Meeting Ireland’s Ambitious GHG 2050 Emissions Target

UCC IEA-ETSAP Energy Modelling Conference
November 15 2010

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Overview

• Context
• 80% Emissions Reduction Scenario
• Irish TIMES Model
• Results
• Conclusions
• Next Steps
Ireland 2009

Total GHG emissions: 62 Mt CO2e

- Agriculture: 29% (large impact)

- Energy: 65%
  - Power gen + refining 21%
  - Transport 21%
  - Residential 12%
  - Industry and Services 11%

- Process Emissions (Industry): 4%

- Waste: 2%
In Ireland, relative to 1990 …
- we are committing to 80% GHG Emissions Reduction by 2050 (F CC Bill 2010)
- GHG emissions grew by 24% by 2005

Energy related CO₂ emissions
- represent 65% of total GHG
- grew by 50% by 2005

This research
- focuses on energy-related CO₂ emissions only.
- implicitly assumes 80% applied to each sector

<table>
<thead>
<tr>
<th>Year</th>
<th>1990 (Ref)</th>
<th>2005</th>
<th>2009</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Emissions</td>
<td>55.6</td>
<td>69.0</td>
<td>62.3</td>
<td>MtCO₂eq</td>
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<tr>
<td>Increase</td>
<td>-</td>
<td>24%</td>
<td>12%</td>
<td>%</td>
</tr>
<tr>
<td>2050 Target</td>
<td>11.1</td>
<td></td>
<td></td>
<td>MtCO₂eq</td>
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<tr>
<td>Reduction</td>
<td>80%</td>
<td>84%</td>
<td>82%</td>
<td>%</td>
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</table>

Energy-related
<table>
<thead>
<tr>
<th>Year</th>
<th>1990 (Ref)</th>
<th>2005</th>
<th>2009</th>
<th>Units</th>
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<tbody>
<tr>
<td>Total Emissions</td>
<td>30.2</td>
<td>45.0</td>
<td>39.4</td>
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<tr>
<td>Increase</td>
<td>-</td>
<td>49%</td>
<td>30%</td>
<td>%</td>
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<tr>
<td>2050 Target</td>
<td>6.0</td>
<td></td>
<td></td>
<td>MtCO₂eq</td>
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<tr>
<td>Reduction</td>
<td>80%</td>
<td>87%</td>
<td>85%</td>
<td>%</td>
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</table>
• Is it technically feasible?
• If so, at what cost?
• How much does energy efficiency do?
• What is the share of renewable energy?
• Will there be significant electrification of transport and heat?
• Can we meet the target with indigenous resources?
• Is our short term pathway aligned?
• Jan – June 2010
  – EN1 16% RES and 10% RES-T by 2020 ✓
  – EM1 20% lower Non-ETS GHG 2020 ✓
  – Energy service demand to 2050 ✓
• Jul – Dec 2010
  – EM2 GHG 80% decrease by 2050 ✓
  – IEA Workshop Cork November 15 2010 ✓
  – EN2 Energy Security in 2050
Reference Energy System – CO₂

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Energy CO₂ Emissions - REF

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Meeting Ireland’s 2050 Emissions Target

Services - Renewables

Industry – Renewables
Transport – Biofuels, Elec & H₂

Electrification
Meeting Ireland’s 2050 Emissions Target

Renewable Energy – 70%

- Renewable Energy
- 70%

2005 - 2010 - 2020 - 2030 - 2040 - 2050

RES-E RES-H RES-T

RES-E RES-T RES-H

IE-REF IE-80%

Mtoe

Wind Hydro Ocean Solar PV Biodiesel Biogas BioEthanol Biomass Geothermal Solar Thermal
Comparing Targets - Transport

At What Cost?

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2050</th>
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<tr>
<td>-40% Emissions by 2050</td>
<td>43.79</td>
<td>58.79</td>
<td>78.02</td>
<td>73.17</td>
<td>74.69</td>
<td>52.89</td>
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<td>-60% Emissions by 2050</td>
<td>42.91</td>
<td>78.57</td>
<td>82.80</td>
<td>77.33</td>
<td>67.24</td>
<td>195.37</td>
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<td>-80% Emissions by 2050</td>
<td>42.31</td>
<td>88.29</td>
<td>85.58</td>
<td>82.83</td>
<td>128.25</td>
<td>438.71</td>
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</table>
Interim Conclusions

• Technology can deliver 80% reduction energy-related CO₂ emissions by 2050
• 25% reduction in Energy Demand
• Electrification => 2.4-fold increase on 2005
• Elec = 38% of TFC (18% currently)
• RE = 70% of Energy Use (47% non elec)
• Marginal CO₂ cost €42 - €439 per tCO₂

Next Steps

• Scrutinise resource and sectoral results
• Validate electricity results using PLEXOS
• Check imports versus indigenous
• Develop energy security scenario
• Examine ‘interim’ 2020 scenarios (30%)
• Explore regional UK-IE TIMES?
• Consider impact of non-energy emissions
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