population and households between 2012 and 2030. Although the population is aging there has been no great change in household size over the last 5 years. This may be due to the present financial constraints on household formation.

However, this stable situation at the European level is not reflected in some nation states. In particular, Germany is facing a 5% decline in population and households and the UK a 12% increase. More recent EU member states in Eastern Europe are also facing declines in their populations and households with the most significant being in Bulgaria with 10% and in Romania with 5%.

In the past some countries have experienced population decline but household growth as households aged and became smaller, the effects of single parent families was felt and younger people left home.

Implications for the dwelling stock

It has been assumed that new building to meet increased populations and households will be to the standards required in the EU Buildings and Energy Directive and that they will be energy efficient.

However, there will clearly be an issue of expenditure priorities in those countries facing decline, with consequences for the dwelling stock and the prospects for retro-fitting to achieve energy saving and renewable energy generation.

This is why the data for these countries is highlighted in the tables.

1 METREX for Europe

Population and households 2012-2030

Eurostat	Population		Change	Household size*	Households		Change
	2012	**2030**	**2012-2030**	2011& 2030	**2012**	**2030**	**2012-2030**
EU (27 countries)	503,663,601			2.4	209,859,834		
1 Austria	8,443,018	8,849,533	**406,515**	2.3	3,670,877	3,847,623	**176,746**
2 Belgium	11,094,850	12,204,065	**1,109,215**	2.3	4,823,848	5,306,115	**482,267**
3 Bulgaria	7,327,224	6,611,320	- 715,904	2.9	2,526,629	2,279,766	- 246,863
4 Cyprus	862,011	973,354	**111,343**	2.8	307,861	347,626	**39,765**
5 Czech Republic	10,505,445	10,839,979	**334,534**	2.5	4,202,178	4,335,992	**133,814**
6 Denmark	5,580,516	5,892,997	**312,481**	2	2,790,258	2,946,499	**156,241**
7 Estonia	1,339,662	1,279,865	- 59,797	2.3	582,462	556,463	- 25,999
8 Finland	5,401,267	5,704,485	**303,218**	2.1	2,572,032	2,716,421	**144,390**
9 France	65,327,724	70,302,983	**4,975,259**	2.2	29,694,420	31,955,901	**2,261,481**
10 Germany	81,843,743	77,871,675	- 3,972,068	2	40,921,872	38,935,838	- 1,986,034
11 Greece	11,290,067	11,577,875	**287,808**	2.6	4,342,333	4,453,029	**110,695**
12 Hungary	9,957,731	9,704,415	- 253,316	2.6	3,829,897	3,732,467	- 97,429
13 Ireland	4,582,769	5,276,163	**693,394**	2.7	1,697,322	1,954,134	**256,813**
14 Italy	60,820,696	64,491,289	**3,670,593**	2.4	25,341,957	26,871,370	**1,529,414**
15 Latvia	2,041,763	2,021,890	- 19,873	2.5	816,705	808,756	- 7,949
16 Lithuania	3,007,758	3,043,919	**36,161**	2.4	1,253,233	1,268,300	**15,067**
17 Luxembourg	524,853	625,941	**101,088**	2.5	209,941	250,376	**40,435**
18 Malta	417,520	416,886	- 634	2.9	143,972	143,754	- 219
19 Netherlands	16,730,348	17,577,605	**847,257**	2.2	7,604,704	7,989,820	**385,117**
20 Poland	38,538,447	37,564,978	- 973,469	2.8	13,763,731	13,416,064	- 347,668
21 Portugal	10,541,840	10,779,647	**237,807**	2.6	4,054,554	4,146,018	**91,464**
22 Romania	21,355,849	20,250,626	- 1,105,223	2.9	7,364,086	6,982,974	- 381,111
23 Slovakia	5,404,322	5,579,504	**175,182**	2.8	1,930,115	1,992,680	**62,565**
24 Slovenia	2,055,496	2,154,609	**99,113**	2.6	790,575	828,696	**38,120**
25 Spain	46,196,276	49,961,157	**3,764,881**	2.7	17,109,732	18,504,132	**1,394,400**
26 Sweden	9,482,855	10,577,959	**1,095,104**	2.1	4,515,645	5,037,123	**521,478**
27 United Kingdom	62,989,551	70,207,694	**7,218,143**	2.3	27,386,761	30,525,084	**3,138,323**
Calculation		**522,342,413**	**18,678,812**			**222,133,023**	**7,885,323**

** No great change over the last 5 years in the EU*

2 Dwellings by type 2012-2030

Flats detached and semi-detached dwellings

Europe is predominantly a continent of flat dwellers, with 42%, in comparison with those in detached houses, at 34%, and semi-detached houses, at 23%. However, there are substantial variations by nation state, ranging from hardly any flats in Ireland, and 59% semi-detached houses, to 65% flats in Spain and far fewer houses.

Retro fitting funding

The make up of the dwelling stock will have implications for retro-fitting programmes and the balance between,

- Private funding (houses)
- Cooperative funding (flats)
- Public and private sector funding (houses and flats)

Public sector funding could include loans and grants and private sector funding could include energy companies.

2 METREX for Europe Dwellings by type 2012-2030

Eurostat	Dwellings* Flats			Change	Dwellings* Detached Houses			Change	Dwellings* Semi detached Houses			Change	Dwellings* Other			Change
	2012%	2012	2030	2012-2030	2012%	2012	2030	2012-2030	2012%	2012	2030	2012-2030	2012%	2012	2030	2012-2030
EU (27 countries)	**41.8**	**87,721,411**			**34.4**	**72,191,783**			**23**	**48,267,762**			**0.8**	**1,678,879**		
1 Austria	42.3	1,552,781	1,627,545	**74,763**	42.9	1,574,806	1,650,630	**75,824**	13.8	506,581	530,972	**24,391**	1.0	36,709	38,476	**1,767**
2 Belgium	20.3	979,241	1,077,141	**97,900**	37.4	1,804,119	1,984,487	**180,368**	41.7	2,011,545	2,212,650	**201,106**	0.5	24,119	26,531	**2,411**
3 Bulgaria	42.7	1,078,871	973,460	- 105,411	47.1	1,190,042	1,073,770	- 116,273	9.7	245,083	221,137	- 23,946	0.5	12,633	11,399	- 1,234
4 Cyprus	21.8	67,114	75,783	**8,669**	47.9	147,465	166,513	**19,048**	29.3	90,203	101,855	**11,651**	1.0	3,079	3,476	**398**
5 Czech Republic	52.8	2,218,750	2,289,404	**70,654**	36.2	1,521,188	1,569,629	**48,441**	10.5	441,229	455,279	**14,050**	0.4	16,809	17,344	**535**
6 Denmark	28.7	800,804	845,645	**44,841**	59.2	1,651,833	1,744,327	**92,494**	12.1	337,621	356,526	**18,905**	0.0			
7 Estonia	64.5	375,688	358,919	- 16,769	29.8	173,574	165,826	- 7,748	5.3	30,870	29,493	- 1,378	0.5	2,912	2,782	- 130
8 Finland	32.8	843,626	890,986	**47,360**	47.6	1,224,287	1,293,017	**68,729**	18.9	486,114	513,404	**27,290**	0.7	18,004	19,015	**1,011**
9 France	33.9	10,066,408	10,833,051	**766,642**	43.5	12,917,073	13,900,817	**983,744**	22.4	6,651,550	7,158,122	**506,572**	0.2	59,389	63,912	**4,523**
10 Germany	53.3	21,811,358	20,752,801	- 1,058,556	29.0	11,867,343	11,291,393	- 575,950	16.0	6,547,499	6,229,734	- 317,765	1.7	695,672	661,909	- 33,763
11 Greece	58.2	2,527,238	2,591,663	**64,425**	33.7	1,463,366	1,500,671	**37,304**	8.2	356,071	365,148	**9,077**	0.0			
12 Hungary	29.7	1,137,479	1,108,543	- 28,936	64.5	2,470,283	2,407,441	- 62,842	5.1	195,325	190,356	- 4,969	0.7	26,809	26,127	- 682
13 Ireland	4.2	71,288	82,074	**10,786**	37.3	633,101	728,892	**95,791**	58.3	989,539	1,139,260	**149,722**	0.2	3,395	3,908	**514**
14 Italy	53.4	13,532,605	14,349,312	**816,707**	25.4	6,436,857	6,825,328	**388,471**	19.3	4,890,998	5,186,174	**295,177**	1.9	481,497	510,556	**29,059**
15 Latvia	65.4	534,125	528,926	- 5,199	30.2	246,645	244,244	- 2,401	4.1	33,485	33,159	- 326	0.3	2,450	2,426	- 24
16 Lithuania	57.0	714,343	722,931	**8,588**	35.2	441,138	446,441	**5,304**	7.5	93,992	95,122	**1,130**	0.4	5,013	5,073	**60**
17 Luxembourg	33.1	69,491	82,875	**13,384**	43.3	90,905	108,413	**17,508**	23.0	48,286	57,587	**9,300**	0.6	1,260	1,502	**243**
18 Malta	47.4	68,243	68,139	- 104	4.9	7,055	7,044	- 11	47.3	68,099	67,996	- 103	0.5	720	719	- 1
19 Netherlands	17.9	1,361,242	1,430,178	**68,936**	16.4	1,247,171	1,310,331	**63,159**	60.7	4,616,055	4,849,821	**233,766**	5.0	380,235	399,491	**19,256**
20 Poland	46.8	6,441,426	6,278,718	- 162,708	48.2	6,634,118	6,466,543	- 167,576	4.8	660,659	643,971	- 16,688	0.2	27,527	26,832	- 695
21 Portugal	37.1	1,504,239	1,538,173	**33,933**	42.5	1,723,185	1,762,058	**38,872**	20.0	810,911	829,204	**18,293**	0.4	16,218	16,584	**366**
22 Romania	37.3	2,746,804	2,604,649	- 142,155	61.0	4,492,092	4,259,614	- 232,478	1.7	125,189	118,711	- 6,479	0.0			
23 Slovakia	49.7	959,267	990,362	**31,095**	48.2	930,315	960,472	**30,156**	2.1	40,532	41,846	**1,314**	0.1	1,930	1,993	**63**
24 Slovenia	28.5	225,314	236,178	**10,864**	67.3	532,057	557,712	**25,655**	3.8	30,042	31,490	**1,449**	0.3	2,372	2,486	**114**
25 Spain	64.5	11,035,777	11,935,165	**899,388**	13.8	2,361,143	2,553,570	**192,427**	21.7	3,712,812	4,015,397	**302,585**	0.1	17,110	18,504	**1,394**
26 Sweden	39.4	1,779,164	1,984,627	**205,462**	51.0	2,302,979	2,568,933	**265,954**	9.2	415,439	463,415	**47,976**	0.3	13,547	15,111	**1,564**
27 United Kingdom	14.0	3,834,147	4,273,512	**439,365**	25.6	7,011,011	7,814,422	**803,411**	60.3	16,514,217	18,406,626	**1,892,409**	0.2	54,774	61,050	**6,277**
Calculation			**90,530,758**	**2,193,925**			**75,362,538**	**2,267,384**			**54,344,455**	**3,394,507**			**1,937,208**	**33,026**

** Note that these figures are for occupied dwellings. The actual dwelling stock will include vacant dwellings, and will be greater, and the vacancy rate will vary by State*

Total dwelling stock change **7,888,842**

3 Dwellings by tenure

Home ownership and rental

Europe is also predominantly a continent of homeowners, with 71%, in comparison with renting, at 29% (18% private and 11% public). However, there are again substantial variations by nation state with 57% owning and 43% renting in Austria, and 53% owning and 47 renting in Germany, to almost complete home ownership in more recent members states in eastern Europe. This is where the dwelling stock has been privatised.

