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RASLRES: Local Resources - Local Energy - Local Solutions - Local Jobs

Regional Energy Balance & Biomass Heating Demand Estimates for 2020

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Executive Summary

This is a part of the wood energy support services package delivered under the RASLRES European project. The objective is to determine an energy balance for the Western region, to understand the current demand for heating and to estimate the future demand for biomass heating in the region. This allows a comparison of supply and demand, and this current work is feeding into a separate forest resource mapping of the region.

The general approach taken is to proportion Total Final Consumption (TFC) data from the national energy balance using appropriate ratios. This allows for analysis of energy within each County and also for the region. This approach is not entirely satisfactory. Inaccuracies in the national data are compounded by further extrapolations to a regional level. Many of the calculations are based on broad underlying assumptions and the largest market, oil for heating, is calculated simply as a residual from other energy sources for heating.

There is very little existing regional reporting or analysis and almost none on a County basis. There is an urgent need for accurate data on a county basis to facilitate regional energy policy planning.

The overall energy balance for the region showed approximately 927 ktoe of thermal energy use for the region based on 2008 data. Galway has the highest heat demand at 284 ktoe, followed by Donegal, Mayo and Clare, all having over 100 ktoe of heat energy demand. Other counties had a smaller heat market, generally commensurate with a smaller area and lower levels of commercial and industrial activity.

For estimating 2020 demand, the provisional forecasts are used. The analysis suggests the overall heat market will fall by 8% for the region, due to energy efficiency measures. This 8% reduction is applied in assessing the biomass demand for heating.

About 10% of the heat market will be provided by bioenergy by 2020 using current national targets. This was used as a blanket assumption for the region, although there are many variables unique to the region, and variations within the region, which can alter this. An example is the lack of natural gas infrastructure in Donegal, Sligo, Roscommon or Leitrim which gives biomass a competitive advantage. The established use of another solid fuel (peat) in the region may lead to a greater uptake. And the proximity to significant forest resources may lead to increased use of biomass for energy.

The overall size of the biomass heating market for 2020 in the region is estimated to be 217,000 oven dry tonnes (odt). The biomass estimates for heating reflect the heat market, with Galway accounting for 31% of biomass heating, Clare and Mayo 16%, Donegal 17% and the balance in the remaining counties. These estimates ignore biomass for other uses, such as co-firing or other large bio-processing facility. No account has been taken of import or export of biomass from the region.

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Introduction: Regional Energy Balance

This is a part of the wood energy support services package delivered under the RASLRES European project, funded by the Western Development Commission and the Northern Periphery Programme. The objective is to determine an energy balance for the Western region, to understand the current demand for heating and to estimate the future demand for biomass heating in the region. This allows a comparison of supply and demand, and this current work is feeding into a separate forest resource mapping of the region.

We set out below an initial energy balance for the region using 2008 energy consumption data, an explanation of the methodology used, and the extrapolation of this to regional biomass demand for heating in 2020 based on a 12% target for heat demand from renewable sources. Of this 12% renewable heat target, 85% is assumed to be met by biomass (Buckley, 2010).

Methodology

This county-by-county and regional analysis is an extension of the methodology set out in the Energy Balance prepared for the Mid-West Regional Authority (MWRA, 2007).

It is necessary to carry out an outline energy balance for the counties and the region in order to identify the thermal energy consumption as a component of the overall energy balance.

The Western Region is characterised by low population density and a comparatively low level of commercial and industrial activity. The natural gas network extends only to a limited part of the region, and in rural areas, peat has been available as a low-cost domestic fuel.

Sustainable Energy Ireland (SEI) gathers national energy consumption data (SEI, 2009). All energy imports are recorded by the state through the ports and the conversion of 'Primary Energy' into electricity is obtained from the ESB Networks who manage all sources of electricity being supplied into the National Grid. SEI also gathers data from other Government Departments and Agencies, energy suppliers and distributors. From this data they can determine with some accuracy the following information:

- Total Primary Energy Requirement (TPER)
- Total Final Energy Consumption (TFEC or TFC)

The general approach that has been taken is to proportion TFC data from a National level using appropriate ratios. This allows for analysis of energy within each County and also for the Region.

