IEA Bioenergy

Task 42 Biorefining

TCBB RESOURCE

Supporting Transition to a Low-Carbon Economy

Ireland Country Report
April 2016

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Ireland's Bio Based Economy

1. Irish Market Dynamics
    a. Indigenous Supply Chain & Markets
    b. Policy & Regulatory Developments

2. Irish Market Opportunities & Market Development

Ireland Eco-Environmental Profile
Small Open Trading Nation
Reliant on a Bio Based Economy

- **Perception: Rural Agricultural "Green Isle"**
  - ➢4.5m (6.0m with NI) population –
  - ➢40% rurally disbursed over 4m hct

- **GDP €180 Bn: recession impacted economy, capital availability & gov't financing**
- **Export Oriented Agri Food & Cleantech Industries:** agri food 2020 target = 40% growth
  - Dairy Processing
  - Meat processing
  - Brewing & Distilling

  - Pharmaceutical & Biomedical technology

Ireland Policy is to Protect "Green" Image

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Irish Market Dynamics

Development of Supply Chain

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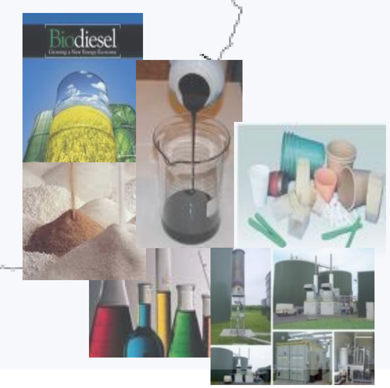

Temperate 10 month growing season

- Livestock – grass based system feeds 6m cattle
  - 4 m Ha of grassland generates> 25M DMT grass
  - 6m cattle generate large manure supply (c. 1M DMT recoverable)
- Tillage & Horticulture – less emphasis on tillage
  - Grain predominantly used as animal feed - net grain importer
  - Sugar Beet - quota forfeited in 2006, eliminated beet planting
  - Large mushroom industry & growing horticultural sector
- Forestry – 750K Ha in Forestry (50% Semi State Forestry Co)
  - Afforestation prog. to double output in next 10 years (3M – 6M m^3)
  - Emphasis on evergreens – sitka spruce/ larch also ash/poplar
  - Roundwood supplies construction but growing pulpwood supply
- Marine – Substantial fishing industry
  - Under exploited shoreline (sensitive to public environ. sentiment)

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Irish Market Dynamics

Supply Chain Overview

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Irish Industrial Production Infrastructure

- Heavily Oriented Toward Agri Food & Cleantech
- Excellent Bio Tech Skills & Production Infrastructure
- Means to Aggregate Agricultural Feedstocks & Access to Global Markets
- Under Utilised Residues
    - Dairy – whey as animal feed
    - Meat Processing – underutilised paunch contents, exported Class 3 MBM
    - Brewing & Distilling – spent grains used as animal feed

Municipal Waste – Privatisation Resulted in Consolidation & Investment in Collection / Management Infrastructure

- Ireland exports majority of MSW materials
    - 500K MT of paper waste exported
    - Most RDF exported
- Municipal & Industrial Wastewaters - 1,000 Plants use Aerobic WWT systems
    - Substantial sludge Volume land spread – discouraged in Org. Fertiliser Regulations

Supply Chain is Substantial but Fragmented – Challenges:

Value chains not requiring scale – Value chains can use aggregated residues (character variations)

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Irish Market Dynamics

Indigenous Energy Market

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Energy Profile – 85% Supplied via Imported Fossil Fuels	Current Market				Renewable Profile				
	ktoe	Share %	€ Est. Value		Current ktoe	Mkt %	2020 ktoe	2020 %	2020 €Value
Electricity	2,405	23%	€3.2 B		546	22.7%	423	40%	€1.3B

- Coal & peat power plants being phased out in favour of gas fired power plants.
- REFIT subventions promote RES E - primarily promotes wind/wave +/- biomass HE CHP
- Strong wind programme ensures 2020 targets will be met – facing increasing public opposition to turbines
- Planning approval granted for 40 MW biomass plant and 2 X large waste incinerators

