National Bioenergy Conference
2012

Published by
Teagasc,
Crops Environment and Land Use,
Oak Park Crops Research,
Carlow

Wednesday, 25 April 2012

Tel: 059-9170200
Fax: 059-9182097
Programme

9.00am Registration/ Tea/Coffee

9.30am Welcome Address by Jim O’Mahony, Teagasc

9.45am **Session 1: Irish Bioenergy Policy**  
*Chair: Dr. John Finnan, Teagasc*

EU’s Sustainability, Food/Fuel Criteria  
Andreas Pilzecker, EU Commission

Meeting 2020 Targets with Bioenergy  
Barry Caslin, Teagasc

Leader – Bioenergy funding options  
Joe Potter, Westmeath Leader

10.50am Questions and Answers

11.05am Tea/Coffee – View Exhibition Stands

11.30am **Session 2: Delivering Bioenergy to the Market**  
*Chair: Peter Young, Irish Farmers Journal*

Beet to Ethanol  
Chris Harmon, BEET Ireland

Anaerobic Digestion  
Cathal Gallagher, Bord Gais

Biomass to Mega Watts  
John O’Halloran, Bord na Mona

12.35pm Questions and Answers

13.00pm Lunch – View Exhibition Stands
14.00pm  **Session 3: Forestry our largest resource**  
*Chair: Mary Ryan, Teagasc*

Timber Supply and Demand  
**Henry Phillips**

Supplychip – Locating the resource  
**Joanne Fitzgerald, Teagasc**

Leveraging additional biomass from the forest resource  
**Tom Kent, Waterford Institute of Technology**

Warming to Wood Energy – Clare County Council  
**Tom Coughlan, Clare County Manager**

15.10pm  Questions and Answers

15.30pm  **Session 4: Panel Discussion – Bioenergy Offers on the table**  
*Chair: Damien O'Reilly, RTE*

John Gilliland, Rural Generation  
Donal Whelan, ITGA  
Paddy O'Toole, Quinns of Baltinglass  
Pat Farrelly, Farrelly Willow  
Des O'Toole, Coillte  
Declan Kennedy, Biotricity  
Joe O’Carroll, Imperative Energy

16.30pm  Close of Conference  
**Tom Kelly, Head of Knowledge Transfer, Teagasc**
Contents

1) EU’s Sustainability – Food/Fuel Criteria  
   Andreas Pilzecker, European Commission

2) Meeting 2020 Targets with Bioenergy  
   Barry Caslin, Teagasc

3) Leader – Bioenergy funding options  
   Joe Potter, Westmeath Leader

4) Beet to Ethanol  
   Chris Harmon, BEET Ireland

5) Future for Renewable Gas in Ireland  
   Cathal Gallagher, Bord Gais

6) Biomass to Mega Watts  
   John O'Halloran, Bord na Mona

7) Timber Supply and Demand  
   Henry Phillips

8) Supplychip – Locating the resource  
   Joanne Fitzgerald, Teagasc

9) Leveraging additional biomass from the forest resource  
   Tom Kent, Waterford Institute of Technology

10) Warming to Wood Energy – Clare County Council  
    Tom Coughlan, Clare County Manager
Content of the presentation

- EU Policy Framework
- Biofuel sustainability requirements, monitoring and review
- Impacts on agricultural markets
- Baseline Study 2008
- EU actions to promote the next generation biofuels and sustainable bioenergy


- Part of the EU climate and energy package (20/20/20)
  - A single, comprehensive Directive for 20% renewable energy in the EU in 2020
    - Combat climate change, environment protection
    - Security of energy supply, diversification of energy supply sources
    - Green jobs, innovation
    - Regional development, especially in rural and isolated areas
- Mandatory targets
  - Specific 10% target for renewable energy in transport
    - No specific biofuel target
    - Apart from biofuels: electric vehicles, hydrogen
- Biofuel sustainability: criteria & monitoring
**EU sustainability criteria for biofuels**
irrespective of whether the raw materials were
cultivated inside or outside the territory of the EU

- GHG saving of at least 35% (50%–60% from 2017/18) compared to fossil fuel
- No conversion of land with high carbon stock and/or
  high value for biodiversity
  - Densely forested areas, wetlands, peatlands
  - No raw material from land with high biodiversity value
  - Primary forest, nature protection areas, highly biodiverse grasslands
- Have to be met in order to:
  - Count toward the targets of the EU Member States (10% and the 20%)
  - Count toward obligations (put on suppliers)
  - Be eligible for financial support (for their consumption)

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**Impacts of EU policy on wider sustainability issues**

- Difficult to link to individual consignments of biofuel
  and
- Raises issues under international law
  therefore
- Addressed through:
  - International cooperation instruments
  - Voluntary certification schemes
  - Monitoring, Reporting

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**EU actions - cooperation with third countries**

- ACP-EU Energy Facility: priority given to access to energy projects which allow not only the supply of electricity but also projects which have a demonstrated impact on agriculture-related and other economic activities
- GBEP (UN CSD partnership): 24 sustainability indicators were adopted in November 2011 as a set of analytical tools that can inform the development of national bioenergy policies and programs and monitor the impact of these policies and programs, environmental, social and economic aspects of sustainable development are covered
EU sustainability schemes for biofuels

The Commission has approved 7 voluntary schemes, more to come soon, check on
http://ec.europa.eu/energy/renewables/biofuels/sustainability_schemes_en.htm:

- ISCC (International Sustainability and Carbon Certification: companies, research, NGO’s, industry associations)
- Bonsucro EU (a roundtable initiative: companies and WWF)
- RTRS EU RED (Round Table on Responsible Soy EU RED: companies and civil society, including NGOs)
- RSB EU RED (Roundtable of Sustainable Biofuels EU RED: companies and civil society, including NGOs)
- 2BSvs (Biomass Biofuels voluntary scheme: EU companies’ based scheme)
- RBSA (Abengoa RED Bioenergy Sustainability Assurance: EU based company scheme)
- Greenenergy (Brazilian Bioethanol verification programme, for Brazilian sugarcane only)

Monitoring and reporting

- December 2010: Report on Indirect land use change (‘ILUC’)
  Conclusion: ILUC can reduce the GHG-benefits of using biofuels. But considerable uncertainties and limitations associated with the modeling

  Accompanying documents include also statistical data and analysis on biofuels production and imports from third countries

- By 31 December 2011: reports of each EU Member State on progress in the production and use of energy from all renewable sources


  Report will also include information on the origin and impacts of the EU policy in the EU and in third countries

EU action – broader renewable energy framework

- Sustainability of solid biomass for energy
  Conclusion of the work soon

- Renewable energy progress reports available:

- Commission’s first progress report due end of 2012

- Renewable Energy Strategy beyond 2020
  Communication forthcoming
Renewable Energy Directive: Safeguards

Member States report on changes in commodity prices and land use (1st report was due by the end of last year)

The Commission monitors the commodity price changes

Based on 1. and 2., the Commission reports on the impact on sustainability, considering economic and environmental impacts (by end of 2012 for the first time)

If appropriate, it proposes corrective action

Monitoring and reporting by the Commission

Article 23 (1)
The Commission shall monitor the origin of biofuels and bioliquids consumed in the Community and the impact of their production on land use in the Community and the main third countries of supply. Such monitoring shall be based on Member States’ reports and those of relevant third countries, intergovernmental organisations, scientific studies and any other relevant pieces of information. The Commission shall also monitor the commodity price changes associated with the use of biomass for energy and any associated positive and negative effects on food security.

Article 23 (5)
The Commission shall, if appropriate, propose corrective action.

