Overview of Energy Supply in Ireland
Key Reference Documents

• SEAI *Energy in Ireland 1990* - Sustainable Energy Authority of Ireland, available online from http://www.seai.ie

• DCMNR 2007 *White Paper: Delivering a Sustainable Energy Future for Ireland* Government of Ireland Department of Communications Marine and Natural Resources, available online from http://www.dcmnr.ie

Energy Balance

- A balance Sheet for Energy
- Standard Format Compiled Annually by each Nation and submitted to the IEA (units toe)
- Irish Figures compiled and published by SEI
- Broken down by fuel type
- Basic Principle:

Net Fuel Supply = Net Fuel Consumption

TPES + Energy Gained in Conversion (Negative) = TFC
Lecture Summary

• The Energy Balance
• Security of Supply
• Energy Intensity
• Energy Trends
• Electricity Supply
• Sectoral Energy Trends – Industry, Transport, Commercial, Residential
• Industrial Energy Prices
Ireland Provisional Energy Balance


Questions:
1. What was the total primary energy supply in Ireland in the year under review?
2. What was the dominant fuel type?
3. What percentage of Ireland's Primary Energy Supply was imported?
4. What was the most significant indigenous fuel source?
5. What percentage of Ireland's Energy Supply came from renewable sources and what was the most significant renewable fuel source?
6. What was the total Final Energy Consumption in Ireland? Can you give reasons for the differences between this and primary energy supply?
7. Which Sector was the largest total consumer of energy?
8. What was the overall efficiency of electricity generation in Ireland in the year under review?
Ireland Energy Balance 2010 in Graphical Form

Source: SEAI *Energy in Ireland*
Security of Supply

- An analysis of security of supply considers how exposed a nation is to the risk of not being able to meet its future energy requirements.
- Among the factors to be considered are:
  - Import dependency and known indigenous energy resources, as a nation has more control over its indigenous resources a low import dependency increases security of supply.
  - Penetration of Renewables: In an era of uncertainty over fossil fuel stock an increasing penetration of renewables increases security of supply.
  - Diversity: A nation with a diverse mix of energy sources is less exposed to shock affecting any one energy source. This increases security of supply
  - Strategic Stockpiles (EU Council Directive 68/414/EEC requires EU member states to hold at least 90 days worth of strategic reserves of petroleum)
  - Physical Infrastructure – Does the country have adequate electricity and gas networks? Does it have adequate roads and ports for the import and distribution of fuels?
  - Commercial Infrastructure – Are the energy markets within the country working effectively whether they are in public or private ownership? Are there any business risks (for example insolvency) which could prevent one or more major energy supply players from performing their role?
Import Dependency

Figure 31 Import Dependency of Ireland and EU

Source: SEAI Energy in Ireland
Energy Intensity

- Energy Intensity is Consumption of energy per unit of output.
- For country Gross Domestic Product is normally used as a measure of output but account must be taken of inflation if different years are to be compared.
- SEI compile Energy Intensity Figures against $\text{constant GDP}$ which is adjusted for the impact of inflation.
Energy Intensity in Ireland 1990-2006

Figure 8  Primary, Final and Electricity Intensity

Primary & Final Intensities (kgce/€ constant)

Electricity intensity (kWh/€ constant)

Source: SEAI Energy in Ireland
Energy Intensity Questions

• Suggest Reasons why energy intensity of Ireland has fallen significantly since 1990.
• Suggest reasons why electrical energy intensity has fallen by less than overall energy intensity.
• Suggest reasons why energy intensity has increased again in 2008
CO2 Emission Factors

- tCO$_2$ (tonnes CO$_2$) and tCO$_2$e (tonnes of CO$_2$ equivalent) have entered the lexicon since the advent of the Kyoto protocol to combat climate change due to emissions of greenhouse gases.
- The relative merits of alternative fuel sources in respect of greenhouse gas emissions can be observed by comparing their respective CO$_2$ emissions per unit of energy.
- Note that these factors are not constant. For fossil fuels they vary slightly depending on the source of the fuel. For electricity the figure varies significantly due to the fuel mix used in generation.
- Questions:
  - Which fuel type is worst and which best for greenhouse gas pollution?
  - How would widespread adoption of wind power affect these figures?
  - Peat was Ireland’s most significant indigenous fuel source in 2005. In your opinion should we try to further develop the peat industry or should we scale down peat production?