For estimating 2020 demand, the provisional forecasts recently submitted to the European Commission as part of the national renewable energy action plan are extrapolated to a regional level (Permanent Representation of Ireland to the EU, 2010).

There is very little regional reporting or analysis and almost none on a County basis. There is an urgent need for accurate data on a county basis to facilitate regional energy policy planning.

The following broad assumptions are made:

- 4% of electricity is used for heating (Polaski, 2009). This is assumed to be split evenly between the residential and commercial sectors.
- All renewable energy in TFC is assumed to be for heating purposes.
- All energy TFC figures are rounded to the nearest whole number and expressed in ktoe (kilotonnes of oil equivalent).
- Statistical differences in the energy balance are ignored.

Specific information on data sources and methodology applied for the relevant sectors (Agriculture, Services, Residential, Transport and Industry) is provided in the following sections.

Agricultural Sector

The energy consumption in the agricultural sector was estimated by the percentage of land farmed ('000ha) in Counties in the Region relative to Ireland. The data for land use was obtained from the Central Statistics Office (CSO) Census of Agriculture (CSO, 2000). Area farmed is the combined area under crops, silage, hay,

pasture and rough grazing land in use (including fallow and set-aside land). Areas taken up by roads, tracks, water, bog, marsh, rocks, unused rough grazing land, buildings etc. are excluded. Forestry is not included in this census.

Services Sector (Commercial & Public)

The energy consumption for the commercial sector is calculated from labour data obtained from the CSO using Census Data (CSO, 2006). The numbers employed in the Commercial and Public Sector can be determined from the Census Data by county. Energy consumption in the Counties in the Region is assumed to be directly related to the level of energy used in this Sector Nationally, and the National Figures are proportioned out based on the numbers working in this sector in the Counties.

SEI note the following caveat in relation to national data on energy consumption in the services sector: "As a result of the heterogeneous nature of the services sector it is difficult to assess the amount of energy that is consumed in this sector. Energy statistics relating to fuel consumption for the services sector in Ireland are calculated as a residual. This approach is unsatisfactory, not least because the energy use in the services sector is affected by uncertainties in all other sectors." (SEI, 2009). These inaccuracies are compounded by further extrapolations to a regional level.

Commercial & Public sector includes: wholesale and retail trade; hotels and restaurants, logistics and communications businesses; banking and financial services; real estate, renting and business activities; public administration and defence; education; health and social work; other community, social and personal service activities.

Residential Sector

Energy Consumption is estimated in the residential sector using Housing Data for the Counties in the Region obtained from the CSO (CSO, 2006). This uses number of households as a proxy for residential energy consumption.

The Economic and Social Research Institute also provides some useful data around the principal methods of heating homes (ESRI, 2003). This data is used as the justification for a higher proportion of peat use in the region than nationally.

Transport

Energy consumption in transport is based on the total number of vehicles under current licence as of 31st December 2008 in Counties in the Region as a percentage of the national vehicle fleet (Department of Transport, 2008).

This approach excludes energy from railways, ports, airports and ferries. It also assumes that where a vehicle is registered is where the fuel is purchased and consumed. This approach also ignores fuel tourism. This data can be regarded as indicative only due to these assumptions.

Industry

The energy consumption for the Industry sector is calculated from labour data obtained from the Census Data (CSO, 2006). Energy consumption in Counties in the Region is assumed to be directly related to the level of energy used in this Sector Nationally, and the National Figures are proportioned out based on the numbers working in this sector in Counties in the Region. Agriculture, forestry and fishing were excluded from the industrial labour force.

Industry sector includes: mining, quarrying and turf production; manufacturing industries; electricity, gas and water supply; construction.

TFC in industry excludes electricity generation, which is treated separately as an energy transformation process in the national energy balance (SEI, 2009).

Regional Energy Balance Results

The extrapolation of the national energy balance regionally is set out below.

