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# Teagasc and ACCBank Bioenergy Conference 2009 - Programme

Thursday, 5 February 2009  
Horse & Jockey Conference Centre,  
Thurles, Co Tipperary

- 9:30am Registration
- 10:00am Opening Address  
Professor Gerry Boyle, Teagasc Director
- 9.15am **Session 1**  
Chair: Pat O'Keeffe, Irish Farmers' Journal
- Ministerial Address**  
Eamon Ryan TD, Minister for Communications, Energy and Natural Resources
- The Irish bioenergy sector**  
*Introduction and overview of the Irish bioenergy sector*  
Richard Browne, Department of Communications, Energy & Natural Resources
- Policy issues**  
Bernard Rice, Teagasc
- 11:10am Questions and answers
- 11:25am Coffee break – view exhibition area
- 11.40am **Session 2**  
Chair: J.J Kavanagh IFA
- Supports available for bioenergy*  
Pearse Buckley, Sustainable Energy Ireland
- Bioenergy opportunities and the carbon challenge*  
John Gilliland OBE, Rural Generation
- Establishing a biomass co-op*  
Seamus O'Donohoe, ICOS
- 12:45pm Questions and answers
- 1.00pm Lunch – view exhibition area
- 2.00pm **Session 3**  
Chair: Conor Ryan, Arrabawn Co-op
- Financing a bioenergy project*  
Hans van den Boom, Rabobank
- 2:20pm *Biomass and the planning system*  
Ciaran Lynch, Tipperary Institute
- 2.40pm *Making anaerobic digestion a commercial reality*  
David McDonnell, Limerick farmer
- 3:00pm Questions and answers
- 3.15pm **Session 4**  
Chair: Tommy Cooke, ICMSA
- Co-firing of biomass with peat*  
Charles Shier, Bord na Mona
- 3.45pm *Technologies and markets for biomass CHP*  
Tom Bruton, Bioxl
- 4.15pm *Best practice for energy crops*  
John Finnan, Teagasc
- 4.45pm Questions and answers
- 5.00pm Close of conference

Friday, 6 February 2009  
Landmark Hotel,  
Carrick-on-Shannon, Co. Leitrim

- 9:30am Registration
- 10:00am Opening Address  
James McGrath, Teagasc, Assistant Director of Advisory Services
- 10.15am **Session 1**  
Chair: Matt Dempsey Irish Farmers' Journal
- Ministerial Address**  
Tony Killeen TD, Minister of State at the Department of Agriculture, Fisheries & Food
- The Irish bioenergy sector**  
*Introduction and overview of the Irish bioenergy sector*  
Martin Finucane, Department of Communications, Energy & Natural Resources
- Policy issues**  
Bernard Rice, Teagasc
- 11:10am Questions and answers
- 11:25am Coffee break – view exhibition stands
- 11.40am **Session 2**  
Chair: Aaron Forde, Connacht Gold Co-op
- Supports available for Bioenergy*  
Pearse Buckley, Sustainable Energy Ireland
- Bioenergy opportunities and the carbon challenge*  
John Gilliland OBE, Rural Generation
- Establishing a biomass co-op*  
Seamus O'Donohoe, ICOS
- 12:45pm Questions and answers
- 1.00pm Lunch – view exhibition stands
- 2.00pm **Session 3**  
Chair: Padraig Walshe, IFA President
- Financing a bioenergy project*  
Hans van den Boom, Rabobank
- Biomass and the planning system*  
Martin McCormack, Tipperary Institute
- Making Anaerobic Digestion a Commercial reality*  
David McDonnell, Limerick farmer
- 3:00pm Questions and answers
- 3.15pm **Session 4**  
Chair: Jim O'Mahony, Teagasc, Tillage Programme Manager
- Burning an alternative biomass to peat*  
Charles Shier, Bord na Mona
- Technologies and markets for biomass CHP*  
Tom Bruton, Bioxl
- Best practice for energy crops*  
John Finnan, Teagasc
- 4.45pm Questions and answers
- 5.00pm Close of conference

## Teagasc and ACCBank Bioenergy Conference 2009 - Speakers' Profiles



**Professor Gerry Boyle, Director of Teagasc**

Professor Gerry Boyle is Director of Teagasc. Professor Boyle joined Teagasc from the National University of Ireland (NUI), Maynooth where he was a former Head of its Economic Department. He is also a former member of the Governing Authority of NUI Maynooth and is a Director and Secretary of the Maynooth University Foundation. He is Co-chairman of the FAPRI-Ireland Partnership and the founding Director of the

National Institute of Regional and Spatial Analysis. He is also a member of the Senate of the NUI and holds Adjunct Professorships at the University of Limerick and at the University of Missouri, Columbia.

Prior to taking up his position with Maynooth, Professor Boyle was as a Senior Research Officer with the Agricultural Institute (now Teagasc) and an Economist with the Central Bank of Ireland. Professor Boyle was also Senior International Consultant, specialising in agricultural policy, with the World Bank.



**Pat O'Keeffe, Irish Farmers' Journal.**

Pat O'Keeffe is Deputy Editor and News Editor of the Irish Farmers' Journal. He is of farming background in east Cork and graduated from UCD with a degree in Agricultural Science in 1996. He later completed a Masters in Animal Science at the Dairy Research Corporation (DRC) in New Zealand. Mr. O'Keeffe is also chairman of the Guild of Agricultural Journalists of Ireland.