Heating/Cooling	4,239	41%	€7.2B		280	6.6%	509	12%	€.87B

- Industrial heat demand predominantly supplied by NG – gas grid serves > 80% of population
- Balance of demand supplied by heating oil & to lesser extent solid fuels
- RHI imminent subject to current consultation process. - targeted primarily at increasing use of LC biomass
- Biogas incentive to follow subject to economic review - grid injection protocol TBD

Transport	3,777	36%	€1.6B		117	5.2% (3.1%)	227	10% (6.0%)	€.1B

- Petrol/Diesel fuels supplied c. 65% via import & c. 35% via domestic refinery
- RES T transport fuels underpinned by BBO - 95% of RES T fuels imported
- 1 X biodiesel plant processing waste cooking oil - exports biodiesel output
- Early policy initiatives promoting electrical transport – mixed results
- Current policy considering promotion of gaseous transport fuels (preferential excise tax established)

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Market Dynamics

Indigenous Raw Materials Markets

Much of Industrial / Consumer Raw Materials Are Imported

- Energy - Fossil Fuel imports € 6,500 M
- Organic Chemical Imports € 3,500 M
- Paper Imports € 375 M
- Bulk Plastic Imports € 200 M
- Fertiliser Imports € 150 M

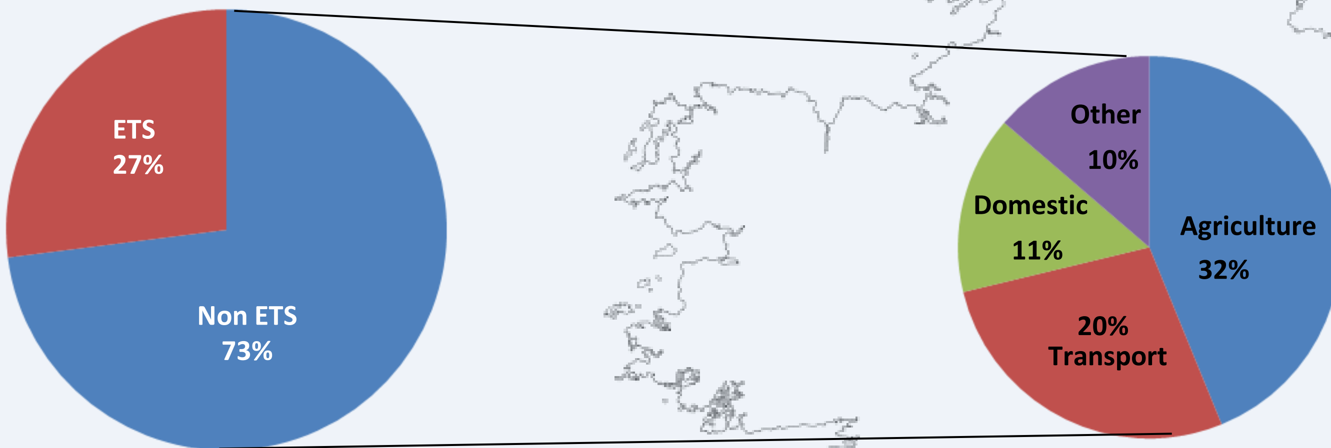
Substantial Under Exploited Indigenous Market Opportunities

Market Dynamics
Irish GHG Mitigation Obligations

Irish Atmospheric Emissions Profile

Binding Climate Change 2020 Oblig'n = 20% reduct'n in GHG vs 2005

Ireland Emissions



Non ETS Emissions

- **Emissions Trading Scheme (ETS - cap and trade) largely compliant**
- **Non ETS obligation fall on state –** Irish profile = 73% non-ETS vs 60% non-ETS avg EU
  - ➢ **Ireland will find it difficult to hit 2020 GHG -** Currently 3% below 2005 level but economic recovery & herd growth = (c. 4M mt $CO_{2\text{-eq}}$ req'd)
  - ➢ **Means to address agricultural, transport & domestic sector GHG emissions –**
    - –Increase Renewable Energy to address Transport and Domestic Sector
    - –Methane emissions related to animal husbandry are more difficult –
      - –Use of animal waste as renewable energy source
      - –Recycling of nutrients (NO_x reduction