Article 23 (8)

Monitoring and reporting by the Commission

By 31 December 2014, the Commission shall present a report, addressing, in particular, the following elements (…) an assessment of the feasibility of reaching the target whilst ensuring the sustainability of biofuels production in the Community and in third countries, and considering economic, environmental and social impacts, including indirect effects and impacts on biodiversity, as well as the commercial availability of second-generation biofuels; the impact of the implementation of the target on the availability of foodstuffs at affordable prices; (…) On the basis of that report, the Commission shall submit, if appropriate, proposals to the European Parliament and the Council, addressing the above elements.
What impacts on agricultural markets?

Agricultural activities related to the renewable energy sector generate a gross value added of well over €9 bn per year.

DG Agriculture (2010)

Sources


Joint Research Centre – IPTS: “Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment”
### EU Biofuels market, 2010–2020 (billion litres)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable production</td>
<td>15.8</td>
<td>16.7</td>
<td>18.1</td>
<td>16.7</td>
</tr>
<tr>
<td>of which biodiesel</td>
<td>5.6</td>
<td>6.6</td>
<td>7.3</td>
<td>6.6</td>
</tr>
<tr>
<td>of which 2nd gen.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Consumption</td>
<td>18.8</td>
<td>21.0</td>
<td>21.6</td>
<td>18.0</td>
</tr>
<tr>
<td>of which biodiesel</td>
<td>6.7</td>
<td>8.0</td>
<td>8.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Net trade</td>
<td>-2.3</td>
<td>-2.5</td>
<td>-2.5</td>
<td>-2.5</td>
</tr>
<tr>
<td>of which biodiesel</td>
<td>-1.1</td>
<td>-1.6</td>
<td>-1.3</td>
<td>-1.1</td>
</tr>
<tr>
<td>of which 2nd gen.</td>
<td>-1.2</td>
<td>-0.7</td>
<td>-1.2</td>
<td>-1.3</td>
</tr>
</tbody>
</table>

### EU cereal market projections, 2010–2020 (mio t)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable production</td>
<td>296.1</td>
<td>277.8</td>
<td>277.3</td>
<td>185.1</td>
</tr>
<tr>
<td>Consumption</td>
<td>288.5</td>
<td>271.7</td>
<td>277.7</td>
<td>203.4</td>
</tr>
<tr>
<td>of which bioenergy</td>
<td>7.6</td>
<td>8.3</td>
<td>10.5</td>
<td>10.3</td>
</tr>
<tr>
<td>Bioenergy %</td>
<td>2.7%</td>
<td>8.4%</td>
<td>5.9%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Imports</td>
<td>8.8</td>
<td>10.3</td>
<td>16.4</td>
<td>13.0</td>
</tr>
<tr>
<td>Exports</td>
<td>27.4</td>
<td>31.8</td>
<td>30.8</td>
<td>22.8</td>
</tr>
</tbody>
</table>

### EU vegetable oils market projections, 2009–2020 (mio t)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable production</td>
<td>14.6</td>
<td>14.5</td>
<td>14.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Consumption</td>
<td>23.3</td>
<td>22.4</td>
<td>22.6</td>
<td>26.1</td>
</tr>
<tr>
<td>of which bioenergy</td>
<td>9.1</td>
<td>9.1</td>
<td>8.5</td>
<td>13.9</td>
</tr>
<tr>
<td>Bioenergy %</td>
<td>38.8%</td>
<td>40.0%</td>
<td>40.3%</td>
<td>53.2%</td>
</tr>
<tr>
<td>Imports</td>
<td>9.4</td>
<td>8.8</td>
<td>10.0</td>
<td>11.3</td>
</tr>
<tr>
<td>Exports</td>
<td>0.9</td>
<td>1.2</td>
<td>0.9</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Analyses and discusses the global impacts of the RE target for transport on agricultural production, markets and land use, as simulated by three agricultural sector models, AGLINK-COSIMO, ESIM and CAPRI.

The impacts identified include higher EU production of ethanol and biodiesel, and of the crops used to produce them, as well as more imports of both biofuels. However, as the extra demand is small in world market terms, the impact on world market prices is limited.

Impact on biodiesel feedstock prices

Impact on ethanol feedstock prices
ESIM: impact on oilseed complex

Prices for the main EU-produced biodiesel inputs (oilseeds, plant oils) increase. The prices of rapeseed and sunflower seed increase by 9.7% and 11.2% respectively, and those of rapeseed oil and sunflower seed oil by just over one-third.

The prices of rapeseed and sunflower seed meals fall by a third or more.

ESIM: impact on grain prices

EU prices for ethanol inputs are higher, by 8%, 21% and 22% for soft wheat, sugar and maize, respectively.

Summary – Impacts
**Key findings of the EU Study “Biofuels Baseline 2008” – land use**

- If accounting for co-products that reduce land needs elsewhere, the total net land use for EU biofuels is estimated at 3.6 Mha.
- The increase in biofuel production in the EU between 2000 and 2008 has led to an increased global agricultural land use of 1.3 Mha (0.02% of global agricultural land).
- A part of the land used for biofuels feedstock production became available through yield improvements of other crops, or at the cost of decreasing production of other crops.
- Countries, mostly influenced in their land use by biofuel export to the EU market - Argentina (soybean), Brazil (soybean and sugarcane), USA (soybean) and Ukraine (rapeseed), to some extent - Malaysia and Indonesia (both oil palm).

**Key findings of the EU Study “Biofuels Baseline 2008” – environmental and social impacts**

- Increased EU biofuel consumption is estimated to have contributed only little to the historical cereal price increases in 2007 and 2008.
- The EU biofuel demand is estimated to account for a rather small share of local environmental impacts from biofuel crop cultivation in most exporting countries.
- Several third countries providing biofuels or feedstocks for the EU market seem to have insufficient requirements for Environmental Impact Assessments.
- In the EU, over 100,000 people may have a job relating to biofuels. This figure in Brazil and its biofuel production may be over 1.5 million, half of which in Brazilian land and related ethanol production.

**EU actions - incentives for advanced biofuels (produced from ligno-cellulosic feedstock and wastes)**

- Counting double towards the 10% target and towards Member States’ biofuel obligations put on suppliers.
- Supported under the 7th RTD Framework Programme (research).
- Specific initiatives under the Strategic Energy Technology (SET) plan, including the European Industrial Bioenergy Initiative (technology transfer and up-take).
Conclusions:

EU rules for sustainability of bioenergy are evolving

Impact of the 10% target for RE in transport on agricultural markets and food prices is low to moderate

Need to monitor and improve
Meeting 2020 Targets with Bioenergy

National Bioenergy Conference

Hodson Bay Hotel, Athlone, Co. Roscommon
April 25th 2012
Barry Caslin, Teagasc, Bioenergy Specialist
barry.caslin@teagasc.ie

Ireland’s Renewable Targets

RED 2009/28/EC – 16% TFC by 2020

- RES-E 40% renewable contribution by 2020
- RES-T 10% renewable contribution by 2020
- RES-H 12% renewable contribution by 2020

Additional Targets
30% co-firing with biomass at peat power stations 2015
800MWe of CHP by 2020
Energy Forecasts

- TFC RES-E 2,665 ktoe
- TFC RES-H 4,126 ktoe
- TFC RES-T 4,910 ktoe
- TFC for 2020 = 11,701 ktoe

16% = 1,872 ktoe

What Technologies?