Table 1: Regional Energy Balance Estimates 2008

2008 ktoe*	National	CE ⁽¹⁾	G	LM	MO	RN	SO	DL	Region
Total final consumption	13400	378	716	96	396	197	199	425	2393
Industry excl. Electricity ⁽²⁾	1810	57	113	11	51	25	27	47	330
Industry electricity ⁽²⁾	686	22	43	4	19	9	10	18	125
Transport ⁽³⁾	5612	158	298	40	168	85	83	183	1014
Residential excl. Electricity ⁽⁴⁾	2452	64	131	18	72	35	36	84	440
Residential – electricity ⁽⁴⁾	733	19	39	5	22	10	11	25	131
Commercial services ⁽²⁾	1159	29	58	7	29	13	14	31	181
Public services ⁽²⁾	648	16	11	5	18	9	12	22	92
Agricultural – oil ⁽⁵⁾	251	12	19	5	15	9	6	13	79
Agricultural – elec ⁽⁵⁾	48	2	4	1	3	2	1	2	15

Notes:

* ktoe is a standard energy unit, kilo-tonnes of oil equivalent

1/ Abbreviated county names: CE (Clare), G (Galway), LM (Leitrim), MO (Mayo), RN (Roscommon), SO (Sligo), DL (Donegal)

2/ Industry and services (Commercial and Public) energy consumption regionally are based on extrapolation of labour force information from Census data (CSO, 2006)

3/ Transport energy extrapolation is based on vehicles under licence in each county (Department of Transport, 2008)

4/ Residential energy consumption is extrapolated based on number of households in each county (CSO, 2006)

5/ Agricultural energy is extrapolated based on farmed land in each county (CSO, 2000). Oil can be diesel or other fuels used in agriculture. All oil used in agriculture is assumed to be for propelled vehicle use.

We set out below the estimated TFC proportion by fuel for each county in the region, together with the general assumptions made in profiling the fuel mix within the region. It must be noted that these assumptions may not accurately reflect the energy mix, but it is a useful starting point in understanding regional energy use.

Table 2: Estimated TFC Proportion by Fuel and County 2008

% TFC by fuel 2008	National	CE ⁽⁷⁾	G	LM	MO	RN	SO	DL
Coal ⁽¹⁾	2.8	2	2	2	2	2	2	2
Peat ⁽²⁾	2.1	4	4	4	4	4	4	4
Oil ⁽³⁾	63.7	73	68.8	75	73	75	75	75
Natural Gas ⁽⁴⁾	12.4	2	6.2	0	2	0	0	0
RES ⁽⁵⁾	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Electricity ⁽⁶⁾	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1

Notes:

1/ We assume a lower than average coal consumption for the region due to the wider availability of peat. Large cement plants are not located in the region. Coal excludes power generation. 2% is an estimate which has not been validated.

2/ We assume a higher than average peat use for the region. All TFC peat consumption is in the residential sector. A 2002 survey (ESRI, 2003) reported 5% peat use for domestic central heating in Urban BMW (Border Midlands Western) region and 15% in Rural BMW. When adjusted to include homes without central heating, this becomes 4% and 11% respectively. These figures do not directly represent the WDC geographic region and many changes have occurred in the housing stock and energy infrastructure in the intervening period. Oil, gas and biomass heating have increased in the region since 2002. The 4% figure is an author's estimate which has not been validated.

3/ This calculation is the residual of the proportion of other fuels in each county

4/ There is no natural gas infrastructure in Leitrim, Sligo, Roscommon or Donegal. Clare estimate is from a regional study (MWRA, 2007) based on the introduction of natural gas to the region in 2000. We use the same figure for Mayo. For Galway we use an unvalidated estimate of 6.2%, which is half the national proportion.

5/ In the absence of sufficient regional data, the national average is used. We assume that heating is the dominant application for RES (Renewable Energy Source) in TFC.

6/ For electricity we have used the national average for the region.