Deprivation

It is also clear that these eastern European states have issues of deprivation to contend with and that much of the privatised housing stock will need high levels of retrofitting and, perhaps, replacement where industrialised building techniques were used in the past.

This means that the energy saving and renewable energy generation assumptions for these countries have to reflect the particular needs of the whole housing stock for retrofitting or replacement.

Private investment potential

Across Europe some 43% of dwellings are owner occupied without a mortgage and some 28% with a mortgage. Although public sector funding is constrained in many EU nation states at the moment, the private business and investment sectors, including energy companies, are open to funding proposals that offer secure returns in the medium term.

A reMAC investment package for the owner occupied sector would be one such investment opportunity.

3 METREX for Europe Dwellings by tenure

Eurostat	**Owned**			**Rented**			**Owned**	**Rented**	Deprivation
	% Owned	% No mortgage	% With mortgage	**% Rented**	% Private rented	% Public rented	**Owned**	**Rented**	
	2010	2010	2010	**2010**	2010	2010	**2010**	**2010**	2010
EU (27 countries)	**70.8**	42.9	27.9	**29.2**	**17.8**	**11.4**			5.7
1 Austria	**57.4**	32.4	25.0	**43**	26.7	15.9	**2,107,084**	**1,563,794**	4.1
2 Belgium	**71.6**	29.9	41.7	**28**	19.6	8.7	**3,450,421**	**1,363,784**	1.9
3 Bulgaria	**86.9**	85.1	1.8	**13**	2.1	10.9	**2,195,641**	**328,462**	14.7
4 Cyprus	**74.6**	59.8	14.8	**25**	10.0	15.4	**229,664**	**78,197**	1.1
5 Czech Republic	**78.8**	61.3	17.5	**21**	5.0	16.2	**3,308,005**	**889,971**	4.5
6 Denmark	**66.6**	13.9	52.7	**33**	33.3	0.1	**1,858,312**	**931,946**	1.3
7 Estonia	**85.5**	68.9	16.6	**15**	2.6	11.9	**498,503**	**84,541**	11.4
8 Finland	**74.3**	32.3	42.0	**26**	10.1	15.6	**1,911,020**	**661,012**	0.9
9 France	**62.0**	33.0	29.0	**38**	20.2	17.8	**18,410,540**	**11,283,880**	3.0
10 Germany	**53.2**	25.4	27.8	**47**	39.7	7.1	**21,770,436**	**19,151,436**	2.1
11 Greece	**77.3**	59.8	17.5	**23**	18.2	4.6	**3,359,980**	**991,042**	7.6
12 Hungary	**89.7**	65.8	23.9	**10**	2.4	7.9	**3,435,417**	**394,479**	17.7
13 Ireland	**73.4**	38.8	34.6	**27**	11.9	14.7	**1,245,834**	**451,488**	0.5
14 Italy	**71.8**	56.4	15.4	**28**	14.0	14.1	**18,195,525**	**7,121,090**	6.7
15 Latvia	**84.2**	76.5	7.7	**16**	6.7	9.2	**687,666**	**129,856**	22.6
16 Lithuania	**93.1**	85.3	7.8	**7**	1.1	5.7	**1,167,926**	**85,305**	13.6
17 Luxembourg	**68.1**	28.7	39.4	**32**	27.6	4.3	**142,970**	**66,971**	2.3
18 Malta	**80.1**	64.1	16.0	**20**	1.4	18.5	**115,437**	**28,679**	1.3
19 Netherlands	**67.3**	7.8	59.5	**33**	32.5	0.3	**5,117,966**	**2,494,343**	0.5
20 Poland	**81.3**	74.5	6.8	**19**	2.5	16.2	**11,189,913**	**2,573,818**	13.3
21 Portugal	**74.9**	42.4	32.5	**25**	12.7	12.3	**3,036,861**	**1,013,638**	5.6
22 Romania	**97.5**	96.9	0.6	**3**	1.1	1.4	**7,179,984**	**184,102**	26.9
23 Slovakia	**90.1**	82.4	7.7	**10**	8.4	1.6	**1,740,773**	**193,205**	3.8
24 Slovenia	**78.2**	70.5	7.7	**22**	5.0	16.9	**617,612**	**172,963**	15.4
25 Spain	**83.0**	47.5	35.5	**17**	8.8	8.3	**14,215,279**	**2,928,690**	1.4
26 Sweden	**70.8**	2.8	68.0	**29**	28.7	0.5	**3,193,880**	**1,317,250**	1.6
27 United Kingdom	**69.9**	26.0	43.9	**30**	11.9	18.1	**19,162,489**	**8,224,244**	2.8
Calculation	**Total dwelling stock by tenure**						**149,545,137**	**64,708,185**	
	Total dwelling stock							**214,253,322**	

4 Employment by sector (Industry and Services) 2012 - 2030

Employment structure

Employment in the European labour market has now changed structurally to be dominated by Services, with some 75% of employment, with Industry at 25%. This balance is expected to continue to 2030.

4 METREX for Europe

Employment by sector (Industry and Services)

Eurostat	Employed 2012 and 2030					Employment 2011		Employment split		Employment 2030	
	Economic activity rate 2012%	**Employed 2012**	Unemployed* 2012%	**Employed 2030**		**Industry 2011**	**Services 2011**	Industry 2011%	Services 2011%	**Industry 2030**	**Services 2030**
EU (27 countries)	45	**224,355,000**	11					25	75		
1 Austria	50	**4,253,000**	5	**4,457,774**		**1,077,300**	**2,847,200**	27	73	**1,223,687**	**3,234,087**
2 Belgium	42	**4,627,000**	7	**5,089,587**		**1,042,700**	**3,408,000**	23	77	**1,192,377**	**3,897,210**
3 Bulgaria	48	**3,490,000**	12	**3,149,011**		**937,700**	**1,811,400**	34	66	**1,074,107**	**2,074,904**
4 Cyprus	45	**387,000**	13	**436,987**		**80,500**	**280,500**	22	78	**97,445**	**339,543**
5 Czech Republic	49	**5,127,000**	7	**5,290,264**		**1,882,500**	**2,875,400**	40	60	**2,093,134**	**3,197,130**
6 Denmark	50	**2,802,000**	8	**2,958,898**		**537,100**	**2,100,800**	20	80	**602,458**	**2,356,440**
7 Estonia	46	**611,000**	10	**583,727**	**	**171,080**	**439,920**	28	72	**163,444**	**420,284**
8 Finland	47	**2,565,000**	8	**2,708,995**		**566,400**	**1,803,100**	24	76	**647,552**	**2,061,443**
9 France	41	**26,977,000**	10	**29,031,527**	*	**5,693,100**	**19,251,500**	23	77	**6,625,858**	**22,405,669**
10 Germany	51	**41,706,000**	6	**39,681,910**		**11,238,200**	**27,851,500**	29	71	**11,408,459**	**28,273,451**
11 Greece	16	**1,842,000**	26	**1,888,957**		**729,000**	**2,854,300**	20	80	**384,296**	**1,504,660**
12 Hungary	42	**4,159,000**	11	**4,053,199**		**1,171,300**	**2,456,300**	32	68	**1,308,720**	**2,744,479**
13 Ireland	40	**1,842,000**	15	**2,120,703**		**341,300**	**13,849,688**	2	98	**51,004**	**2,069,699**
14 Italy	41	**24,733,000**	11	**26,225,663**		**6,538,000**	**15,578,800**	30	70	**7,752,631**	**18,473,032**
15 Latvia	44	**897,000**	14	**888,269**	*	**225,600**	**632,800**	26	74	**233,450**	**654,819**
16 Lithuania	43	**1,302,000**	13	**1,317,653**	**	**364,560**	**937,440**	28	72	**368,943**	**948,710**
17 Luxembourg	42	**222,400**	5	**265,235**	**	**62,272**	**160,128**	28	72	**74,266**	**190,969**
18 Malta	41	**173,000**	7	**172,737**	**	**48,440**	**124,560**	28	72	**48,366**	**124,371**
19 Netherlands	52	**8,700,000**	5	**9,140,585**		**1,278,200**	**6,881,800**	16	84	**1,431,801**	**7,708,784**
20 Poland	40	**15,605,000**	10	**15,210,823**		**4,932,900**	**9,152,800**	35	65	**5,326,925**	**9,883,898**
21 Portugal	44	**4,686,000**	16	**4,791,709**		**1,322,700**	**3,035,800**	30	70	**1,454,168**	**3,337,540**
22 Romania	44	**9,417,000**	7	**8,929,645**		**2,631,400**	**3,893,800**	40	60	**3,601,034**	**5,328,611**
23 Slovakia	41	**2,214,000**	14	**2,285,767**		**878,700**	**1,401,000**	39	61	**881,039**	**1,404,729**
24 Slovenia	46	**944,000**	9	**989,518**		**294,900**	**561,100**	34	66	**340,898**	**648,620**
25 Spain	39	**17,818,000**	26	**19,270,122**		**3,948,400**	**13,396,000**	23	77	**4,386,785**	**14,883,338**
26 Sweden	50	**4,752,000**	8	**5,300,773**		**923,500**	**3,625,700**	20	80	**1,076,071**	**4,224,702**
27 United Kingdom	51	**31,900,000**	8	**35,555,507**	*	**5,536,300**	**23,054,900**	19	81	**6,884,844**	**28,670,663**
Calculation				**231,795,545**		**54,454,052**	**164,266,236**			**60,733,762**	**171,061,783**

** % of total labour force* ** 2010 ** EU average* *UNECE 2011*

5 Final energy consumption by sector*

Final consumption and gross consumption

Final energy consumption, by consumers, is about 66% of gross energy production. Gross energy production includes energy generation and this is an indication of the loss that results from centralised energy generation and distribution and the potential efficiency gains from a more decentralised system that includes urban renewable energy.

Consumption by sector

Transport is the largest user of energy, at 33%, with industry at 26%, services at 13% and residential at 25%.

These figures illustrate the potential for energy saving by sector and that, to be effective, energy saving and renewable energy generation programmes are needed that are tailored to the needs and characteristics of the building stock and the vehicle fleet.