- RES – E (5.6% bioenergy)
  - Wind
  - PV
- RES – H (9.7% bioenergy)
  - Geothermal
  - Solar
- RES – T (8.6% biofuel and 1% electric)
  - Bioethanol
  - Biodiesel
  - PPO

Bioenergy Contribution to TFC

<table>
<thead>
<tr>
<th>Sector</th>
<th>2020 (ktoe)</th>
<th>% biomass</th>
<th>ktoe biomass</th>
<th>GWh biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>RES-E</td>
<td>2,665</td>
<td>5.6%</td>
<td>149</td>
<td>1,733</td>
</tr>
<tr>
<td>RES-H</td>
<td>4,126</td>
<td>9.7%</td>
<td>400</td>
<td>4,652</td>
</tr>
<tr>
<td>RES-T</td>
<td>4,910</td>
<td>8.6%</td>
<td>245</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11,701</td>
<td>7.6%</td>
<td>894</td>
<td>6,385</td>
</tr>
</tbody>
</table>
Bioenergy in Ireland

- Wood residues – pulpwood, sawmill residues, forestry residues, recycled wood.
- Dry agricultural residues – straw, poultry litter, spent mushroom compost.
- Wet agricultural residues – animal manure / slurry.
- Industry residues – sludge, fats, meat & bonemeal, food processing residues.
- Purpose grown energy crops – oilseed rape, cereals, sugar beet, short rotation coppice willow, miscanthus.
- Others – recovered vegetable oil.

Ireland Land Situation 2011

<table>
<thead>
<tr>
<th>Area type</th>
<th>Area (ha)</th>
<th>Production (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grassland</td>
<td>3,466,767</td>
<td></td>
</tr>
<tr>
<td>Hill / Rough Land</td>
<td>471,400</td>
<td></td>
</tr>
<tr>
<td>Forestry</td>
<td>277,900</td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>471,100</td>
<td></td>
</tr>
</tbody>
</table>

Why Do We Need Energy Crops?

- Kyoto agreement
- Global warming
- Depletion of fossil fuels
- Fuels and Security
- Increasing energy prices
Biomass Conversion Technologies

- Biomass - Heat only
- Biomass CHP – Large & Small
- Biomass to Power
- Waste to Energy – CHP
- Waste to Energy – Power only
- Electricity co-firing with biomass
- Anaerobic Digestion (AD) on farm
- Biogas – on / off farm
- Municipal Sewage AD
- Landfill Gas
- Biofuels (Bioethanol, Biodiesel, PPO)

RES-E biomass forecasts

2020 forecast Gross Final Consumption = 2,665 ktoe

100 MWe of Solid Biomass CHP
50 MWe of AD CHP

Result
(Power)
150 MWe or 84 ktoe biomass produced electricity

RES - E agricultural biomass requirement

<table>
<thead>
<tr>
<th>149 ktoe biomass</th>
<th>MW Input Energy</th>
<th>kWtoe</th>
<th>Ha / t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass Edenderry Power</td>
<td>35</td>
<td>747 GWh</td>
<td>64 input 23 output</td>
</tr>
<tr>
<td>Biomass combustion Small scale CHP</td>
<td>100</td>
<td>825 GWh</td>
<td>223 input 71 output</td>
</tr>
<tr>
<td>AD CHP</td>
<td>50</td>
<td>151 GWh</td>
<td>36 input 13 output</td>
</tr>
</tbody>
</table>
**RES-T**

2020 Target is 10%

Forecasted demand for Transport = 345 ktoe

1% Electric Vehicles
9% biofuels

**RES - T agricultural biomass requirement**

<table>
<thead>
<tr>
<th>345 ktoe divided</th>
<th>ktoe</th>
<th>Litres</th>
<th>Hectares Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Use (61%)</td>
<td>210</td>
<td>266m</td>
<td>90,000 wheat or 60,000 sugar beet</td>
</tr>
<tr>
<td>Petrol Use (39%)</td>
<td>135</td>
<td>268m</td>
<td>230,000 OSR</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>534m</td>
<td>320,000</td>
</tr>
</tbody>
</table>

**RES- H biomass forecasts**

2020 forecast Gross Final Consumption = 4,126 ktoe

100 MWe of Solid Biomass CHP
50 MWe of AD CHP

Result

(H)
240 MW heat or 128 ktoe
### RES - H agricultural biomass requirement

<table>
<thead>
<tr>
<th></th>
<th>MW</th>
<th>Input Energy</th>
<th>kt Biomass</th>
<th>Ha / t</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP</td>
<td>240</td>
<td>1.488 GWh</td>
<td>128</td>
<td>52,000 ha willow and 127,000 t straw</td>
</tr>
<tr>
<td>Biomass Boilers heat only</td>
<td>790</td>
<td>3.945 GWh</td>
<td>339 input 27 output</td>
<td>1.3m fresh tonnes forest wood chip &amp; 18,000 ha of willow or miscanthus.</td>
</tr>
<tr>
<td>AD CHP</td>
<td>50</td>
<td>415 GWh</td>
<td>36 input 13 output</td>
<td>10,000 ha grass or slurry from 800,000 cattle</td>
</tr>
</tbody>
</table>

### Issues in reaching heat target

- Cost of energy crop production
- Support services / infrastructure
- Drying of willow/wood chips
- Miscanthus boiler
- Local supply chains
- Transport costs
- Coilltes supplies committed
- Getting farmers to thin plantations

### Summary

To meet the 2020 targets would require:

- 215 ktoe of forest pulpwood / thinnings (1.3 m fresh tonnes)
- 127,000 t straw from 25,000 ha of tillage ground
- 70,000 ha willow or miscanthus
- AD will contribute possibly 10,000 ha grass or slurry from 800,000 cattle.
- To meet the transport targets requires almost 1m ha of tillage land. This wont happen without imports.
Thank you for your attention!
The LEADER Approach - Rural Development Programme
LEADER Funding for Farm Diversification
Joe Potter – Westmeath Local Action Group
25th April 2012

Contents
• Delivery Structure
• LEADER, what is it?
• Context of the programme
• Details of the measures
• Details of grant levels
• Application to Approval Process
• Activity
• Questions

Local Action Groups- What are they?
- 53 Local Development Companies delivering a range of programmes.
Rural Companies deliver RDP (LEADER)
Using LEADER Approach very important for European funding in the future
“Links between actions for the Development of the Rural Economy”

The LEADER approach
- Local Implementation
- Local identification of needs and solutions
- Innovation in products and processes
- Networking of local actors and partners.
- Co-operation projects
- Focus on economic activity, expansion, development and sustainability and job creation.

What is LEADER

“Improve the quality of life in rural areas and diversify the rural economy”

EU 55% and state 45% funding.

Department of Environment, Community & Local Government

<table>
<thead>
<tr>
<th>Economic Dev. Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Diversification</td>
</tr>
<tr>
<td>Business Creation and Development</td>
</tr>
<tr>
<td>Encouragement of Tourism Activities</td>
</tr>
<tr>
<td>Training</td>
</tr>
</tbody>
</table>
**Enterprise Rates of Grant**

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Maximum Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>50% max of €150,000</td>
<td></td>
</tr>
<tr>
<td>Analysis &amp; Development</td>
<td>75% max of €30,000</td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**LEADER in Agriculture**

1. **Diversification into non-Agricultural Activities**

   **Aim:** to significantly increase the percentage of holdings where the fixed assets of the farm are utilised in any non-agricultural activity by a member of the farm household for economic gain.

   **Examples of possible projects:**
   - Agri-tourism including educational tourism
   - Farm shops
   - Energy conservation including biomass and forestry products
   - Arts and craft projects
   - Food Network
   - Horticulture products
   - Recycling projects using farm waste
   - Food production units

**Key Aspects of a Project**

**Evaluation Of Project**

- Promoter’s background and expertise
- Viability of the project
- Innovation
- Sustainability
- Markets for the product/service and non-displacement of existing enterprises
- Potential for job creation
- Benefits to the local area
- Cross checks with other Agencies
Application, Evaluation and Approval process

- Expression of interest meeting / discussion with rural development officer.
- Application process, Quotations, planning permission, business plan, etc
- Assessment by Evaluation Committee, recommendation to the Board.
- Approval or refusal of funding.
- Following approval letter of offer and contract to the promoter.
- Acceptance to be signed and returned within 14 days

Application, Evaluation and Approval process

- Contract expiry date. Extension @ discretion of Board
- Grant payment is made on completion and submission of valid documents.
- Site visits by staff. Further inspections possible by the Dept of Environment, Community and Local Government, Dept of Agriculture, Fisheries and Food Inspectors.
- Appeals process to LAG and Dept.