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<th>Liquid Fuels</th>
<th>t CO$_2$/TJ (NCV)</th>
<th>g CO$_2$/kWh (NCV)</th>
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<td>Motor Spirit (Gasoline)</td>
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<td>Jet Kerosene</td>
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<td>Other Kerosene</td>
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<td>Gas/Diesel Oil</td>
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<td>Residual Oil</td>
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<td>LPG</td>
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<td>Naphtha</td>
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<td>Petroleum Coke</td>
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<td>Coal</td>
<td>94.6</td>
<td>340.6</td>
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<td>Milled Peat</td>
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<tr>
<td>Sod Peat</td>
<td>104.0</td>
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<td>Peat Briquettes</td>
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<td>Natural Gas</td>
<td>56.9</td>
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<th>Electricity</th>
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<tr>
<td>(2010)</td>
<td>161.5</td>
<td>528.2</td>
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</table>

Source: SEI Energy in Ireland
Trends (Looking Backwards)

Source: SEAI, Energy in Ireland
Question on Energy Trends

• When did “the Celtic Tiger” really take off?
• Did Primary Energy Requirement rise in line with GDP? Suggest Reasons?
• Did CO$_2$ emissions rise in line with Primary Energy? Suggest Reasons.
• What impacts would you expect the current recession to have on TPER and on C0$_2$ emissions?
• Why do you think energy consumption did not fall in line with gdp in 2008?
Energy Trends by Fuel

Figure 2: Total Primary Energy Requirement

Source: SEAI *Energy in Ireland*
Exercise

• Use the numerical data from Energy in Ireland of TPER by fuel type to
  1. Plot Pie Charts (Excel) for 1990 and 2009 of share of different fuels in Irelands Energy Supply mix
  2. Comment on the trend and identify our most significant dependencies.
Energy By Mode of Application

Figure 4  Primary Energy by Mode of Application

Source: SEAI Energy in Ireland 1990-2009
Trends: Total Final Consumption

• The Previous Slides look at trends in Primary Energy Supply.
• Consumption drives supply so the trend in TFC tells a similar story to TPER
• It can be argued that TFC is not as true a picture as TPER because TFC handles electricity in the same manner as other fuels when in fact electricity is a derived energy source. Discuss.
Total Final Consumption by Fuel Type

Figure 6  Total Final Consumption by Fuel

Source: SEAI *Energy in Ireland*
Questions

• Look again at TPER by mode of application – What mode shows the most significant growth rate. What fuels are most impacted by this?

• Compare the relative positions of electricity in TPER by mode and TFC by Fuel. Discuss.
Focus on Electricity

Figure 10  Flow of Energy in Electricity Generation 2010

Source: SEAI  Energy in Ireland
Efficiency Of Electricity Supply

Figure 12  Efficiency of Electricity Supply

Source: SEAI *Energy in Ireland 1990-2009*
Primary Fuel Mix for Electricity Generation

Source: SEAI *Energy in Ireland*
Figure 23  *Renewable Energy Contribution to Gross Electricity Consumption (RES-E normalised)*

Source: SEAI *Energy in Ireland*
Electricity Questions

• Which Forms of Electricity Generation are most efficient.

• Suggest reasons for the dramatic improvement in Efficiency since the mid 1990s (both mechanisms and driving factors should be considered)
Sectoral Energy Trends

Figure 3  Total Primary Energy Requirement by Sector

Source: SEAI Energy in Ireland
Sectoral Energy Trends Questions

• If necessary refer to the tabular data in Energy in Ireland to answer these questions

• Which Sector’s energy requirement has grown most rapidly?

• Which Sector has grown least?

• What factors determine the energy growth rate in each sector?

• How is electricity accounted for in these figures?
Industry

Figure 45  Industry Final Energy Use by Fuel

Source: SEAI *Energy in Ireland*
Industry

Figure 47  Industry Energy Intensity

Source: SEAI Energy in Ireland
Industry Continued

• What is meant by Industrial Energy Intensity?
• What is the unit kgoe/€2006?
• Suggest Reasons Why Ireland's industrial energy intensity has fallen dramatically since 1990
• National energy intensity rose slightly in 2008 but industrial energy intensity continued to fall. Discuss possible reasons for this.
Transport

Figure 50  Transport Final Energy Use by Fuel

Source: SEAI Energy in Ireland
Transport Energy Demand by Mode

Figure 51  Transport Energy Demand by Mode 1990 - 2010

Source: SEAI Energy in Ireland
Questions

• Discuss the different responses of Road Freight and private transport to the economic turmoil post 2008.

• What is meant by “Fuel Tourism”? Suggest reasons for its prevalence in the period 1995-2008
Commercial and Public Sector

Figure 68  Commercial and Public Services Final Energy Use by Fuel

Source: SEAI Energy in Ireland
Residential Energy Demand

Figure 61: Residential Final Energy Use by Fuel

Source: SEAI *Energy in Ireland*
Figure 63  Unit Consumption of Energy per Dwelling (permanently occupied)

Source: Based on SEAI, CSO and Met Eireann data

Energy Per Dwelling

Source: SEAI  *Energy in Ireland*
Residential Questions

• Total energy per dwelling has not increased substantially since 1990 yet total residential energy demand has grown substantially. Discuss.

• Give Reasons why Fossil Fuel Demand per dwelling has fallen while electricity demand per dwelling has risen

• Discuss the factors that affect the residential energy demand fuel mix and the timescales involved.
Questions

• Which Sector is most dependent on Electricity. Why?

• If government policy was to try to switch demand from fuel type A to fuel type B which sector do you think might be most responsive, explain your reasons.
Energy Prices
Figure 34  *Electricity Prices to Industry*

Source: SEAI *Energy in Ireland*
Figure 35  Fuel Oil Prices to Industry

Source: SEAI Energy in Ireland