** This source table is in 1000toe (tonnes of oil equivalent). The figures have been converted to GWh for use in all other tables, on a consistent basis. The conversion factor is 1000toe = 11.63 GWh.*

5 METREX for Europe Final energy consumption by sector*

Eurostat	**Residential**	**Industry**	**Services**	**Transport**	Others inc Ag/Forestry	**Totals**
1000toe	2011	2011	2011	2011	2011	2011
EU (27 countries)	**272,700**	**286,923**	**140,527**	**364,083**	38,838	**1,103,071**
%	25	26	13	33	4	100
1 Austria	6,444	8,669	2,937	8,734	545	27,329
2 Belgium	7,398	13,266	4,401	10,702	3,097	38,864
3 Bulgaria	2,380	2,709	1,047	2,942	209	9,287
4 Cyprus	308	193	221	1,043	129	1,894
5 Czech Republic	5,851	8,432	3,020	6,328	816	24,447
6 Denmark	4,370	2,383	1,964	5,138	824	14,679
7 Estonia	936	607	406	784	110	2,843
8 Finland	5,045	11,231	1,852	5,046	2,005	25,179
9 France	36,948	30,361	20,902	50,063	9,791	148,065
10 Germany	52,934	59,987	29,855	62,328	1,989	207,093
11 Greece	5,448	3,322	1,873	7,666	526	18,835
12 Hungary	5,521	2,844	3,148	4,274	489	16,276
13 Ireland	2,731	2,180	1,323	4,314	252	10,800
14 Italy	31,320	30,129	15,750	42,042	3,071	122,312
15 Latvia	1,318	739	580	1,190	155	3,982
16 Lithuania	1,527	940	587	1,526	116	4,696
17 Luxembourg	426	665	424	2,735	24	4,274
18 Malta	73	46	56	268	3	446
19 Netherlands	9,750	14,184	8,167	15,307	3,255	50,663
20 Poland	19,006	16,461	8,104	17,769	3,646	64,986
21 Portugal	2,786	5,337	1,853	6,944	430	17,350
22 Romania	7,860	7,106	1,774	5,155	681	22,576
23 Slovakia	2,121	4,253	1,603	2,661	157	10,795
24 Slovenia	1,173	1,236	527	1,927	88	4,951
25 Spain	16,221	21,179	9,539	36,040	3,553	86,532
26 Sweden	6,957	11,115	4,527	9,098	471	32,168
27 United Kingdom	35,839	27,645	14,077	52,060	2,402	132,023

* *Final energy consumption is 66% of gross energy production. 1000 toe=11.63 GWh for all other tables with GWh*

6/7/8 Electricity consumption by sector

Electricity consumption by sector

Consumption of electrical energy is similar in the residential, industrial and services sectors, with some 29%, 37% and 31% respectively. However, there are variations between countries depending on their economic structure and levels of renewable energy supply.

Renewables

Renewable energy supply ranges from highs of 59% in Sweden and some 40% or more in Denmark, Portugal and Latvia, to 20-30% in 7 countries and under 20% in 16 countries.

This illustrates the scale of the renewable energy capacity that remains to be developed to meet the EU target of 20% of final energy consumption by 2020.

Electricity is only 22% of total EU final energy consumption but electricity from renewable energy must become the prime source of energy for appliances, lighting, heating (with bio fuels) and cooling and electromobility if decarbonisation is to be achieved.

7 Non-electrical consumption by sector

Transport is clearly the prime source of non-electrical energy consumption with 43% and is the target for electromobility and hydrogen power for larger vehicles. Natural gas has replaced coal as a prime source of energy for electricity production, through gas turbines and combined gas cycle power plants and for domestic heating.

Decentralised electricity production from renewable energy sources must become the prime source of energy for heating and cooling if decarbonisation is to be achieved.

8 Natural gas and electricity prices

Energy suppliers offer reduced prices (about 40% less) to industrial customers as against domestic customers.

6 METREX for Europe Electricity consumption by sector

Eurostat	**Renewables Electricity**	**Renewables Electricity**	Residential Electricity 1000toe	**Residential Electricity**	**Industry Electricity**	**Transport Electricity**	**Households & Services**	**Services Electricity**	**Total Electricity**	**Residential Electricity**	**Industry Electricity**	**Services Electricity**	**Transport Electricity**
GWh	2011	2011%	2011	2011	2011	2011	2011	2011	**2011**	**2011%**	**2011%**	**2011%**	**2011%**
EU (27 countries)		**20**	**69,075**		**1,032,010**	**67481**	**1,668,058**		**2,767,549**	**29.0**	**37.3**	**31.2**	**2.4**
1 Austria	18,524	30	1,532	17,817	26,808	3,125	31,607	13,790	**61,540**	**29.0**	**43.6**	**22.4**	**5.1**
2 Belgium	7,242	9	1,656	19,259	37,261	1,631	41,223	21,964	**80,115**	**24.0**	**46.5**	**27.4**	**2.0**
3 Bulgaria	2,785	10	938	10,909	8,422	367	19,632	8,723	**28,421**	**38.4**	**29.6**	**30.7**	**1.3**
4 Cyprus	119	3	148	1,721	529	-	4,192	2,471	**4,721**	**36.5**	**11.2**	**52.3**	**0.0**
5 Czech Republic	5,835	10	1,221	14,200	23,119	2,251	31,283	17,083	**56,653**	**25.1**	**40.8**	**30.2**	**4.0**
6 Denmark	12,184	39	869	10,106	8,485	397	22,511	12,405	**31,393**	**32.2**	**27.0**	**39.5**	**1.3**
7 Estonia	838	13	166	1,931	2,046	51	4,530	2,599	**6,627**	**29.1**	**30.9**	**39.2**	**0.8**
8 Finland	22,188	28	1,874	21,795	39,542	730	39,974	18,179	**80,246**	**27.2**	**49.3**	**22.7**	**0.9**
9 France	53,892	13	12,778	148,608	117,891	12,398	289,428	140,820	**419,717**	**35.4**	**28.1**	**33.6**	**3.0**
10 Germany	106,129	20	11,745	136,594	230,655	16,600	274,262	137,668	**521,517**	**26.2**	**44.2**	**26.4**	**3.2**
11 Greece	6,728	13	1,516	17,631	14,640	205	36,949	19,318	**51,794**	**34.0**	**28.3**	**37.3**	**0.4**
12 Hungary	2,193	6	973	11,316	9,878	1,117	23,545	12,229	**34,540**	**32.8**	**28.6**	**35.4**	**3.2**
13 Ireland	4,826	19	712	8,281	9,484	45	15,348	7,067	**24,877**	**33.3**	**38.1**	**28.4**	**0.2**
14 Italy	71,352	24	6,031	70,141	128,076	10,793	162,959	92,818	**301,828**	**23.2**	**42.4**	**30.8**	**3.6**
15 Latvia	2,596	42	152	1,768	1,670	124	4,397	2,629	**6,191**	**28.6**	**27.0**	**42.5**	**2.0**
16 Lithuania	826	10	225	2,617	2,768	74	5,738	3,121	**8,580**	**30.5**	**32.3**	**36.4**	**0.9**
17 Luxembourg	191	3	73	849	3,251	120	3,120	2,271	**6,491**	**13.1**	**50.1**	**35.0**	**1.8**
18 Malta	7	0	51	593	527	-	1,287	694	**1,814**	**32.7**	**29.1**	**38.3**	**0.0**
19 Netherlands	10,844	10	2,037	23,690	39,011	1,731	66,726	43,036	**107,468**	**22.0**	**36.3**	**40.0**	**1.6**
20 Poland	10,121	8	2,430	28,261	44,573	3,317	74,050	45,789	**121,940**	**23.2**	**36.6**	**37.6**	**2.7**
21 Portugal	21,096	44	1,182	13,747	16,957	404	31,003	17,256	**48,364**	**28.4**	**35.1**	**35.7**	**0.8**
22 Romania	11,554	27	995	11,572	21,083	1,424	20,207	8,635	**42,714**	**27.1**	**49.4**	**20.2**	**3.3**
23 Slovakia	4,221	17	387	4,501	11,241	536	13,035	8,534	**24,812**	**18.1**	**45.3**	**34.4**	**2.2**
24 Slovenia	3,303	26	276	3,210	5,864	164	6,579	3,369	**12,607**	**25.5**	**46.5**	**26.7**	**1.3**
25 Spain	72,414	30	6,378	74,176	72,030	3,158	164,754	90,578	**239,942**	**30.9**	**30.0**	**37.7**	**1.3**
26 Sweden	73,181	59	3,133	36,437	53,801	2,640	68,186	31,749	**124,627**	**29.2**	**43.2**	**25.5**	**2.1**
27 United Kingdom	29,257	9	9,595	111,590	102,398	4,079	211,533	99,943	**318,010**	**35.1**	**32.2**	**31.4**	**1.3**
Calculation	**554,447**			**803,319**				**864,739**					

1000 toe=11.63 GWh

7 METREX for Europe Non electrical energy consumption by sector*

Eurostat	**Residential**	**Industry**	**Services**	**Transport**	Others inc Ag/Forestry*	**Totals**
GWh	2011	2011	2011	2011	2011	2011
EU (27 countries)	**2,368,077**	**2,308,347**	**769,474**	**4,166,816**	**30,291**	**9,643,004**
%	24.6	23.9	8.0	43.2	0.3	100
1 Austria	57,127	74,012	20,367	98,451	425	250,383
2 Belgium	66,779	117,023	29,220	122,833	2,416	338,271
3 Bulgaria	16,770	23,084	3,454	33,848	163	77,319
4 Cyprus	1,861	1,716	99	12,130	101	15,907
5 Czech Republic	53,847	74,945	18,040	71,344	636	218,812
6 Denmark	40,717	19,229	10,437	59,358	643	130,383
7 Estonia	8,955	5,013	2,122	9,067	86	25,244
8 Finland	36,879	91,075	3,359	57,955	1,564	190,832
9 France	281,097	235,207	102,270	569,835	7,637	1,196,047
10 Germany	479,028	466,994	209,546	708,275	1,551	1,865,394
11 Greece	45,729	23,995	2,465	88,951	410	161,550
12 Hungary	52,893	23,198	24,382	48,590	381	149,444
13 Ireland	23,481	15,869	8,319	50,127	197	97,993
14 Italy	294,111	222,324	90,354	478,155	2,395	1,087,340
15 Latvia	13,561	6,925	4,116	13,716	121	38,438
16 Lithuania	15,142	8,164	3,706	17,673	90	44,776
17 Luxembourg	4,105	4,483	2,660	31,688	19	42,955
18 Malta	256	8	- 43	3,117	2	3,340
19 Netherlands	89,702	125,949	51,947	176,289	2,539	446,426
20 Poland	192,779	146,868	48,460	203,336	2,844	594,288
21 Portugal	18,655	45,112	4,294	80,355	335	148,751
22 Romania	79,840	61,560	11,996	58,529	531	212,456
23 Slovakia	20,166	38,221	10,109	30,411	122	99,030
24 Slovenia	10,432	8,511	2,760	22,247	69	44,018
25 Spain	114,474	174,282	20,361	415,987	2,771	727,875
26 Sweden	44,473	75,466	20,900	103,170	367	244,376
27 United Kingdom	305,218	219,113	63,772	601,379	1,874	1,191,356