Combining the regional energy balance with estimates of TFC by fuel gives an indicative profile of fuel use by county, as set out in Table 3. This includes transport, thermal and electricity consumption. Removal of transport, electricity and agricultural energy gives an estimate of thermal energy consumption in the region, shown in energy terms in Table 4 and in % terms in Figure 1. An estimate according to different fuel types can then be derived and is given in Table 5.

Table 3: Energy Balance by Fuel and County 2008

ktoe 2008	National	CE	G	LM	MO	RN	SO	DL	WDC
Coal	380	8	14	2	8	4	4	9	48
Peat	280	15	29	4	16	8	8	17	96
Oil	8534	276	493	72	289	148	149	319	1746
Natural Gas	1659	8	44	0	8	0	0	0	60
RES	253	7	14	2	8	4	4	8	46
Electricity	2294	65	122	16	68	34	34	73	412

Table 4: Estimate of Thermal Component of TFC by Sector and County 2008

ktoe 2008	National	CE	G	LM	MO	RN	SO	DL	WDC
<i>Residential</i>	2498	65	134	18	74	35	37	86	448
<i>Industry</i>	1810	57	113	11	51	25	27	47	330
<i>Services</i>	1027	26	37	6	25	12	15	29	149
Thermal Total	5335	148	284	35	149	72	78	162	197

Notes:

- * Transport energy use, electrical energy, agricultural energy were removed from the energy balance
- * Electricity for heating (4%) has been split equally between the residential and services sectors
- * Numbers are indicative estimates only and are likely to have an unreliably high margin of accuracy
- * Assumes all RES is for thermal applications, ignoring e.g. solar PV and micro-wind.

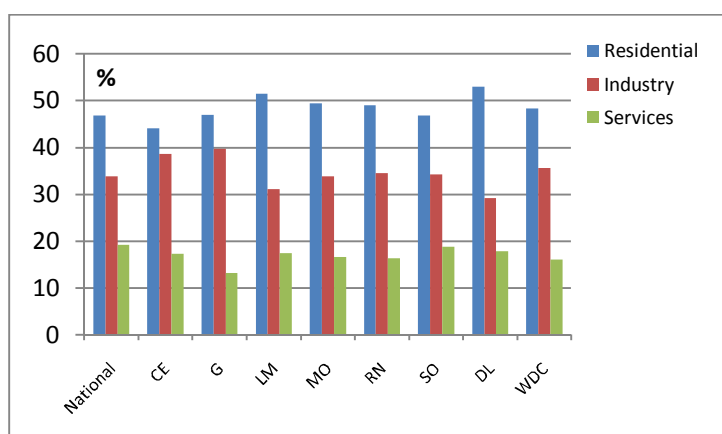


Figure 1: Estimated Split of Thermal TFC by Sector 2008

Table 5: Estimated TFC for Thermal Use by Fuel and County % 2008

Column %	National	CE	G	LM	MO	RN	SO	DL	WDC
Coal	7	5	5	6	5	6	5	5	5
Peat	5	10	10	11	11	11	10	11	10
Oil	50	73	62	76	72	76	78	77	71
Natural Gas	31	5	16	0	5	0	0	0	7
RES	5	5	5	5	5	5	5	5	5
Electric heating	2	2	2	2	2	2	2	2	2

Demand Estimates for 2020 for Biomass Heating

A further analysis of the regional energy balance can give broad estimates of biomass demand for heating by county.

But first it is necessary to take account of the overall energy forecast for 2020. The effect of expected energy efficiency measures is expected to reduce in particular the overall thermal component of TFC to 4,931 ktoe nationally (Permanent Representation of Ireland to the EU, 2010). This represents an 8% reduction overall. The consumption figures from Table 4 are adjusted pro-rata as inputs for estimating 2020 biomass demand, giving a projected thermal heat market of 857 ktoe for the region.