Important to note

1. Planning permission
2. Matching funds (bank statement or Loan approval)
3. Plan (business and marketing)
4. Quotations
5. Tax clearance applicant
6. C2 / Tax clearance contractor suppliers
7. Insurance
8. Proof of ownership / Lease (or legal agreement)
9. SFP documentation
Redeveloping the Irish Sugar Industry

Sugar Beet to Ethanol

Presentation at National Bioenergy Conference by Chris Harmon 25th April 2012

Presentation Content

• Introduction to BEET Ireland
• The Opportunity
• Sugar Beet to Ethanol
• The Road Ahead...

Introduction to BEET Ireland
What is BEET Ireland?

BEET Ireland is an Independent Steering Group
With No Links To the Former Sugar Industry

- Michael Hoey - MD of Country Crest
- Simon Cross - MD of Cross Agricultural Engineering
- Jim O’Regan - Grower representative from Cork
- Pat Cleary - Grower representative from Kildare/Laois/Carlow
- Brian Arnold - Business Consultant
- Chris Harmon - Financial Controller of Country Crest

BEET Ireland’s Vision

“To re-establish a sustainable sugar beet processing industry in Ireland where the beet grower is put at the heart of the business model”

The Journey so far..

Jan 2010 - Presentation at the National Tillage Conference
- Potential of a new sugar beet industry in Ireland

Oct 2010 - Series of beet grower meetings to gauge interest

Mar 2011 - Country Crest appointed PM Group to undertake feasibility study
- BEET Ireland formed
- Met Minister Coveney to announce launch of study
- Interim progress update to Minister

Sept 2011 - Feasibility Study/business plan presented to Minister

Oct 2011 - Formal endorsement of plan received from Minister
- Announcement of proposal to abolish sugar quotas
- Expressions of Interest sought

Nov 2011 - Series of further beet grower meetings

2012 - Reviewing regional locations / site selection
The Opportunity

Irish Policy Framework

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dairy</th>
<th>Beef</th>
<th>Pigmeat</th>
<th>Sheep</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Growth</td>
<td>€ million</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>700</td>
<td>200</td>
<td>150</td>
<td>50</td>
<td>15</td>
</tr>
</tbody>
</table>

The Irish Sugar Economy

*Every grain of sugar consumed in Ireland is imported*
 Targets for Bio-ethanol Use in Ireland
“10% of all transport fuels to be from renewable sources by 2020”

<table>
<thead>
<tr>
<th>Year</th>
<th>Target (ktoe)</th>
<th>Import (ktoe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>2013</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>2014</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>2015</td>
<td>90</td>
<td>59</td>
</tr>
<tr>
<td>2016</td>
<td>100</td>
<td>59</td>
</tr>
<tr>
<td>2017</td>
<td>110</td>
<td>69</td>
</tr>
<tr>
<td>2018</td>
<td>120</td>
<td>79</td>
</tr>
<tr>
<td>2019</td>
<td>129</td>
<td>89</td>
</tr>
<tr>
<td>2020</td>
<td>139</td>
<td>99</td>
</tr>
</tbody>
</table>

Source: NREAP

Redeveloping the Sugar Industry Will Impact

Sugar & Bio-Ethanol Processing Plant Represents A €400 million investment
Making Production Feasible

• Single location Sugar & Bio-ethanol plant
• 3 Phases for production expansion growing to 1.8 million tonnes sugar beet requirement
• Project financing by way of grower stake + equity + bank finance

Strategic Partnership With Growers

• Sugar Beet is critical raw material
• Traditionally supply prices negotiated in an employer/union type model
• New model will give growers a share in the value added processing profits as well as on-farm supply profits
• Grower partnership will ensure better working relationships and sustainable supply arrangements

The Business Case
Site Selection Is A Key Business Decision

Key Criteria:

- Proximity to Tillage Land
- Raw Material Supply – Sugar Beet
- Accessibility – Road Network
- Suitable Water Supply
- Natural Gas Supply
- Electricity Supply

- 5 regions analysed

Sugar Beet to Ethanol

Bio-ethanol plant elements < 10% of total capital spend
### Ethanol Production Process

- **Sugar Harvest**
- **Preparation**
- **Fermentation**
- **Distillation**
- **Final Product**

### Ethanol Production Capacity

<table>
<thead>
<tr>
<th>Phase</th>
<th>Sugar Beet (000 tons)</th>
<th>Ethanol Maximum (000m^3)</th>
<th>Ethanol Minimum (000m^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>800</td>
<td>47.0</td>
<td>4.8</td>
</tr>
<tr>
<td>2</td>
<td>1,200</td>
<td>56.0</td>
<td>6.5</td>
</tr>
<tr>
<td>3</td>
<td>1,800</td>
<td>56.0</td>
<td>11.0</td>
</tr>
</tbody>
</table>

This maximum production capacity almost equates to the 57 million litres of "bio-fuel in gasoline" consumed in Ireland in 2011.

*Source: NORA levy returns 2011*
**Sugar/Ethanol Production Cycle**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beet campaign</td>
<td>120 days</td>
</tr>
<tr>
<td>Thick juice campaign</td>
<td>210 days</td>
</tr>
<tr>
<td>Ethanol production</td>
<td>330 days</td>
</tr>
</tbody>
</table>

**The Road Ahead...**

**Driving the Project Forward**

- Feasibility
- Business Case
- Draft Outline
- Regulations
- Concepting
- Plan Project Implementation with Defined Timelines

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© BEET Ireland
Thank You!

Presentation at National Bioenergy Conference
by Chris Harmon
25th April 2012
Future for Renewable Gas in Ireland

National Bioenergy Conference 2012

Cathal Gallagher
New Energy & Technology

© Bord Gáis Energy

About Bord Gáis Éireann

Bord Gáis Éireann was founded in 1976 to develop the natural gas industry in Ireland. It is a commercial state body operating in the energy sector. The company employs just over 1,000 staff and is headquartered in Cork City, Ireland. Today, BGE is Ireland’s leading energy provider, serving all energy customers in Ireland. BGE is a commercial state body operating in the energy sector. The company employs just over 1,000 staff and is headquartered in Cork City, Ireland. Today, BGE is Ireland’s leading energy provider, serving all energy customers in Ireland.

Bord Gáis Energy is the retail arm of Bord Gáis, selling gas and electricity to all market segments.

Supply & Trading Asset Division

Bord Gáis Energy Organisation Overview

Tage: Bord Gáis Energy toplinn, and head office of Meath, business, energy and renewable energy from the ECO's 2010 Energy Plan. It is the world's first operational renewable energy provider, opening its first wind farm in 2010. The company employs just over 1,000 staff and is headquartered in Cork City, Ireland. Today, BGE is Ireland’s leading energy provider, serving all energy customers in Ireland.

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Biomass is produced when feedstocks, such as organic wastes, and energy crops, are converted into biogas using anaerobic digestion technology.
What is biogas?

- In addition to methane (CH₄), biogas can also contain:
  - Water vapour, carbon dioxide (CO₂), hydrogen sulphide (H₂S), organic silicon compounds (e.g. siloxanes), ammonia (NH₃), and dust

...as well as:
- Small amounts of hydrogen (H₂), air, i.e. oxygen (O₂) and nitrogen (N₂), biological agents, halocarbons....