** Assumes 78% of final consumption is non-electrical, as industry*

8 METREX for Europe

Natural gas and electricity prices

Eurostat Statistics Database	Household Natural gas €/kW/h	Household Electricity €/kW/h	**Houshold average at 75/25% split €/kW/h *****	Ind/Services Natural gas €/kW/h **	Ind/Services Electricity €/kW/h **	**Ind/Services average at 62/38% split €/kW/h *****
	2012	2012	**2012**	2012	2012	**2012**
1 Austria	0.0642	0.2010	**0.0984**	0.04021	0.1185	**0.0699**
2 Belgium	0.0582	0.2301	**0.1012**	0.04022	0.0990	**0.0626**
3 Bulgaria	0.0463	0.0841	**0.0557**	0.03294	0.0633	**0.0445**
4 Cyprus*		0.2327	**0.2327**		0.1695	**0.1695**
5 Czech Republic	0.0548	0.1487	**0.0783**	0.03774	0.0999	**0.0614**
6 Denmark	0.1114	0.3022	**0.1591**	0.08427	0.0977	**0.0894**
7 Estonia	0.0439	0.1062	**0.0594**	0.0316	0.0769	**0.0488**
8 Finland*		0.1561	**0.1561**	0.04622	0.0744	**0.0569**
9 France	0.0543	0.1427	**0.0764**	0.04137	0.0777	**0.0552**
10 Germany	0.0600	0.2598	**0.1100**	0.04966	0.1142	**0.0742**
11 Greece		0.1329	**0.1329**		0.0899	**0.0899**
12 Hungary	0.0599	0.1616	**0.0853**	0.04122	0.0959	**0.0620**
13 Ireland	0.0527	0.2066	**0.0912**	0.03852	0.0962	**0.0604**
14 Italy	0.0726	0.2171	**0.1087**	0.0417	0.1444	**0.0807**
15 Latvia	0.0416	0.1310	**0.0639**	0.03363	0.0972	**0.0578**
16 Lithuania	0.0396	0.1273	**0.0615**	0.03832	0.1070	**0.0644**
17 Luxembourg	0.0510	0.1680	**0.0802**	0.04769	0.0748	**0.0580**
18 Malta*		0.1714	**0.1714**		0.1631	**0.1631**
19 Netherlands	0.0700	0.2127	**0.1057**	0.04434	0.0914	**0.0622**
20 Poland	0.0444	0.1448	**0.0695**	0.03428	0.0877	**0.0546**
21 Portugal	0.0599	0.1861	**0.0914**	0.04193	0.1009	**0.0643**
22 Romania	0.0280	0.1072	**0.0478**	0.02386	0.0735	**0.0427**
23 Slovakia	0.0506	0.1727	**0.0811**	0.04011	0.1216	**0.0711**
24 Slovenia	0.0632	0.1540	**0.0859**	0.05574	0.0867	**0.0675**
25 Spain	0.0538	0.1949	**0.0891**	0.03675	0.0993	**0.0605**
26 Sweden	0.1061	0.2009	**0.1298**	0.05802	0.0776	**0.0655**
27 United Kingdom	0.0403	0.1547	**0.0689**	0.0286	0.0990	**0.0553**
Calculation	**0.0577**	**0.1743**	**0.0997**	**0.04387**	**0.0999**	**0.0708**

** Appears not to use natural gas for industrial and/or domestic purposes*

*** Services at industrial prices* ****See Tables 6 and 7 for split %'s*

9 Dwelling stock energy saving potential

Energy Efficiency Plan 2011

In the Energy Efficiency Plan 2011, the European Commission states that,

" A large energy saving potential remains untapped. Techniques exist to cut existing buildings' consumption by 50-75% and to halve the energy consumption of typical appliances. But the renovation rate of buildings is too low, as is the uptake of the most efficient appliances. Examples of refurbishment in the EU Green Building programme show cost-effective reductions up to 80%".

Residential building stock

In the EU the average energy consumption in the residential sector is 195kWh/m2. In comparison, the Passivhaus standard is 125kw/h/m2 and it does not seem unreasonable to assume that a reduction in consumption to this level should be possible by 2030

The European Environment Agency (EEA)* has shown that energy efficiency in the residential sector increased by 24%, or 1.4%, a year over the period 1990 to 2009. The introduction of new dwellings with better insulation since 1990 contributed to decreases in consumption, per dwelling, of 12% for Sweden, around 35% for France and Netherlands, 40% for Poland, 50% for Denmark and 70% for Germany.

This level of past performance would not have to be increased a great deal to achieve 125kWh/m2 by 2030

Dwelling size

In some eastern European states dwelling sizes are much smaller than the European average, for example, 39m2 in Romania as against the European average of 84m2.

There will be competing demands to restructure, as well as retrofit, the dwelling stock

** In an Assessment published in April 2012*

9 METREX for Europe

Dwelling stock energy saving potential

Eurostat Statistics Database	**Dwelling stock**	**Energy** GWh/pa	**Energy/ Dwelling** kWh/pa	**Average dwelling** size m2	**Average energy** kWh/m2	**Energy saving potential** at 120kWh/m2	**Energy saving potential** kWh/pa/Dwg	Natural Gas € per kWh	Electricity € per kWh	**Energy saving potential** €/Dwelling	**Energy saving potential** €/Nationally
	2012	2011		2012	2012		2030	2012	2012	**2030**	**2030**
EU (27 countries)	217,642,672	3,171,501	14,572								
1 Austria	3,670,877	74,944	20,416	99	207	42%	8,596	0.0642	0.2010	**831**	**3,051,252,593**
2 Belgium	4,819,024	86,039	17,854	81	220	45%	8,098	0.0582	0.2301	**783**	**3,772,781,290**
3 Bulgaria	2,526,629	27,679	10,955	64	171	30%	3,287	0.0463	0.0841	**201**	**508,178,645**
4 Cyprus	307,861	3,582	11,635	84	139	13%	1,555		0.2327	**174**	**53,547,171**
5 Czech Republic	4,197,976	68,047	16,210	76	212	44%	7,054	0.0548	0.1487	**525**	**2,203,815,544**
6 Denmark	2,790,258	50,823	18,214	114	159	25%	4,486	0.1114	0.3022	**670**	**1,869,249,493**
7 Estonia	583,044	10,886	18,670	61	305	61%	11,326	0.0439	0.1062	**622**	**362,704,729**
8 Finland	2,572,032	58,673	22,812	79	287	58%	13,284		0.1561	**1252**	**3,220,367,124**
9 France	29,694,420	429,705	14,471	91	159	25%	3,551	0.0543	0.1427	**301**	**8,949,415,957**
10 Germany	40,921,872	615,622	15,044	90	167	28%	4,256	0.0600	0.2598	**444**	**18,176,693,390**
11 Greece	4,346,676	63,360	14,577	81	179	33%	4,821		0.1329	**178**	**775,150,777**
12 Hungary	3,829,897	64,209	16,765	78	216	44%	7,441	0.0599	0.1616	**579**	**2,218,458,957**
13 Ireland	1,697,322	31,762	18,713	104	180	33%	6,233	0.0527	0.2066	**579**	**981,946,037**
14 Italy	25,341,957	364,252	14,373	96	150	20%	2,853	0.0726	0.2171	**286**	**7,259,790,417**
15 Latvia	816,705	15,328	18,769	59	321	63%	11,749	0.0416	0.1310	**610**	**497,985,708**
16 Lithuania	1,254,486	17,759	14,156	63	226	47%	6,644	0.0396	0.1273	**349**	**437,648,484**
17 Luxembourg	209,941	4,954	23,599	134	177	32%	7,579	0.0510	0.1680	**538**	**112,982,173**
18 Malta	144,116	849	5,891	106	**55**	0%			0.1714		
19 Netherlands	7,604,704	113,393	14,911	98	152	21%	3,151	0.0700	0.2127	**314**	**2,391,556,093**
20 Poland	13,763,731	221,040	16,060	70	229	48%	7,636	0.0444	0.1448	**437**	**6,010,375,582**
21 Portugal	4,054,554	32,401	7,991	83	**96**	0%		0.0599	0.1861		
22 Romania	7,364,086	91,412	12,413	39	321	63%	7,769	0.0280	0.1072	**296**	**2,176,650,191**
23 Slovakia	1,932,045	24,667	12,767	56	228	47%	6,035	0.0506	0.1727	**440**	**849,231,465**
24 Slovenia	789,785	13,642	17,273	76	228	47%	8,201	0.0632	0.1540	**694**	**547,765,151**
25 Spain	17,126,842	188,650	11,015	99	**111**	0%		0.0538	0.1949		
26 Sweden	4,511,130	80,910	17,936	93	193	38%	6,800	0.1061	0.2009	**1012**	**4,563,475,416**
27 United Kingdom	27,414,148	416,808	15,204	87	175	31%	4,776	0.0403	0.1547	**339**	**9,289,647,927**
Calculation				**84**	**195**	**39%**	**6,549**	0.0577	0.1743	**519**	**80,280,670,313**

Denotes apparently already below Passivhaus standard of 120kWh/m2

10 Dwelling stock renewable energy generation potential

The residential urban energy generation potential has been assessed on a conservative basis. Eurostat data on the dwelling stock distinguishes between flats in blocks of over, and under, 10 units. This means that only 10% of the flats are deemed to have roof space and it has been assumed that only 50% may be available for PV installations. Only 50% of detached and semi-detached dwellings have been assumed to have available roof space.

Even on this basis the PV generating potential of Europe's residential building stock can be seen to be significant. Solar thermal (for water heating) could be added to this potential.

At the moment many European governments and energy companies are supporting the concept of feed in tariffs, which give a favourable return on solar electricity generating technologies, including PV. The purpose of such feed in tariffs is to support the development of markets for new generating technologies. As the markets develop the tariff is reduced.

Although the energy saving potential of Europe's dwelling stock has been recognised, the scale and significance of its renewable energy generating potential has not yet been recognised or quantified.

It amounts to 563,518GWh or the equivalent of 64GW of generating capacity. A conventional combined cycle gas turbine (CCGT) might generate 1-2GW.

It should be noted that technologies now exist to utilise the urban fabric for solar generation purposes, including inter locking tiles for historic areas, windows and cladding as well as conventional PV panels. There are also combined PV and solar thermal panels.