The national energy policy white paper (DCENR, 2007), sets out a target of 12% share of the overall heat demand by 2020 from renewable energy sources. Biomass is expected to supply 85% of this target (Buckley, 2010), or 10% of the overall target. If we apply this figure across each county, regardless of existing energy supply profile and infrastructure, we get a basis for 2020 biomass demand for heating applications. We will assume a blanket 10% figure across residential, industry and services sector for the region. This target figure for the region may well be exceeded. There are many variables unique to the region, and variations within the region, which can alter this. An example is the lack of natural gas infrastructure in Donegal, Sligo, Roscommon or Leitrim which gives biomass a competitive advantage. The established use of another solid fuel (peat) in the region may lead to a greater uptake. And the proximity to significant forest resources may lead to increased use of biomass for energy.

We will use oven-dry-tonnes (odt) of biomass, using a conversion of 1 toe = 45.37 GJ = 2.48 odt woody biomass. This uses a mean Lower Heating Value of untreated wood fuel of 18.32 GJ/tonne. An adjustment for 2.1% mean ash content was made (Savolainen & Berggren, 2000) based upon a large database of untreated wood fuel references.

The results are shown in Table 6 and a summary by county in Figure 2. These estimates ignore biomass for other uses, such as co-firing or other large bio-processing facility. No account has been taken of import or export of biomass from the region. Estimates are based solely on heat demand.

The overall size of the biomass heating market for 2020 in the region is estimated to be 217,000 (odt). The biomass estimates for heating reflect the heat market, with Galway accounting for 31% of biomass heating, Clare and Mayo 16%, Donegal 17% and the balance in the remaining counties.

Table 6: Biomass Heating Demand Estimates by Region and Sector 2020

'000 odt biomass 2020	National	CE	G	LM	MO	RN	SO	DL	WDC
Residential	584	15	31	4	17	8	9	20	105
Industry	423	13	26	3	12	6	6	11	77
Services	240	6	9	1	6	3	3	7	35
Total	1247	35	66	8	35	17	18	38	217

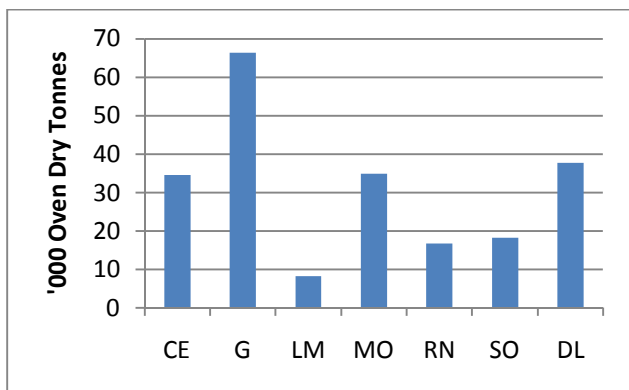


Figure 2: Biomass Heating Demand Estimates for 2020 by County

Bibliography

- Buckley, P. (2010, February 9th). Biomass Project Manager, Sustainable Energy Ireland.
- CSO. (2000). *Census of Agriculture 2000*. Central Statistics Office.
- CSO. (2006). *Census of Population*. Central Statistics Office.
- DCENR. (2007). *Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007 - 2020*. Dublin: Department of Communications, Energy and Natural Resources.
- Department of Transport. (2008). *Irish Bulletin of Vehicle and Driver Statistics*. Department of Transport.
- ESRI. (2003). *Irish National Survey of Housing Quality 2001-2002*. Economic and Social Research Institute.
- MWRA. (2007). *Energy and Emissions Balance for Mid West Region*. Mid-West Regional Authority.
- Permanent Representation of Ireland to the EU. (2010). *Submission from Ireland under Article 4(3) of Directive 2009/28/EC on the promotion of the use of energy from renewable sources*. Brussels.
- Polaski, K. (2009, February 8th). Renewables Division, Sustainable Energy Ireland.
- Savolainen, V., & Berggren, H. (2000). *Wood Fuels Basic Information Pack*. Jyväskylä, Finland: Gummerus Kirjapaino Oy.
- SEI. (2009). *Energy in Ireland Key Statistics 2009*. Sustainable Energy Ireland.
- SEI. (2009). *Greener Homes Scheme Applications Approved by County - Biomass Technologies September 2009*. Sustainable Energy Ireland.