Biogas/natural gas properties

<table>
<thead>
<tr>
<th>Component</th>
<th>Unit</th>
<th>Natural gas</th>
<th>Biogas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>%</td>
<td>85 – 98</td>
<td>55 – 70</td>
</tr>
<tr>
<td>Ethane</td>
<td>%</td>
<td>0.3 – 8.2</td>
<td>0</td>
</tr>
<tr>
<td>Propane</td>
<td>%</td>
<td>0.01 – 2.9</td>
<td>0</td>
</tr>
<tr>
<td>Butane</td>
<td>%</td>
<td>0.003 – 0.6</td>
<td>0</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>%</td>
<td>0.2 – 0.8</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>%</td>
<td>0.5 – 2.6</td>
<td>30 – 45</td>
</tr>
<tr>
<td>Hydrogen sulphide</td>
<td>ppm</td>
<td>1 – 100</td>
<td>50 – 2000</td>
</tr>
<tr>
<td>Ammonia</td>
<td>ppm</td>
<td>0 – 100</td>
<td>0</td>
</tr>
<tr>
<td>Net calorific value</td>
<td>MJ/m³</td>
<td>39.2</td>
<td>23.3</td>
</tr>
</tbody>
</table>

Why clean and upgrade biogas?

- **Cleaning**: removes corrosive products and other components harmful to the natural gas grid, appliances or end-users
- **Upgrading**: removes CO₂ to increase the energy content of the gas
- **Biomethane (renewable gas)**:
  - is biogas that has been upgraded to natural gas standard
  - is a higher value product than biogas, can be distributed via the gas grid to a large market
How much upgrading is required?

- Intended use determines level of cleaning and upgrading required.

Techniques

- H₂S removal:
  - Air/O₂ dosing
  - Iron chloride dosing
  - Iron oxides or hydroxides
  - NaOH scrubbing
  - PSA (pressure swing adsorption)
  - Biological filters

- CO₂ removal:
  - PSA/carbon molecular sieves
  - Water scrubbing/absorption/water wash
  - Polyethylene glycol scrubbing/adsorption
  - Adsorption with chemical reaction
  - Membrane separation
  - Cryogenic separation
  - In-situ methane enrichment

Other treatments

- Odorisation
  - For safety reasons to ensure leak detection
  - Typical compounds: tetrahydrothiophene (THT) and mercaptans

- Compression
  - Level of compression depends on use, e.g. fast-fill/slow-fill vehicle fuel, addition to transmission/distribution grid

- Addition of propane or liquefied petroleum gas (LPG)
  - Sometimes added to increase energy value and bring net calorific value and Wobbe index in line with quality specifications
Injection into the gas network may look like...

Substrat (s) Met hanisation Treatment (CO₂, H₂S, water, traces)

Raw biogas

• Bio waste
• Sewage
• Food-processing waste
• Energy crops

Composition:

• 50-65% CH₄
• 30-40% CO₂
• Water
• H₂S
• NH₃
• Traces

Upgraded gas

Composition similar to natural gas

Process Control (CH₄, CO₂, O₂, H₂S, H₂O)

Digestion/Odorisation/PG*

Regulator for flow / pressure (2nd compressor?)

Compression

Metering

Control of gas quality

Injection point

Valve

Natural gas

Natural gas + Biogas

Vent

Storage

If quality is not good enough!

Out of the limits

Safety equipment (shut-off valve, safety valve...)

Grid Injection is happening across Europe

Germany is taking the lead..
Didcot BtG facility

UK’s first BtG Project

First gas on 3rd Oct 2010

cng services ltd

Schematic of Didcot BtG

Blommethane to Grid at Didcot

CNG Services is designer and project manager

cng services ltd

Potential for Renewable Gas in Ireland

<table>
<thead>
<tr>
<th>Source of Gas</th>
<th>Figures converted from PJ to mscm natural gas equivalent (pJ to MLA Mc/m^3)</th>
<th>Practical (mscm pa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Slurry</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>OFMSW</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Slaughter Waste</td>
<td>18.6</td>
<td></td>
</tr>
<tr>
<td>Surplus Grass</td>
<td>325.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>410</td>
<td></td>
</tr>
<tr>
<td>As % of total Irish gas demand</td>
<td>7.5%</td>
<td></td>
</tr>
</tbody>
</table>

1. Agricultural Slurry & Grass
2. OFMSW Digesters
3. Slaughter Waste Digesters

Figures converted from PJ to mscm natural gas equivalent (pJ to MLA Mc/m^3).

Practical (mscm pa):

Agricultural Slurry 51
OFMSW 15.6
Slaughter Waste 18.6
Surplus Grass 325.7
Total 410
As % of total Irish gas demand 7.5%
The Cost of Producing Biomethane

<table>
<thead>
<tr>
<th>Feedstock/scenario</th>
<th>G/t(^2)</th>
<th>€/km(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar (Saccharum Officinarum)</td>
<td>0.22</td>
<td>0.4</td>
</tr>
<tr>
<td>Slaughter Waste (55.6 lb t(^{-1}))</td>
<td>0.73</td>
<td>0.9</td>
</tr>
<tr>
<td>Grass (207 ha, farm model)</td>
<td>0.97</td>
<td>0.7</td>
</tr>
<tr>
<td>Grass (207 ha, developer model)</td>
<td>1.10</td>
<td>1.1</td>
</tr>
<tr>
<td>Slurry (175 t m(^{-1}))</td>
<td>1.35</td>
<td>34.9</td>
</tr>
</tbody>
</table>

Source: Green Gas Technologies Ltd., March 2010

Irish Renewable Targets

National Targets
- RES-E: 40% electricity from renewable sources by 2020
- RES-H: 12% heating from renewable sources by 2020
  - Renewable energy accounted for 3.6% of thermal energy in 2008
  - Biogas could deliver 60% of this target
- RES-T: 10% renewable fuels for transport by 2020
  - Renewable energy accounted for 1.2% of transport energy in 2008
  - Biogas could exceed this target (12%)
Renewable Gas has a key role to play in a low carbon future for Ireland

- Simple efficiency measures across all sectors
- Decarbonised electricity fuels zero emission cars
- Decarbonise gas using renewable gas

Constraints are Surmountable

- Technical Issues
  - Gas Quality
  - Compression
  - Odorisation
  - Propane
  - Minimum Demand
- Regulatory Arrangements
  - Preferred Model for Ireland
  - Connection Arrangements
  - Tariff Arrangements
- Political Support

Thank you

Any Questions??
The German Scene

- 7.5 GW of Solar added in 2011 – 30 GW total (Concerns regarding suitability of existing grid to accommodate further development)
- 107 Feeding Biomethane Stations into Grid (Range from 250 m³/hr to 10,000 m³/hr)
- Between 30 and 60 Biomethane plants planned for 2012
- Target:
  - 6% Biomethane to Grid – 2020
  - 10% Biomethane to Grid – 2030
  - Less than 1% Biomethane to Grid – 2012
- 900 CNG filling stations
  - 160 comprise Biomethane 5-50%
  - 20 Pure Biomethane
  - 4 Insular Biomethane

Bloaufelden Emmertsbuhl Biogas Project

- Biogas digester installed on a former dairy farm
- Biogas originally used for CHP

The Distribution Zone

- Circa 1000 residential customers a small industrial
- 5 km of gas mains operating circa 550 mbar
- Grid operator and energy supplier ENBW (45% state owned)
The Energy Supply

• Local Grid Heating value 10.7 kWh/m³
• Transmission Heating value 11.3 kWh/m³
• No Biomethane enrichment
• Customers volunteer to pay an additional 3 cents/kWh for the privilege of burning Green Gas (Biomethane)
• Regional heating law requires new buildings to be 20% renewables

The Biomethane Plant

• Feedstock is Maze and Silage
• No Cows in Cow shed - now Silage storage
Peat-Fired Stations

3 Peat-fired Stations
- Edenderry Power (2000)
  128 MWe - BNM
  100 MWe - ESB
- West Offaly Power (2005)
  150 MWe - ESB

- 3 Mt milled peat – 23.7 PJ/a
- 30% co-firing – 7.1 PJ/a
- Need ≡ 1 Mt green biomass
**Irish Government Policy**

White Paper, March 2007
- Set a target of 30% co-firing in the 3 peat stations by 2015.