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Market Dynamics

Policy Initiatives

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Irish Bio-economic Development Heavily Agri – Food Centric

Supportive Policies & Frameworks –

- **Supportive Bio Energy Policy**
  - *Extension of Supportive REFIT subventions for high efficiency CHP*
  - *Imminent introduction of Renewable Heat Incentive*
  - *Continuing afforestation policy & energy crop grant schemes*
  - *Upcoming grid access framework for biogas injection to gas grid*
  - *Attractive Excise Tax Rate Enshrined for Use of Gaseous Fuels*
  - *BBO Obligation increasing from 6% to 8% 2017*

- **Climate Action & Low Carbon Dev Bill –** enshrines state compliance re EU Obligations
  – *Prepare a Low Carbon National Mitigation Plan & Expert Advisory Council on Climate Change*

- **DAFM initiative re National Bio economy Policy-** *Bio Eire*
- **DAFM R&D Programme on Biorefinery Demonstration**
- **DAFM Grass Based AD Test Plant under construction**

Range of Policy Initiatives Promote Bio Economic Development

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Market Opportunities & Activities

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Supportive Policies & AMFM Feedstock Availability Offer Means to Exploit Market Opportunities

Biomass/Waste to Energy: Near term commercial focus

- **40 MW biomass CHP plant –** *Mayo Renewable Power*
- **AD of Agri- Food Residues + Biomass –**
  - *Gas Networks Ireland (Gas utility)* - *Grid Injection target 20% Green Gas by 2030*
  - *Off Grid applications* - *Biogas Transport, Displacement of Heating Oil / Distillates*
- **Anaerobic WWT –** *NVP Energy developing high rate low temp AD for WWT*
  - *Irish Water (newly privatised water utility) now operator of WWT plants*
- **Farm-scale FBC for poultry & equine litter –** *Biomass Heating Solutions Ltd.*
  - *New Reg's classify farm scale poultry litter as ABP vs Waste – viable*
- **Continuous Pyrolysis System for Biomass HE CHP –** *Premier Green Energy*

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Market Opportunities & Activities Ct'd

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Biorefining - Biofuels : R&D Focus

- R&D on VFA based platform energy carrier
- R&D on lignocellulosic derived levullinic acid for aviation fuel

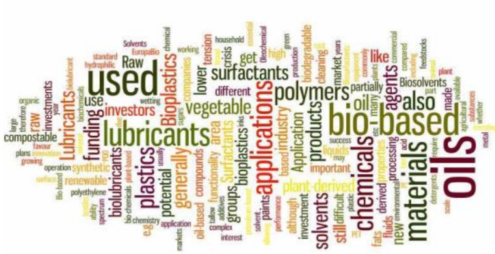
Biorefining – Nutraceuticals: R&D and Early Commercial Stage

- Food for Health Technology Centre – State Sponsored R&D
  - *Bioadditives from Dairy Extracts*
- Bio Marine Ingredients -Donegal Based Fish Processing-R&D
  - *Bioactive extracts from fish processing residues*
- Biopharmed-West – R&D
  - *Anti fungal and antibacterial applications from willow bark extracts*
- Hemp based essential oil extracts

Market Opportunities & Activities Ct’d

Biorefining – Biochemicals: R&D Stage

- **Dairy Processing Technology Centre – State Sponsored R&D**
  - *Organic acid fermentations from dairy whey residues*
- **Reintroduction of Sugar Beet Industry as Biochemical Feedstock**
  - *Aspirational R&D into Organic Acid Fermentations*



Biorefining – Biomaterials: R&D Stage

- **AMBER Technology Centre – State Sponsored R&D**
  - *Medium Chain PHA’s*
- **Thermo chem process to refine hemp fibres**

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