10 METREX for Europe Dwelling stock renewable energy generation potential

Eurostat Statistics Database	**Dwelling stock**					**Renewable energy generation potential (GWh)**					
	Flats	**Detatched houses**	**Semi detached houses**	**Other**	**Approx Generation** kWh/1kWp Soalr PV*	**10 Flats** @50% 4kWp PV	**Detatched houses** @50% 4kWp PV	**Semi detached** @50% 4kWp PV	**Other** @50% 4kWp PV	**Total** GWh	**Energy generation** €
	2030	2030	2030	2030		2030	2030	2030	2030		
EU (27 countries)	**90,974,637**	**72,191,783**	**50,057,815**	**1,741,141**							
1 Austria	1,627,545	1,574,806	530,972	38,476	916	298	5,770	1,945	141	**8,155**	**22,256,318**
2 Belgium	1,077,141	1,804,119	2,212,650	26,531	942	203	6,798	8,337	100	**15,438**	**40,971,568**
3 Bulgaria	973,460	1,190,042	221,137	11,399	1,140	222	5,427	1,008	52	**6,709**	**14,712,513**
4 Cyprus	75,783	147,465	101,855	3,476	1,660	25	979	676	23	**1,704**	**2,565,854**
5 Czech Republic	2,289,404	1,521,188	455,279	17,344	947	434	5,762	1,725	66	**7,986**	**21,082,817**
6 Denmark	845,645	1,651,833	356,526	0	921	156	6,085	1,313	0	**7,555**	**20,506,413**
7 Estonia	358,919	173,574	29,493	2,782	873	63	606	103	10	**781**	**2,237,944**
8 Finland	890,986	1,224,287	513,404	19,015	818	146	4,006	1,680	62	**5,894**	**18,012,551**
9 France	10,833,051	12,917,073	7,158,122	63,912	1,120	2,427	57,868	32,068	286	**92,650**	**206,807,589**
10 Germany	20,752,801	11,867,343	6,229,734	661,909	934	3,877	44,336	23,274	2,473	**73,960**	**197,966,260**
11 Greece	2,591,663	1,463,366	365,148	0	1,300	674	7,610	1,899	0	**10,182**	**19,580,979**
12 Hungary	1,108,543	2,470,283	190,356	26,127	1,120	248	11,067	853	117	**12,285**	**27,421,935**
13 Ireland	82,074	633,101	1,139,260	3,908	886	15	2,244	4,038	14	**6,310**	**17,803,734**
14 Italy	14,349,312	6,436,857	5,186,174	510,556	1,380	3,960	35,531	28,628	2,818	**70,938**	**128,510,531**
15 Latvia	528,926	246,645	33,159	2,426	902	95	890	120	9	**1,114**	**3,086,766**
16 Lithuania	722,931	441,138	95,122	5,073	899	130	1,586	342	18	**2,077**	**5,774,800**
17 Luxembourg	82,875	90,905	57,587	1,502	939	16	341	216	6	**579**	**1,541,371**
18 Malta	68,139	7,055	67,996	719	1,660	23	47	451	5	**526**	**791,759**
19 Netherlands	1,430,178	1,247,171	4,849,821	399,491	913	261	4,555	17,712	1,459	**23,986**	**65,679,923**
20 Poland	6,278,718	6,634,118	643,971	26,832	957	1,202	25,395	2,465	103	**29,165**	**76,188,574**
21 Portugal	1,538,173	1,723,185	829,204	16,584	1,550	477	10,684	5,141	103	**16,404**	**26,458,817**
22 Romania	2,604,649	4,492,092	118,711	0	1,130	589	20,304	537	0	**21,429**	**47,410,354**
23 Slovakia	990,362	930,315	41,846	1,993	992	196	3,691	166	8	**4,062**	**10,236,725**
24 Slovenia	236,178	532,057	31,490	2,486	1,060	50	2,256	134	11	**2,450**	**5,778,427**
25 Spain	11,935,165	2,361,143	4,015,397	18,504	1,560	3,724	14,734	25,056	115	**43,629**	**69,918,021**
26 Sweden	1,984,627	2,302,979	463,415	15,111	876	348	8,070	1,624	53	**10,094**	**28,807,371**
27 United Kingdom	4,273,512	7,011,011	18,406,626	61,050	851	727	23,865	62,656	208	**87,457**	**256,923,625**
Calculation					**1,083**	**20,584**	**310,508**	**224,167**	**8,259**	**563,518**	**1,339,033,541**

Dwelling stock PV generation potential (GWh)	**563,518**
Generation saving potential (GW)	**64.3**

* *Solar generation figures from the EU Joint Research Centre*

** *Assumes one year = 8760 hours. One GW will produce 8760 GW/h. Assumes 1GW power plant*

11 Energy saving for Industry

Energy Efficiency Plan 2011

In the Energy Efficiency Plan 2011, the European Commission states that

"This is the sector where progress in energy efficiency has been greatest, with a 30% improvement in energy intensity over 20 years. Nevertheless, worthwhile energy saving opportunities remain".

Industrial building stock

Data on the nature of the building stock for industry is not available from Eurostat in the way that data on the dwelling stock is. In the industry sector there will be great variations between major manufacturing plants, distribution and storage depots and premises for small to medium size enterprises (SME). Similarly in the services sector there will be variations between major headquarter buildings, call centres and local offices.

Industrial employment

Employment density is around some 50m2 per employee in industry and on this basis it is possible to convert industrial employment to notional industrial floorspace totals by country. However, such figures can only be approximate and offer only a very general indication of energy saving potential.

11 METREX for Europe Energy saving potential for Industry

*Eurostat Statistics Database METREX assumptions**	**Employment Industry**	**Energy GWh**	**Implied floorspace** at 50m2/emp*	**Energy** kWh/m2*	**Employment Industry**	**Implied floorspace** at 50m2/emp*	**Energy 30% saving** kWh/m2*	**Energy** GWh	**Energy Saving potential GWh**	**Generation saving potential GW****	**Natural Gas** € per kWh	**Electricity** € per kWh	**Energy saving potential €**
	2012	**2012**	2011/m2	2012	2030	2030/m2	2030	2030	**2030**	**2030**			**2030**
EU (27 countries)		**3,336,914**											
1 Austria	1,077,300	**100,820**	53,865,000	1,872	1,223,687	61,184,350	1,310	80,164	**20,656**	**2.4**	0.0402	0.1185	**1,260,319,578**
2 Belgium	1,042,700	**154,284**	52,135,000	2,959	1,192,377	59,618,855	2,072	123,501	**30,782**	**3.5**	0.0402	0.0990	**1,674,965,258**
3 Bulgaria	937,700	**31,506**	46,885,000	672	1,074,107	53,705,346	470	25,262	**6,244**	**0.7**	0.0329	0.0633	**256,265,475**
4 Cyprus	80,500	**2,245**	4,025,000	558	97,445	4,872,229	390	1,902	**343**	**0.0**		0.1695	**13,690,390**
5 Czech Republic	1,882,500	**98,064**	94,125,000	1,042	2,093,134	104,656,687	729	76,326	**21,739**	**2.5**	0.0377	0.0999	**1,139,132,691**
6 Denmark	537,100	**27,714**	26,855,000	1,032	602,458	30,122,903	722	21,761	**5,954**	**0.7**	0.0843	0.0977	**526,258,805**
7 Estonia	171,080	**7,059**	8,554,000	825	163,444	8,172,185	578	4,721	**2,338**	**0.3**	0.0316	0.0769	**104,567,233**
8 Finland	566,400	**130,617**	28,320,000	4,612	647,552	32,377,604	3,229	104,532	**26,085**	**3.0**	0.0462	0.0744	**1,428,413,209**
9 France	5,693,100	**353,098**	284,655,000	1,240	6,625,858	331,292,916	868	287,665	**65,433**	**7.5**	0.0414	0.0777	**3,500,227,546**
10 Germany	11,238,200	**697,649**	561,910,000	1,242	11,408,459	570,422,957	869	495,753	**201,896**	**23.0**	0.0497	0.1142	**14,332,226,454**
11 Greece	729,000	**38,635**	36,450,000	1,060	384,296	19,214,820	742	14,257	**24,378**	**2.8**		0.0899	**830,839,619**
12 Hungary	1,171,300	**33,076**	58,565,000	565	1,308,720	65,435,985	395	25,869	**7,206**	**0.8**	0.0412	0.0959	**414,790,587**
13 Ireland	341,300	**25,353**	17,065,000	1,486	51,004	2,550,196	1,040	2,652	**22,701**	**2.6**	0.0385	0.0962	**1,364,094,125**
14 Italy	6,538,000	**350,400**	326,900,000	1,072	7,752,631	387,631,533	750	290,848	**59,552**	**6.8**	0.0417	0.1444	**4,718,350,814**
15 Latvia	225,600	**8,595**	11,280,000	762	233,450	11,672,504	533	6,226	**2,369**	**0.3**	0.0336	0.0972	**108,914,751**
16 Lithuania	364,560	**10,932**	18,228,000	600	368,943	18,447,148	420	7,745	**3,188**	**0.4**	0.0383	0.1070	**177,550,698**
17 Luxembourg	62,272	**7,734**	3,113,600	2,484	74,266	3,713,287	1,739	6,456	**1,277**	**0.1**	0.0477	0.0748	**75,491,697**
18 Malta	48,440	**535**	2,422,000	221	48,366	2,418,322	155	374	**161**	**0.0**		0.1631	**25,882,234**
19 Netherlands	1,278,200	**164,960**	63,910,000	2,581	1,431,801	71,590,045	1,807	129,348	**35,612**	**4.1**	0.0443	0.0914	**1,975,183,621**
20 Poland	4,932,900	**191,441**	246,645,000	776	5,326,925	266,346,248	543	144,713	**46,728**	**5.3**	0.0343	0.0877	**2,182,816,088**
21 Portugal	1,322,700	**62,069**	66,135,000	939	1,454,168	72,708,421	657	47,767	**14,302**	**1.6**	0.0419	0.1009	**829,951,664**
22 Romania	2,631,400	**82,643**	131,570,000	628	3,601,034	180,051,701	440	79,167	**3,476**	**0.4**	0.0239	0.0735	**126,936,304**
23 Slovakia	878,700	**49,462**	43,935,000	1,126	881,039	44,051,928	788	34,716	**14,747**	**1.7**	0.0401	0.1216	**864,687,641**
24 Slovenia	294,900	**14,375**	14,745,000	975	340,898	17,044,915	682	11,632	**2,743**	**0.3**	0.0557	0.0867	**187,564,913**
25 Spain	3,948,400	**246,312**	197,420,000	1,248	4,386,785	219,339,243	873	191,562	**54,750**	**6.3**	0.0368	0.0993	**3,013,066,936**
26 Sweden	923,500	**129,267**	46,175,000	2,800	1,076,071	53,803,568	1,960	105,437	**23,831**	**2.7**	0.0580	0.0776	**1,577,264,515**
27 United Kingdom	5,536,300	**321,511**	276,815,000	1,161	6,884,844	344,242,205	813	279,878	**41,633**	**4.8**	0.0286	0.0990	**2,123,537,049**
Calculation	**54,454,052**		**2,722,702,600**		**60,733,762**	**3,036,688,103**		**2,600,233**	**740,124**	**84.5**			**44,832,989,893**

***Assumes one year = 8760 hours. One GW will produce 8760 GW/h. Assumes 1GW power plant*

12 Energy generation potential for Industry

The industrial urban energy generation potential has also been assessed on a conservative basis. Industrial floor space data is not available from Eurostat in the same way that dwelling stock data, by type, is. An approximation can be made by taking industrial employment at 50m2 per employee. It is assumed that most industrial development will include 1, 2 and 3 storey elements and on this basis only 50% of floorspace is assumed to be roof space and of this only 50% has been deemed to be available for PV installations.

Even on this basis the PV generating potential of Europe's industrial building stock can be seen to be significant. Solar thermal (for water heating) could be added to this potential.