NREAP, July 2010
- Generation of 1,006 GWh from bioenergy in 2020, of which 687 GWh from solid biomass

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**BnM PowerGen Portfolio**

- Derrygreenagh CCGT/OCGT - 600 MW
- Cushaling Power OCGT - 116 MW
- Bruckana wind farm - 40 MW
- Oweninny wind farm - ~372 MW
- Bellacorrick wind farm - 6.5 MW
- Mountlucas wind farm - 80 MW
- Whyte Corrib wind farm - 325 MW
- Derrygreenagh EPL - 50% biomass co-firing

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**Why Co-fire with Biomass**

1. Co-firing is Governmental policy
2. Leads to reduced carbon intensity
3. Planning consent only to 2015 – ABP Mayo Power refusal
4. Priority dispatch as a Hybrid Plant, with >50% biomass
5. IED – lower SO₂, NOₓ and dust emission limits from 2016
Edenderry Volumes & Specification

<table>
<thead>
<tr>
<th>Biomass Required (kt)</th>
<th>Quality Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008: 20</td>
<td>Moisture: 10 – 60%</td>
</tr>
<tr>
<td>2009: 72</td>
<td>Wt. Av. m.c. &gt;45%</td>
</tr>
<tr>
<td>2010: 110</td>
<td>Ash: &lt;5%</td>
</tr>
<tr>
<td>2011: 156</td>
<td>Size: &lt;40mm</td>
</tr>
<tr>
<td>2012: 180</td>
<td>Gross CV: &gt;18 GJ/t</td>
</tr>
<tr>
<td>2013: 220</td>
<td>Chlorine: &lt;0.1%</td>
</tr>
<tr>
<td>2014: 260</td>
<td>Ash Deform. &gt;1000 °C</td>
</tr>
<tr>
<td>2015: 300</td>
<td></td>
</tr>
<tr>
<td>2020: 500</td>
<td></td>
</tr>
</tbody>
</table>

Carbon Emissions per MWh

Suitable Biomass Types

<table>
<thead>
<tr>
<th>Suitable Economic Types</th>
<th>Suitable Biomass Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Type</td>
<td></td>
</tr>
<tr>
<td>Peat</td>
<td>Forest Materials</td>
</tr>
<tr>
<td></td>
<td>- Wood Chips</td>
</tr>
<tr>
<td></td>
<td>- Sawdust</td>
</tr>
<tr>
<td></td>
<td>- Pulpwood/Residues</td>
</tr>
<tr>
<td>Distillate</td>
<td>Energy Crops</td>
</tr>
<tr>
<td></td>
<td>- Willow</td>
</tr>
<tr>
<td></td>
<td>- Miscanthus</td>
</tr>
<tr>
<td></td>
<td>- Black Oats</td>
</tr>
<tr>
<td>HFO</td>
<td>Dry Materials</td>
</tr>
<tr>
<td></td>
<td>- Wood Pellets</td>
</tr>
<tr>
<td></td>
<td>- Palm Kernel Shells</td>
</tr>
<tr>
<td></td>
<td>- Almond Shells</td>
</tr>
<tr>
<td></td>
<td>- Olive Stones</td>
</tr>
</tbody>
</table>

Laboratory Tests

Handling Trials

Combustion and Corrosion Tests
Biomass Targets 2015

<table>
<thead>
<tr>
<th>Category</th>
<th>Biomass Type</th>
<th>(kt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Crops</td>
<td>Willow</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Miscanthus</td>
<td>15</td>
</tr>
<tr>
<td>Forest Materials</td>
<td>Sawmill residues</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Forestry thinnings</td>
<td>50</td>
</tr>
<tr>
<td>Dry Materials</td>
<td>Wood Pellets, PKS,</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Almond Shells, etc.</td>
<td></td>
</tr>
</tbody>
</table>

Total: 300,000 energy tonnes

Bord na Móna Programme

- Long term contracts with:
  - Individuals
  - Co-ops
  - Farmer Groups
- Index linked pricing
- Low risk, sustainable return
- Biomass from the land:
  - Willow
  - Miscanthus
  - Black Oats
  - Forest Thinnings

Willow Requirements

- 100,000 ET requires 5,000 Ha of land
- Major marketing campaign to encourage farmers commenced 2011
- By spring 2012 300 Ha planted
- Poor result!!!
Why the poor take-up?

• High current farm commodity prices
• CAP reform – uncertainty
• Locking in good land for 20 years
• ‘Wait and see approach’ by some farmers
• No income for 3 years!!

Solution

• We need a Clear Policy statement by Government on Bioenergy crop grants over the next 5 years
• Replace indigenous peat industry with an indigenous bioenergy crop industry --- AVOID IMPORTS
• Every 100,000 tonnes of willow chip has the potential to create c.750 Irish Jobs—sustainable and long term
• Annual premium to match forestry to overcome the 3 year ‘wait’ for first revenue
TIMBER SUPPLY AND DEMAND

GROWING THE BIOECONOMY

National Bioenergy Conference

Hodson Bay Hotel, Athlone
25th April 2012

FORECAST ROUNDWOOD SUPPLY (000 m³)

Potential Wood Energy Availability (ROI)
Historic Demand for Forest-based Biomass for Energy Use in the Republic of Ireland

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firewood</strong></td>
<td>171</td>
<td>184</td>
<td>199</td>
</tr>
<tr>
<td>Roundwood chipped in forest</td>
<td>63</td>
<td>53</td>
<td>39</td>
</tr>
<tr>
<td>Short rotation coppice (SRC)</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Charcoal</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wood pellets &amp; briquettes</td>
<td>82</td>
<td>110</td>
<td>121</td>
</tr>
<tr>
<td>Process heat/energy use by industry/Co-firing</td>
<td>384</td>
<td>438</td>
<td>554</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>703</td>
<td>791</td>
<td>916</td>
</tr>
<tr>
<td>% use by forest products/industry/Co-firing</td>
<td>55</td>
<td>55</td>
<td>60</td>
</tr>
</tbody>
</table>

Source: Joint Wood Energy Enquiry (JWEE) 2009 – 2011

Forecast Demand for Forest-based Biomass for Energy use in Ireland

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>000 m³/annum</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHP</td>
<td>388</td>
<td>1,550</td>
</tr>
<tr>
<td>Heat only</td>
<td>1,092</td>
<td>1,425</td>
</tr>
<tr>
<td>Co-firing</td>
<td>109</td>
<td>109</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,589</td>
<td>3,084</td>
</tr>
</tbody>
</table>

Source: COFORD, All Ireland Roundwood Demand Forecast 2011 – 2020

Supply – Demand Balance – Republic Only

Supply-Demand Balance (‘000m3)

- 2011
- 2020

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-firing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat Only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential Supply</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Supply – Demand Balance (All Ireland)

Challenges to Mobilising Wood Fibre Volumes

1. Owners
   a) Thin plantations
   b) Collaborate with other owners

2. Infrastructure
   a) Forest Roads
   b) Thinning Capacity

3. Supply Chain
   a) Sales Method
   b) Logistics
   c) Certification

BUT THESE ALONE WILL NOT FILL THE GAP

POSSIBLE SOLUTIONS

Creating a more enabling environment

Creating an increased regulatory and compliance environment
1. Owners
   a) Thin plantations
      a) Awareness + education + guidance
      b) Financial support
   b) Collaborate with other owners
      a) Support for producer/owner groups
      b) Support for collaborative initiatives

2. Infrastructure
   a) Forest Roads
      a) Priority 5-10 year roading scheme
      b) Collaboration between owners (Coillte)
   b) Thinning Capacity
      a) Support for training of operatives
      b) Re-introduce support for thinning machines
      (Linkage with collaboration + producer groups)