Although the energy saving potential of Europe's building stock has been recognised, the scale and significance of its industrial building renewable energy generating potential has not yet been recognised or quantified.

It amounts to 822,324GWh or the equivalent of 94GW of generating capacity. A conventional combined cycle gas turbine (CCGT) might generate 1-2GW.

12 METREX for Europe Energy generation potential for Industry

*Eurostat Statistics Database METREX assumptions**	**Employment** Industry 2030	Implied floorspace * at 10m2/emp 2030/m2	**Generation** Approx Generation kWh/1kWp Solar PV ***	**Renewable energy generation potential (GWh) **	**Energy generation €**
1 Austria	1,223,687	61,184,350	916	**14,011**	**38,240**
2 Belgium	1,192,377	59,618,855	942	**14,040**	**37,262**
3 Bulgaria	1,074,107	53,705,346	1,140	**15,306**	**33,566**
4 Cyprus	97,445	4,872,229	1,660	**2,022**	**3,045**
5 Czech Republic	2,093,134	104,656,687	947	**24,777**	**65,410**
6 Denmark	602,458	30,122,903	921	**6,936**	**18,827**
7 Estonia	163,444	8,172,185	873	**1,784**	**5,108**
8 Finland	647,552	32,377,604	818	**6,621**	**20,236**
9 France	6,625,858	331,292,916	1,120	**92,762**	**207,058**
10 Germany	11,408,459	570,422,957	934	**133,194**	**356,514**
11 Greece	384,296	19,214,820	1,300	**6,245**	**12,009**
12 Hungary	1,308,720	65,435,985	1,120	**18,322**	**40,897**
13 Ireland	51,004	2,550,196	886	**565**	**1,594**
14 Italy	7,752,631	387,631,533	1,380	**133,733**	**242,270**
15 Latvia	233,450	11,672,504	902	**2,632**	**7,295**
16 Lithuania	368,943	18,447,148	899	**4,146**	**11,529**
17 Luxembourg	74,266	3,713,287	939	**872**	**2,321**
18 Malta	48,366	2,418,322	1,660	**1,004**	**1,511**
19 Netherlands	1,431,801	71,590,045	913	**16,340**	**44,744**
20 Poland	5,326,925	266,346,248	957	**63,723**	**166,466**
21 Portugal	1,454,168	72,708,421	1,550	**28,175**	**45,443**
22 Romania	3,601,034	180,051,701	1,130	**50,865**	**112,532**
23 Slovakia	881,039	44,051,928	992	**10,925**	**27,532**
24 Slovenia	340,898	17,044,915	1,060	**4,517**	**10,653**
25 Spain	4,386,785	219,339,243	1,560	**85,542**	**137,087**
26 Sweden	1,076,071	53,803,568	876	**11,783**	**33,627**
27 United Kingdom	6,884,844	344,242,205	851	**73,238**	**215,151**
Calculation	60,733,762	3,036,688,103	1,083	**822,324**	**1,897,930**
	Generation potential (GW)			**93.9**	

** *Assumes one year = 8760 hours. One GW will produce 8760 GW/h. Assumes 1GW power plant*
Assumes two storey average and 50% roof generating

*** *EU Joint Research Centre*

13 Energy saving for Services

Energy Efficiency Plan 2011

In the Energy Efficiency Plan 2011, the European Commission states that,

Public sector stock

Publicly owned or occupied buildings represent about 12% by area of the EU building stock. The Commission will therefore present a legal instrument under whose provisions public authorities will be required to refurbish at least 3% of their buildings (by floor area) each year – about twice the currently prevailing rate for the European building stock.

Dwellings, offices, shops and other buildings

Nearly 40% of final energy consumption is in houses, public and private offices, shops and other buildings. A large energy saving potential remains untapped. Techniques exist to cut existing buildings' consumption by 50-75% and to halve the energy consumption of typical appliances.

Services building stock

Data on the nature of the building stock for services is not available from Eurostat in the way that data on the dwelling stock is. In the services sector there will be great variations between major headquarter buildings, call centres and local offices.

Services employment

Employment density is around some 10m2 per employee in services and on this basis it is possible to convert services employment to notional services floorspace totals by country. However, such figures can only be approximate and offer only a very general indication of energy saving potential.

13 METREX for Europe Energy saving potential for Services

*Eurostat Statistics Database METREX assumptions**	**Employment Services**	**Energy GWh**	**Implied floorspace** at 10m2/emp*	**Energy** kWh/m2*	**Employment Services**	**Implied floorspace** at 10m2/emp*	**Energy 30% saving** kWh/m2*	**Energy** GWh	**Energy Saving potential GWh**	**Generation saving potential GW****	Natural Gas € per kWh	Electricity € per kWh	**Energy saving potential €**
	2012	**2012**	2011/m2	2012	2030	2030/m2	2030	2030	**2030**	**2030**			**2030**
EU (27 countries)		**1,634,329**											
1 Austria	2,847,200	**34,157**	28,472,000	1200	3,234,087	32,340,867	840	27,159	**6,998**	**0.80**	0.04021	0.11845	**502,448,397**
2 Belgium	3,408,000	**51,184**	34,080,000	1502	3,897,210	38,972,103	1051	40,972	**10,212**	**1.17**	0.04022	0.09899	**668,263,796**
3 Bulgaria	1,811,400	**12,177**	18,114,000	672	2,074,904	20,749,038	471	9,764	**2,413**	**0.28**	0.03294	0.06326	**131,898,944**
4 Cyprus	280,500	**2,570**	2,805,000	916	339,543	3,395,429	641	2,178	**392**	**0.04**		0.16953	**63,942,660**
5 Czech Republic	2,875,400	**35,123**	28,754,000	1221	3,197,130	31,971,298	855	27,337	**7,786**	**0.89**	0.03774	0.09993	**529,342,751**
6 Denmark	2,100,800	**22,841**	21,008,000	1087	2,356,440	23,564,399	761	17,935	**4,907**	**0.56**	0.08427	0.09774	**449,385,967**
7 Estonia	439,920	**4,722**	4,399,200	1073	420,284	4,202,838	751	3,158	**1,564**	**0.18**	0.0316	0.07686	**88,395,409**
8 Finland	1,803,100	**21,539**	18,031,000	1195	2,061,443	20,614,427	836	17,237	**4,301**	**0.49**	0.04622	0.07443	**301,229,091**
9 France	19,251,500	**243,090**	192,515,000	1263	22,405,669	224,056,685	884	198,043	**45,048**	**5.14**	0.04137	0.07768	**2,811,146,898**
10 Germany	27,851,500	**347,214**	278,515,000	1247	28,273,451	282,734,513	873	246,732	**100,482**	**11.47**	0.04966	0.11417	**7,560,029,847**
11 Greece	2,854,300	**21,783**	28,543,000	763	1,504,660	15,046,601	534	8,038	**13,745**	**1.57**		0.08994	**1,096,317,848**
12 Hungary	2,456,300	**36,611**	24,563,000	1491	2,744,479	27,444,790	1043	28,635	**7,977**	**0.91**	0.04122	0.09593	**474,566,130**
13 Ireland	13,849,688	**15,386**	138,496,880	111	2,069,699	20,696,991	78	1,610	**13,777**	**1.57**	0.03852	0.09618	**895,567,573**
14 Italy	15,578,800	**183,173**	155,788,000	1176	18,473,032	184,730,319	823	152,042	**31,131**	**3.55**	0.0417	0.14438	**2,917,920,283**
15 Latvia	632,800	**6,745**	6,328,000	1066	654,819	6,548,192	746	4,886	**1,859**	**0.21**	0.03363	0.09716	**108,571,005**
16 Lithuania	937,440	**6,827**	9,374,400	728	948,710	9,487,104	510	4,836	**1,991**	**0.23**	0.03832	0.10696	**138,749,162**
17 Luxembourg	160,128	**4,931**	1,601,280	3079	190,969	1,909,691	2156	4,117	**815**	**0.09**	0.04769	0.07482	**49,021,207**
18 Malta	124,560	**651**	1,245,600	523	124,371	1,243,709	366	455	**196**	**0.02**		0.16313	**34,077,620**
19 Netherlands	6,881,800	**94,982**	68,818,000	1380	7,708,784	77,087,838	966	74,477	**20,505**	**2.34**	0.04434	0.09138	**1,346,215,817**
20 Poland	9,152,800	**94,250**	91,528,000	1030	9,883,898	98,838,977	721	71,245	**23,005**	**2.63**	0.03428	0.08768	**1,385,435,741**
21 Portugal	3,035,800	**21,550**	30,358,000	710	3,337,540	33,375,402	497	16,585	**4,966**	**0.57**	0.04193	0.10086	**442,535,232**
22 Romania	3,893,800	**20,632**	38,938,000	530	5,328,611	53,286,107	371	19,764	**868**	**0.10**	0.02386	0.07348	**38,726,427**
23 Slovakia	1,401,000	**18,643**	14,010,000	1331	1,404,729	14,047,286	931	13,085	**5,558**	**0.63**	0.04011	0.12163	**430,352,890**
24 Slovenia	561,100	**6,129**	5,611,000	1092	648,620	6,486,200	765	4,960	**1,170**	**0.13**	0.05574	0.08673	**85,110,899**
25 Spain	13,396,000	**110,939**	133,960,000	828	14,883,338	148,833,376	580	86,279	**24,659**	**2.82**	0.03675	0.09927	**2,164,990,064**
26 Sweden	3,625,700	**52,649**	36,257,000	1452	4,224,702	42,247,016	1016	42,943	**9,706**	**1.11**	0.05802	0.07764	**677,979,592**
27 United Kingdom	23,054,900	**163,716**	230,549,000	710	28,670,663	286,706,632	497	142,516	**21,200**	**2.42**	0.0286	0.09895	**1,516,779,430**
Calculation	**164,266,236**		**1,642,662,360**		**171,061,783**	**1,710,617,827**			**367,229**	**41.9**			**26,909,000,679**

***Assumes one year = 8760 hours. One GW will produce 8760 GW/h. Assumes 1GW power plant*

14 Energy generation potential for Services

The services urban energy generation potential has also been assessed on a conservative basis. Services floor space data is not available from Eurostat in the same way that dwelling stock data, by type, is. An approximation can be made by taking services employment at 10m2 per employee. It is assumed that most services development will include 1, 2 and 3 storey elements and on this basis only 50% of floor space is assumed to be roof space and of this only 50% has been deemed to be available for PV installations.

Even on this basis the PV generating potential of Europe's services building stock can be seen to be significant. Solar thermal (for water heating) could be added to this potential.

Although the energy saving potential of Europe's building stock has been recognised, the scale and significance of its services building renewable energy generating potential has not yet been recognised or quantified.

It amounts to 277,937GWh or the equivalent of 32GW of generating capacity. A conventional combined cycle gas turbine (CCGT) might generate 1-2GW.

14 METREX for Europe Energy generation potential for Services

	*Eurostat Statistics Database METREX assumptions**	**Employment** Services 2030	Implied floorspace * at 10m2/emp 2030/m2	**Generation** Approx Generation kWh/1kWp Solar PV ***	**Renewable energy generation potential (GWh) **	**Energy generation €**
1	Austria	3,234,087	32,340,867	916	**4,444**	**12,127,825**
2	Belgium	3,897,210	38,972,103	942	**5,507**	**14,614,539**
3	Bulgaria	2,074,904	20,749,038	1,140	**3,548**	**7,780,889**
4	Cyprus	339,543	3,395,429	1,660	**845**	**1,273,286**
5	Czech Republic	3,197,130	31,971,298	947	**4,542**	**11,989,237**
6	Denmark	2,356,440	23,564,399	921	**3,255**	**8,836,650**
7	Estonia	420,284	4,202,838	873	**550**	**1,576,064**
8	Finland	2,061,443	20,614,427	818	**2,529**	**7,730,410**
9	France	22,405,669	224,056,685	1,120	**37,642**	**84,021,257**
10	Germany	28,273,451	282,734,513	934	**39,611**	**106,025,442**
11	Greece	1,504,660	15,046,601	1,300	**2,934**	**5,642,475**
12	Hungary	2,744,479	27,444,790	1,120	**4,611**	**10,291,796**
13	Ireland	2,069,699	20,696,991	886	**2,751**	**7,761,372**
14	Italy	18,473,032	184,730,319	1,380	**38,239**	**69,273,870**
15	Latvia	654,819	6,548,192	902	**886**	**2,455,572**
16	Lithuania	948,710	9,487,104	899	**1,279**	**3,557,664**
17	Luxembourg	190,969	1,909,691	939	**269**	**716,134**
18	Malta	124,371	1,243,709	1,660	**310**	**466,391**
19	Netherlands	7,708,784	77,087,838	913	**10,557**	**28,907,939**
20	Poland	9,883,898	98,838,977	957	**14,188**	**37,064,616**
21	Portugal	3,337,540	33,375,402	1,550	**7,760**	**12,515,776**
22	Romania	5,328,611	53,286,107	1,130	**9,032**	**19,982,290**
23	Slovakia	1,404,729	14,047,286	992	**2,090**	**5,267,732**
24	Slovenia	648,620	6,486,200	1,060	**1,031**	**2,432,325**
25	Spain	14,883,338	148,833,376	1,560	**34,827**	**55,812,516**
26	Sweden	4,224,702	42,247,016	876	**5,551**	**15,842,631**
27	United Kingdom	28,670,663	286,706,632	851	**36,598**	**107,514,987**
	Calculation	171,061,783	1,710,617,827	1,083	**277,937**	**641,481,685**
		Generation potential (GW)**			**31.7**	

** *Assumes one year = 8760 hours. One GW will produce 8760 GW/h. Assumes 1GW power plant*
Assumes three storeys and 50% roof generating

*** *EU Joint Research Centre*

15 Transportation

Clean Power for Transport*

Whilst further efficiency improvements spurred by EU regulations on vehicle emissions of CO2 will continue to represent the lowest hanging fruits in the short to medium term, low-CO2 alternatives to oil are also indispensable for a gradual decarbonisation of transport, a key objective of the Europe 2020 strategy for smart, sustainable and inclusive growth.

Research convened by the European Climate Foundation finds that 'greening' cars could generate about 700,000 additional jobs by 2025.

Vigorous action of the Union as a first-mover on innovative alternative fuel solutions (for instance on batteries and powertrains) will also create new market opportunities for European industry and bolster Europe's competitiveness on the emerging global market.

Member States aim to have 8-9 million electric vehicles (EV) on the road by 2020.

Electromobility

Vehicle manufacturers have indicated that carbon fuelled vehicles may not be manufactured in quantity after 2030. The reason for this is the cost of maintaining dual production lines with EV's.

Although the present differences in carbon (petrol and diesel) fuels and electricity (industrial) prices are not yet great, it can be expected that the advantage will swing to electricity as renewable energy sources are developed, particularly from decentralised urban sources, and oil prices continue to rise.

Electric vehicles convert about 59/62% of the electrical energy from the grid to power at the wheels whereas conventional gasoline vehicles only convert about 17/21% of the energy stored in gasoline to power at the wheels.** It is, therefore, reasonable to include an efficiency gain of 40% for electromobility in the assessment of benefits.

The financial benefits of electromobility will offer transportation investment opportunities to the industrial and services sectors and increased disposable income to households.

** Communication from the Commission to the European Parliament, the Council, EESC, CoR - Clean Power for Transport: A European alternative fuels strategy*

*** US Department of Energy*

15 METREX for Europe

Transportation - Electromobility benefit

Eurostat Statistics Database Europe's Energyy Portal	**Transport** GWh	**Carbon energy price** Petroleum €/litre*	Diesel €/litre*	Petrol/Diesel 50/50 € kWh	**Carbon energy cost** * 10kWh/litre €kWh	**Electricity energy cost** ** €/kWh	**Electricity energy cost**	**Benefit** With 40% efficiency gain over carbon fuel
GW/h	2011	2013	2013	€	**€**	€	**€**	**%**
EU (27 countries)	**4,234,285**							
1 Austria	98,451	1.21	1.14	0.1173	**11,543,428,995**	0.1185	**11,661,570,699**	**-0.5**
2 Belgium	122,833	1.37	1.24	0.1303	**16,005,173,778**	0.0990	**12,159,264,407**	**13.7**
3 Bulgaria	33,848	1.10	1.12	0.1111	**3,760,563,906**	0.0633	**2,141,253,580**	**27.4**
4 Cyprus	12,130	1.20	1.21	0.1206	**1,462,888,854**	0.1695	**2,056,414,158**	**-16.9**
5 Czech Republic	71,344	1.18	1.16	0.1171	**8,350,773,062**	0.0999	**7,129,369,945**	**7.9**
6 Denmark	59,358	1.31	1.28	0.1299	**7,710,596,406**	0.0977	**5,801,645,056**	**14.1**
7 Estonia	9,067	1.09	1.09	0.1087	**985,574,204**	0.0769	**696,883,471**	**17.2**
8 Finland	57,955	1.34	1.26	0.1298	**7,519,658,655**	0.0744	**4,313,589,161**	**27.1**
9 France	569,835	1.44	1.31	0.1372	**78,181,319,468**	0.0777	**44,264,758,719**	**27.7**
10 Germany	708,275	1.36	1.22	0.1286	**91,084,118,704**	0.1142	**80,863,715,649**	**5.9**
11 Greece	88,951	1.41	1.16	0.1281	**11,394,569,298**	0.0899	**8,000,215,165**	**17.5**
12 Hungary	48,590	1.11	1.13	0.1123	**5,456,614,326**	0.0959	**4,661,202,247**	**7.9**
13 Ireland	50,127	1.31	1.25	0.1277	**6,401,194,914**	0.0962	**4,821,197,548**	**14.1**
14 Italy	478,155	1.50	1.42	0.1457	**69,643,342,749**	0.1444	**69,036,085,315**	**0.4**
15 Latvia	13,716	1.11	1.08	0.1098	**1,505,298,075**	0.0972	**1,332,617,412**	**6.1**
16 Lithuania	17,673	1.13	1.10	0.1117	**1,974,116,546**	0.1070	**1,890,344,725**	**2.2**
17 Luxembourg	31,688	1.16	1.08	0.1122	**3,555,399,210**	0.0748	**2,370,899,901**	**20.0**
18 Malta	3,117	1.25	1.17	0.1212	**377,605,166**	0.1631	**508,450,109**	**-14.8**
19 Netherlands	176,289	1.51	1.24	0.1378	**24,283,866,228**	0.0914	**16,109,326,286**	**20.2**
20 Poland	203,336	1.10	1.10	0.1103	**22,417,845,818**	0.0877	**17,828,541,690**	**11.4**
21 Portugal	80,355	1.36	1.21	0.1285	**10,325,581,520**	0.1009	**8,104,577,059**	**12.1**
22 Romania	58,529	1.07	1.09	0.1080	**6,318,167,768**	0.0735	**4,300,685,202**	**19.0**
23 Slovakia	30,411	1.26	1.19	0.1221	**3,711,715,032**	0.1216	**3,698,942,231**	**0.2**
24 Slovenia	22,247	1.29	1.17	0.1229	**2,733,045,179**	0.0867	**1,929,483,177**	**17.2**
25 Spain	415,987	1.18	1.13	0.1158	**48,171,317,760**	0.0993	**41,295,049,344**	**7.7**
26 Sweden	103,170	1.37	1.36	0.1367	**14,098,144,971**	0.0776	**8,010,098,614**	**27.5**
27 United Kingdom	601,379	1.16	1.43	0.1291	**77,638,003,080**	0.0990	**59,506,432,260**	**13.2**
					-			
Calculation		1.25	1.20	0.1226	**536,609,923,670**	0.0999	**424,492,613,129**	**14.1**

**Europe's Energy Portal*

**9kwh/litre for petrol and 11 kwh/litre for diesel*

*** Industrial electrical energy costs*

16 Energy saving and disposable income/investment funds

Table 15 shows the key outcomes of the METREX approach to urban retro fitting and energy generation. The approach is essentially economic and seeks to demonstrate the significant scale of financial savings that could be achieved, the extent to which savings can fund generating investment and, after the pay back period, can then contribute to productive economic investment or disposable income.

However, METREX is aware that the global issue of dangerous climate change has currently been over shadowed in Europe by a major financial crisis. In times of austerity it seems even more necessary to avoid waste, particularly of energy, which is such an important cost factor for households and businesses.

There is a virtuous circle to be exploited of urban energy saving, urban renewable energy generation, medium term employment creation, investment availability, decarbonisation and dangerous green house gas reduction.

There is an economically beneficial route to the avoidance of dangerous climate change and Europe's metropolitan regions and areas have a key role to play in raising awareness of this, demonstrating its feasibility through the use of reMAC and making it happen.