3. Supply Chain
   a) Sales Method
      a) Confidence + Security
      b) Longer term arrangements
   b) Logistics
   c) Certification
      a) Awareness raising + education
1. Owners
   a) Thin plantations
      a) Tax regime
      b) Legal requirement for management (Private Forest Districts)
   b) Collaborate with other owners
      a) Legal requirement for management (Private Forest Districts)

REMAINING GAP
1. Harvesting Practices
   a) Process down to smaller top diameter
   b) Whole tree harvesting
   c) Bundling of clearfell residues
2. Alternative Fibre Sources
   a) Fast growing species e.g. Eucalyptus
      a) Reconfigure grant support scheme
   b) Short rotation coppice
   c) Import
3. Regulatory Framework
   a) Felling licences + Restrictions
      a) Time for Uncommon Sense
SUMMARY

a) Long term supply is increasing
b) Increasing GAP between estimated Supply & Demand
c) Forestry alone cannot fill the GAP
d) Major challenges in mobilising wood volumes
e) Range of interventions / solutions
   - Carrot + Stick Approaches
   - Changed practices
   - Alternative Supply Sources
   - Import
SUPPLYCHIP: Investigating the potential supply of wood energy from forestry

Dr Joanne Fitzgerald
Teagasc

SUPPLYCHIP: Why did this project happen?

• CLUSTER Project – identified areas of high forest density
• Demand for wood energy
• SUPPLYCHIP: uses one cluster as a case study to evaluate the potential wood energy resource.

CLUSTER Identified distinct geographic concentrations of private forest plantations

42% of Private Grant Aided Forestry occurs with Clusters
86,000 Ha
Clusters occupy 15% of National Land Area 1.035 M Ha
Local Markets

Planted 1996
100% Sitka Spruce
Predicted GYC: 26
16 hectares
Adjacent to 3rd Class Road

SCHIP ID 745

Ideal Forest
Ideal Forest

If 100% of 1st thinnings from this plantation went into wood energy:

- 1451 m³
- 8913 GJ

= 550 GJ ha⁻¹
Limiting factors

- Not all sites are productive
- Inaccessible to machinery
- Small plantation size
- Windthrow risk
- Soil conditions
SUPPLYCHIP
Identifying Resource Potential

Developed a methodology for assessing forest resources at a local level, where no data exists.

How?

- Identify forest parameters remotely
- Aerial Photography Interpretation
- Growth and Yield Modelling (Farrelly et al. 2011)
- Forecasting
- GIS Analysis – Roading Infrastructure

Identify Forest Parameters:
Aerial Photo analysis

Capture Productive Area, development stage, Access etc
Yield Prediction – Productive Areas

GIS Roading Analysis: Distance to Public Road

Site Potential - Road Access.

- 1. Adjacent to Public Road - 2481 stands
- 2. <50 m from public road – 115 stands
- 3. >50 m from public road – 680 stands
Thinning and Harvesting Analysis

Site Potential Decision Tree

- Is site adjacent to public road?
  - Yes
  - No

- Is site > 5 ha?
  - Yes
  - No

- Ground Conditions?
  - Good
  - Poor

- Standard Thin

Local Level Forecasting

GIS – End User Analysis

- Tracing distance to end use
- Highlight out road plantation to end use

Distance 35 km
If 100% of first thinnings go for biomass this forest cluster could annually:

Fuel five 1 MWe Biomass CHP facilities

Or

Meet 1/8th of Edenderry Power’s projected biomass demand for 2015.
1. Donegal Woodland Owners Society Ltd
2. Sligo/north Leitrim Forest Owner Group
3. County Clare Wood Energy Group
4. Galway Forest Producer Group
5. West Cork Forest Producer Group
6. Antrim-Belfast Forest Owner Group
7. Galway Forest Owner Group
8. Waterford Forest Owner Group
9. Kerry Farm Forestry Owners Group
10. Headford Farm Forestry Group
11. Ballylanders Forest Owners
12. Limerick/Tipperary Forest Producer Group
13. South Tipperary Ash Growers Group
14. West Limerick Forest Producer Group
15. Wicklow Private Woodland Owners Group
16. Westmeath Forestry Producer Group
17. Offaly Forestry Producer Group
18. Laois Forestry Producer Group
19. Longford Forestry Producer Group
20. Meath Forestry Producer Group
21. Cavan Forestry Producer Group

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Thank You

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drjbfitzgerald@gmail.com

- Find me on LinkedIn
- www.teagasc.ie/forestry
LEVERAGING ADDITIONAL BIOMASS FROM THE FOREST RESOURCE

Tom Kent,
Waterford Institute of Technology
tkent@wit.ie

National Bioenergy Conference 2012 ‘Growing the Bio-economy’
Hodson Bay Hotel, Athlone, Co. Westmeath
Wednesday, 25 April 2012

Wood fuel Demand & Supply

Wood fuel Demand Forecast 2020:
- 12% renewable heat generation;
- 800 MW of Combined Heat & Power (CHP) by 2020;
- 30% co-firing with biomass at the three peat-fuelled power plants.
- 3 million cubic metres wood per year (COFORD, 2011)

Where can this come from?
1. Leverage additional biomass from clearfell residues
2. Mobilise thinning in non-industrial private forests

COFORD Forest Energy Research Programme

Current wood harvesting practice in Ireland

Cut-to-length harvesting method
- ~ 170 Harvesters
- ~ 160 Forwarders
- ~ 380 Timber Trucks
• Capacity > 3 M m³ roundwood/yr.
• Harvest 2011: 2.7 M m³
• Two-thirds from clearfelling
• One third from thinnings
Clearfelling

- 7000 - 8000 ha of clearfells per year
- Residues: brash & stumps,
- Potentially, > 1.5 million tonnes or 12 PJ per annum

Stumps*:
- 100 – 150 tonnes
- 550 – 900 GJ/ha

Brash:
- 80 – 100 tonnes
- 650 – 850 GJ/ha

Roundwood:
- 300 – 400 m³ volume per ha

Example 1: Overview Brash Supply Chain

- Brash (like straw) is scattered and has low density when loose
- Brash bundles are compacted for efficient handling, transport, storage and processing
- Medite (Europe) Ltd. contracted Coillte to produce brash bundles for boiler fuel
- Coillte tendered for a harvesting contractor to produce brash bundles
- WIT carried out studies on:
  1. Fuel characteristics of brash bundles
  2. Quantification of resource
  3. Productivity of the supply chain

Thinning

- 22,800 ha in 2011
- 49,400 ha in 2028 (Phillips, 2011)
- Large increase in private sector thinnings
- Roundwood: 30 – 60 m³ per ha
- Only 55% of tree volume in harvestable stem
- 45% top and branches

Medite (Europe) Ltd. contracted Coillte to produce brash bundles for boiler fuel

Coillte tendered for a harvesting contractor to produce brash bundles

WIT carried out studies on:
  1. Fuel characteristics of brash bundles
  2. Quantification of resource
  3. Productivity of the supply chain
Brash Supply Chain: Elements

- Brash Bundler
- Extracting to forest road
- Shredding bundles to hogfuel
- Road transportation to end-user

Brash Supply Chain: Fuel characteristics per bundle

- Measurements taken from 14 trial sites
- European Solid Biofuel Standard methods used
- High variability between individual bundles
- High moisture & ash content impacts negatively on net energy content

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>m$^3$</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Tonnes</td>
<td>0.383</td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>%, total weight</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Dry Weight</td>
<td>oven dry tonnes</td>
<td>0.188</td>
<td></td>
</tr>
<tr>
<td>Net Energy Content</td>
<td>GJ</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Ash Content</td>
<td>%, dry weight</td>
<td>2.30</td>
<td></td>
</tr>
</tbody>
</table>

Brash Supply Chain: Quantification

- Total quantification of bundles produced on 14 trial sites
- 300 truck loads weighed and moisture sampled to derive delivered energy
- Bundling on only 55% of area
- Constrained by: steep terrain; wet ground; brash contaminated by soil & stones; windblown areas; illegal dumping; insufficient concentration of brash.
Brash Supply Chain: Productivity & Indicative Production Cost

<table>
<thead>
<tr>
<th>Element</th>
<th>Bundles per SMH</th>
<th>Cost per Tonne</th>
<th>Cost per GJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundler</td>
<td>21</td>
<td>€14.92</td>
<td>€1.84</td>
</tr>
<tr>
<td>Forwarder</td>
<td>45</td>
<td>€4.62</td>
<td>€0.57</td>
</tr>
<tr>
<td>Timber Truck</td>
<td>63 (per load)</td>
<td>€9.10</td>
<td>€1.12</td>
</tr>
<tr>
<td>Shredder</td>
<td>60</td>
<td>€9.51</td>
<td>€1.18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>€38.15</strong></td>
<td><strong>€4.71</strong></td>
</tr>
</tbody>
</table>

**Assumptions:**
- SMH - Scheduled Machine Hour includes non-productive work time
- Bundler, Forwarder & Shredder time & production study results
- Assumed Machine Costs/SMH: Bundler €120; Forwarder €80; Shredder €180
- Trucking cost from HYTAC Model (Murphy, 2008) assumes 70km one-way distance

Brash Supply Chain: Conclusions

1. Simple supply chain with one new element only (John Deere bundler)
2. Integrated supply chain as site selection, timber harvesting and replanting planned around brash bundling
3. Flexible supply chain as bundles can be stored, transported and processed on-demand
5. Potentially 800,000 tonnes per annum (6 PJ), more likely less than 200,000 tonnes per annum
6. Because, scale-up constrained by limited site suitability

Example 2: Whole Tree First Thinning & Chipping Overview

- Forest Energy Research Programme
- Main objective: to investigate cost-effective wood fuel supply chains from forest thinnings
- Technology Transfer programme from Denmark to Ireland
- 800,000m³ of wood chip from first thinnings per year in Denmark
- Documented in Forest Energy Reports (www.coford.ie)
Wholetree Supply Chain: Elements

Chainsaw felling for line thinning
Feller-buncher for selective thinning
Self-propelled front-mounted chipper
Container truck for road transport
Close up loader unloading into containers at the forest road

Wholetree Supply Chain: Production Cost

- based on results from eight conifer and four broadleaf sites over three years harvesting trials
- Woodchip production cost: harvesting, extraction & chipping to forest roadside
- Error bars show the range of values between trial sites

Wholetree Supply Chain: Quantification

- based on results from eight conifer and four broadleaf sites
- Mean harvested volume per thinned tree
- Error bars show the range of values between trial sites
Wholetree Supply Chain: Conclusions

1. Can be employed on any site that will support cut-to-length thinning
2. Produces more biomass at lower cost from first thinning compared to cut-to-length thinning
3. Requires new technology, not currently employed in Ireland
4. Complex logistics to co-ordinate harvesting, chipping & transport
5. Complex contracting in private sector forestry, as there are many owners & forest managers
6. Requires large energy end-user to keep system productive

Overall Conclusions

• Cut-to-length supply chain utilises 40 – 70% of the available forest biomass
• More biomass can be leveraged from Irish forests by harvesting residues, stumps and small whole trees
• Wood fuel from these sources will only be suitable for larger installations due to moisture and particle size distribution
• Forest site, soil and environment will constrain deployment and must be protected – this is the role of forest managers
• All parts of the tree have value.

Acknowledgements

1. Coillte, Medite (Europe) Ltd. & Mr. Willie Dwyer, Contractor

2. The Forest Energy Research Project is funded by:
   The Department of Agriculture, Fisheries & Food, under the COFORD Forest Research Programme as part of the National Development Plan 2007-13
National Bioenergy Conference -
Warming to Wood Energy

Tom Coughlan
Clare County Manager
25th April 2012

Overview
- Role of Local Authorities - why should we be involved in the development of renewable energy?
- Our Vision - what do we hope to achieve in County Clare?
- What's happening in County Clare?
- Concluding thoughts.

What do we do?
- Traditional local government services - roads, housing, planning, water, environment.
- Wider role - economic, social, cultural development - power of "general competence".
General Competence

- A local authority may take such measures, engage in such activities or do such things as it considers necessary and desirable to promote the interests of the local community - social inclusion or the social, economic, environmental, recreational, cultural, community or general development of the area.

What are we doing?
How can local authorities encourage "warming to wood energy"?

- Planning - how to make optimal use of our resources.
- Facilitating - bringing interested parties together.
- Influencing - influencing policy.
- Making it happen - direct action.

Planning

- County Clare Integrated Strategy on Energy and Climate Change.
Our Vision

- County Clare, as the national leader in renewable energy regeneration, supporting energy security, efficiency, conservation and storage, and assisting in meeting Ireland’s green energy targets.
Biomass - What’s happening in Co. Clare?

- Commercial biomass boilers using wood chip from Clare forests - 8 commercial (1.8 MW) boilers using 1,500 tonnes of wood chip.
- County Clare has 52,000 hectares of forest - 55% privately owned. The County Clare Wood Energy Project has been organising harvesting and auctioning of wood for small forest holders.
- Co-firing wood pellet with coal at Moneypoint power station is under review.
- Combined Heat and Power (CHP) generation using biomass wood is being considered.
- Clare County Council meets 27% of its total heat needs from biomass - 90% of County Hall energy from wood chip.

Clare County Council - Heat

27% of own heat requirement presently met by biomass

<table>
<thead>
<tr>
<th>Clare County Council Heat</th>
<th>Euro</th>
<th>kWh</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEROSENE</td>
<td>€6,251</td>
<td>53,136</td>
<td>2%</td>
</tr>
<tr>
<td>GAS</td>
<td>€70,684</td>
<td>1,413,680</td>
<td>53%</td>
</tr>
<tr>
<td>WOODCHIP</td>
<td>€35,708</td>
<td>714,157</td>
<td>27%</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>€147,866</td>
<td>2,646,267</td>
<td>100%</td>
</tr>
</tbody>
</table>

Clare County Hall - Heat

- Clare County Hall meets 90% of heat needs with local wood chip.
- Solar thermal panels on the roof contribute to hot water needs.
- 540 kW wood chip boiler.
- Supports 2 FTE jobs in County Clare.
- Reduces CO₂ emissions by 3,000 tonnes.
Clare Supply & Demand

Supply
- Clare is 16% forest; 52,000 ha
- 45% is public; 55% private
- Clare Wood Energy Project organising private forest

Demand
Present (2012)
- 1,800 kW of boilers installed
- 1,500 tonnes of wood chip

Combined Heat & Power Plant - Shannon

Population 9,222 (2006)
- Households 3,493
- Employed 8,000+
- Shannon International Airport
- Shannon Free Zone
- Industrial Areas
- Town Centre
- Residential Areas

Plans afoot for €85 million power plant
Shannon in line for €85m green project

Council to decide on power plant rezoning

Irish Examiner

Council vote paves way

for €85m power plant
Conclusion

- There is a role for local authorities in the development of renewable energy.
- Integrated plans/strategies with clear targets are essential.
- Co-operation between agencies/bodies/government departments is critical.
- It will be necessary to win “hearts and minds”.
- Warming to wood energy will not be easy – will be a slow burner!!!

Thank You
National Bioenergy Conference 2012
‘Growing the Bioeconomy’
Hodson Bay Hotel, Athlone, Co. Westmeath
Wednesday, 25 April 2012

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