16 METREX for Europe Energy saving and disposable income/investment funds

	Household disposable income after pay back					Investment income after pay back			
Eurostat Statistics Database	Per capita disposable income €pa 2011	Household size 2012	**Household disposable income €pa 2011**	**Energy saving per household €**	**Residential energy saving €pa**	Industry energy saving €pa	Services energy saving €pa	**Total economic investment saving €pa**	**Transport energy saving €pa**
EU (27 countries)	19682	2.4	**47237**						
1 Austria	23806	2.3	**54754**	**831**	**3,051,252,593**	1,260,319,578	502,448,397	**1,762,767,975**	None
2 Belgium	22291	2.3	**51269**	**783**	**3,772,781,290**	1,674,965,258	668,263,796	**2,343,229,054**	**3,845,909,371**
3 Bulgaria*	7149	2.9	**20732**	**201**	**508,178,645**	256,265,475	131,898,944	**388,164,419**	**1,619,310,326**
4 Cyprus	18713	2.8	**52396**	**174**	**53,547,171**	13,690,390	63,942,660	**77,633,050**	None
5 Czech Republic	13855	2.5	**34638**	**525**	**2,203,815,544**	1,139,132,691	529,342,751	**1,668,475,442**	**1,221,403,117**
6 Denmark	20453	2	**40906**	**670**	**1,869,249,493**	526,258,805	449,385,967	**975,644,773**	**1,908,951,350**
7 Estonia	10920	2.3	**25116**	**622**	**362,704,729**	104,567,233	88,395,409	**192,962,642**	**288,690,733**
8 Finland	21586	2.1	**45331**	**1252**	**3,220,367,124**	1,428,413,209	301,229,091	**1,729,642,300**	**3,206,069,494**
9 France	23232	2.2	**51110**	**301**	**8,949,415,957**	3,500,227,546	2,811,146,898	**6,311,374,444**	**33,916,560,749**
10 Germany	24698	2	**49396**	**444**	**18,176,693,390**	14,332,226,454	7,560,029,847	**21,892,256,301**	**10,220,403,055**
11 Greece	15715	2.6	**40859**	**178**	**775,150,777**	830,839,619	1,096,317,848	**1,927,157,467**	**3,394,354,133**
12 Hungary	11848	2.6	**30805**	**579**	**2,218,458,957**	414,790,587	474,566,130	**889,356,716**	**795,412,079**
13 Ireland	19328	2.7	**52186**	**579**	**981,946,037**	1,364,094,125	895,567,573	**2,259,661,698**	**1,579,997,366**
14 Italy	20140	2.4	**48336**	**286**	**7,259,790,417**	4,718,350,814	2,917,920,283	**7,636,271,096**	**607,257,434**
15 Latvia	10083	2.5	**25208**	**610**	**497,985,708**	108,914,751	108,571,005	**217,485,756**	**172,680,663**
16 Lithuania	12636	2.4	**30326**	**349**	**437,648,484**	177,550,698	138,749,162	**316,299,860**	**83,771,821**
17 Luxembourg**	28660	2.5	**71650**	**538**	**112,982,173**	75,491,697	49,021,207	**124,512,904**	**1,184,499,309**
18 Malta***	19682	2.9	**57078**	None	None	25,882,234	34,077,620	**59,959,853**	None
19 Netherlands	21264	2.2	**46781**	**314**	**2,391,556,093**	1,975,183,621	1,346,215,817	**3,321,399,438**	**8,174,539,942**
20 Poland	12662	2.8	**35454**	**437**	**6,010,375,582**	2,182,816,088	1,385,435,741	**3,568,251,829**	**4,589,304,128**
21 Portugal	15941	2.6	**41447**	None	None	829,951,664	442,535,232	**1,272,486,896**	**2,221,004,461**
22 Romania	7485	2.9	**21707**	**296**	**2,176,650,191**	126,936,304	38,726,427	**165,662,730**	**2,017,482,566**
23 Slovakia	13557	2.8	**37960**	**440**	**849,231,465**	864,687,641	430,352,890	**1,295,040,531**	**12,772,801**
24 Slovenia	16154	2.6	**42000**	**694**	**547,765,151**	187,564,913	85,110,899	**272,675,812**	**803,562,001**
25 Spain	18604	2.7	**50231**	None	None	3,013,066,936	2,164,990,064	**5,178,057,000**	**6,876,268,416**
26 Sweden	21899	2.1	**45988**	**1012**	**4,563,475,416**	1,577,264,515	677,979,592	**2,255,244,106**	**6,088,046,357**
27 United Kingdom	21669	2.3	**49839**	**339**	**9,289,647,927**	2,123,537,049	1,516,779,430	**3,640,316,479**	**18,131,570,820**
Calculation				**519**	**80,280,670,313**	44,832,989,893	26,909,000,679	**71,741,990,571**	**112,959,822,492**

** 2010 ** 2009 *** EU average*

17/18 Greenhouse gas (GHG) emission reductions

Table 17 shows the make up of Europe's renewable energy generating capacity. It amounts to some 1.9GWh or 15% of the current final energy demand of 12.8MWh. The EU target is 20% by 2020.

Table 18 shows that the METREX approach would deliver a reduction of 5.5MWh, through energy saving and generation. This would, in effect, reduce carbon fuels to 50% of current final energy demand, with a commensurate reduction in dangerous greenhouse gas emissions.

This confirms the feasibility of an economic route to European decarbonisation and greenhouse gas emission reduction.

17 METREX for Europe - renewable energies

	Solar	Biomass and wastes	Geothermal	Hydro	Wind	Totals	Totals
1000toe	2011	2011	2011	2011	2011	2011	**GWh**
EU (27 countries)	6062	108248	6204	26374	15393	162281	
GWh	**70,501**	**1,258,924**	**72,153**	**306,730**	**179,021**		**1,887,328**
1 Austria	2,093	5,045	34	2,939	166	10,277	**119,526**
2 Belgium	115	2,131	4	17	199	2,466	**28,680**
3 Bulgaria	23	1,048	33	251	74	1,429	**16,619**
4 Cyprus	64	21	1		10	96	**1,116**
5 Czech Republic	198	2,629		169	34	3,030	**35,239**
6 Denmark	20	2,162	8	1	840	3,031	**35,251**
7 Estonia		942		3	32	977	**11,363**
8 Finland	1	8,000		1,070	41	9,112	**105,973**
9 France	240	12,624	83	3,854	1,052	17,853	**207,630**
10 Germany	2,218	22,800	584	1,485	4,203	31,290	**363,903**
11 Greece	235	1,085	26	345	285	1,976	**22,981**
12 Hungary	6	1,674	104	19	54	1,857	**21,597**
13 Ireland	8	285		61	377	731	**8,502**
14 Italy	1,069	6,997	5,015	3,940	847	17,868	**207,805**
15 Latvia		1,817		248	6	2,071	**24,086**
16 Lithuania		1,077	3	41	41	1,162	**13,514**
17 Luxembourg	3	71		5	6	85	**989**
18 Malta		1				1	**12**
19 Netherlands	33	2,656	8	5	439	3,141	**36,530**
20 Poland	10	6,949	13	200	276	7,448	**86,620**
21 Portugal	92	3,088	202	992	788	5,162	**60,034**
22 Romania		3,618	24	1,266	120	5,028	**58,476**
23 Slovakia	39	1,016	6	325		1,386	**16,119**
24 Slovenia	14	554	38	306		912	**10,607**
25 Spain	1,348	6,118	17	2,631	3,649	13,763	**160,064**
26 Sweden	12	9,503		5,712	523	15,750	**183,173**
27 United Kingdom	131	4,336	1	489	1,333	6,290	**73,153**
%	**4**	**67**	**4**	**16**	**9**	**100**	

1000toe = 11.63 GWh

18 METREX for Europe Greenhouse gas (GHG) reductions

Eurostat Statistics Database	**Final energy demand** GWh 2011	**Renewable energy** GWh 2011	**Renewable energy %** **2011**	Final energy demand less renewables GWh 2011	**Energy saving** GWh Dwellings, Industry, Services and Transportation	**Energy generation** GWh Dwellings, Industry and Services	**Reduced final demand** GWh 2030	**Reduced final demand %** **2030**	**GHG emissions** 1000tCO2 2010	GHG emissions/ final energy ratios 1000tCO2/GWh *100 2011	**Reduced GHG emissions 1000tCO2** **2030**
EU (27 countries)	**12,831,902**	**1,887,328**	**14.71**						**4,729,879**		
1 Austria	317,836	119,526	**37.61**	198,310	98,589	27,931	71,791	**63.80**	84,594	27	**53,970**
2 Belgium	451,988	28,680	**6.35**	423,309	129,152	35,958	258,199	**39.00**	132,459	29	**51,665**
3 Bulgaria	108,008	16,619	**15.39**	91,389	30,501	27,442	33,446	**63.40**	61,427	57	**38,946**
4 Cyprus	22,027	1,116	**5.07**	20,911	6,066	4,694	10,151	**51.45**	10,838	49	**5,577**
5 Czech Republic	284,319	35,239	**12.39**	249,080	87,672	40,747	120,661	**51.56**	139,158	49	**71,746**
6 Denmark	170,717	35,251	**20.65**	135,466	47,122	18,048	70,297	**48.11**	61,065	36	**29,377**
7 Estonia	33,064	11,363	**34.37**	21,702	14,133	3,289	4,280	**80.28**	20,517	62	**16,471**
8 Finland	292,832	105,973	**36.19**	186,859	87,735	15,525	83,598	**55.26**	74,556	25	**41,201**
9 France	1,721,996	207,630	**12.06**	1,514,366	443,857	229,059	841,450	**44.44**	522,373	30	**232,119**
10 Germany	2,408,492	363,903	**15.11**	2,044,589	759,845	260,200	1,024,544	**49.89**	936,544	39	**467,242**
11 Greece	219,051	22,981	**10.49**	196,070	94,657	19,632	81,781	**58.29**	118,287	54	**68,950**
12 Hungary	189,290	21,597	**11.41**	167,693	63,118	37,345	67,230	**59.91**	67,679	36	**40,546**
13 Ireland	125,604	8,502	**6.77**	117,102	67,108	8,821	41,173	**64.84**	61,314	49	**39,756**
14 Italy	1,422,489	207,805	**14.61**	1,214,684	354,257	256,910	603,516	**50.31**	510,318	36	**256,766**
15 Latvia	46,311	24,086	**52.01**	22,225	19,310	4,863	- 1,948	**108.76**	12,077	26	**13,135**
16 Lithuania	54,614	13,514	**24.74**	41,100	20,583	7,905	12,613	**69.31**	20,810	38	**14,424**
17 Luxembourg	49,707	989	**1.99**	48,718	16,358	1,804	30,555	**37.28**	12,075	24	**4,502**
18 Malta	5,187	12	**0.22**	5,175	1,604	1,937	1,635	**68.41**	3,035	59	**2,076**
19 Netherlands	589,211	36,530	**6.20**	552,681	150,594	50,633	351,454	**36.41**	210,053	36	**76,479**
20 Poland	755,787	86,620	**11.46**	669,167	256,162	115,092	297,913	**55.48**	400,865	53	**222,400**
21 Portugal	201,781	60,034	**29.75**	141,746	51,410	55,387	34,949	**75.34**	70,599	35	**53,192**
22 Romania	262,559	58,476	**22.27**	204,083	84,968	88,488	30,627	**84.99**	121,355	46	**103,143**
23 Slovakia	125,546	16,119	**12.84**	109,427	44,130	18,565	46,731	**57.29**	45,982	37	**26,345**
24 Slovenia	57,580	10,607	**18.42**	46,974	19,288	8,558	19,127	**59.28**	19,522	34	**11,573**
25 Spain	1,006,367	160,064	**15.91**	846,303	245,805	169,498	431,001	**49.07**	355,898	35	**174,648**
26 Sweden	374,114	183,173	**48.96**	190,941	105,479	27,935	57,528	**69.87**	66,232	18	**46,277**
27 United Kingdom	1,535,427	73,153	**4.76**	1,462,275	434,318	199,741	828,217	**43.36**	590,247	38	**255,937**
Calculation				10,922,345	**3,733,820**	**1,736,004**	**5,452,520**	**50.08**			**2,368,686**

* *Indicators of relative, and comparative, levels of GHG emissions*

Using only PV on roofs

EU target are 80-95% by 2050