**Eamon Ryan, Minister for Communications, Energy and Natural Resources**

Minister Eamon Ryan was educated in Gonzaga College and UCD where he graduated with a B.Comm. He was first elected to Dáil Éireann in 2002. Prior to his appointment as Minister for Communications, Energy and Natural Resources, he was the Green Party spokesperson for Transport and Enterprise, Trade and Employment and opposition convener on the Joint Oireachtas

Committee for Communications, Marine and Natural Resources.

Prior to his election to the Dáil he set up and ran two businesses, Irish Cycling Safaris and Belfield Bike shop. He was an active member and chairman of the Dublin Cycling Campaign, and from 1995 to 2002 he served on the Advisory Committee of the Dublin Transport Office.



**Richard Browne, Department of Communications, Energy & Natural Resources**

Richard Browne's (Renewable and Sustainable Energy Division, Department of Communications, Energy and Natural Resources) roles include national bioenergy policy (including biofuels and renewable heat programmes) and corporate governance responsibilities for Sustainable Energy Ireland."

He has a PhD in Geography and an MSc in Policy Analysis.



**Bernard Rice, Teagasc**

Bernard Rice is a graduate in mechanical engineering from UCD. As an employee of Teagasc Bernard has been involved with the biofuels research programme for many years, first on transport biofuels and more recently on biomass heating systems. He is also an active member of IrBEA, the Irish Bioenergy Association.



**JJ Kavanagh, IFA**

JJ Kavanagh is a tillage and drystock farmer from New Ross in County Wexford. He currently holds the position of IFA South Leinster Vice-President. He is the leader of the IFA project team on alternative land-use. The project team was established to identify profitable alternative land uses for tillage farmers.

He is a board member of Wexford Farmers Co-op and previously held the position of IFA County Chairman in Wexford.



**Pearse Buckley, Sustainable Energy Ireland**

Pearse Buckley graduated from University College Dublin in 1975 with a BE Mechanical degree. He worked as a Product Engineer in Canada for 13 years. Upon his return to Ireland in 1991 he began research into energy from biomass at Trinity College Dublin. From 1998, he worked for four years with a waste management company before joining Sustainable Energy Ireland in August 2002 as Project Manager -

Biomass. In this role he is responsible for the promotion of bioenergy through strategy development and for providing policy advice to government in this area.



**John Gilliland, Rural Generation NI**

Dr John Gilliland OBE, Hon DSc., FRSA, FRAGs., HND, is Chairman and Director of Rural Generation Ltd. John runs a thriving agri-business demonstrating new sustainable and alternative land uses on the outskirts of Londonderry city. He has won numerous awards for innovation and environmental advances in its farming practices. In 2003 John was awarded an OBE for "Services to the Environment".

In July 2007 John was awarded an honorary degree in Doctorate of Science for his work with agriculture and renewable energy by the University of Ulster. He has just been appointed a non-executive Director of the Scottish Agriculture College and a Fellow of the Royal Society.

John has represented the agri-business sector at numerous meetings at all levels of government, EU and worldwide economic bodies. In 2005, Prime Minister Blair appointed him the N.I. Sustainable Development Commissioner. In 2006, he led the Food Foresight exercise for N.I., creating a collection of visions and R&D and innovation priorities for the industry to 2020. In 2007, John's company represented N.I. at the Smithsonian Institute's Annual Festival in Washington.



**Seamus O'Donohoe, ICOS**

Seamus O'Donohoe is a graduate in agricultural economics and holds an MBA. He has extensive experience in the organisation and development of primary and secondary co-operatives for producers in both agricultural and rural sectors.

Having worked as an agricultural adviser in County Galway, Seamus joined ICOS in 1980 as Regional Development Executive. He was

appointed Director of Member Development of ICOS in 1985 and held that position until 2000 when he became Secretary of ICOS Ltd. As Director of Member Development, he was responsible for the inauguration and development of training programmes for co-operative directors and young co-operative leaders, up to diploma level in university. He was also responsible for the development of start-up co-operative businesses in sectors such as rural tourism, forestry, group water schemes, wind energy, shell fishing and community development.

In his present role, Seamus is responsible for legislative, legal and rural matters relating to member co-operatives. He has also been actively involved in the restructuring, consolidation, merger and rationalisation of individual and groups of co-operatives in the different agricultural and rural sectors, as well as undertaking business planning and restructuring work on a consultancy basis with other rural bodies and organisations.



**Ciaran Lynch, Tipperary Institute**

Ciaran is Head of the Rural Development Department and Director of Rural Development at Tipperary Institute. He is a graduate of UCD, the University of Wales and the Institute of Public Administration and has a background in social studies and physical planning having worked for over 20 years as a town planner with a number of local authorities. He was Chief Planner for 13 years with Clare County Council and was very

involved in community planning and project development as well as strategic planning.

He is a Director on the boards of the Tipperary Energy Agency, Kilkee Waterworld, the East and Mid-Clare Waymarked Ways, the North Tipperary Sports Partnership and South Tipperary Volunteer Centre.

He presently works with a variety of public and community-based organisations on collaborative planning and development issues and has a broad experience in policy development and analysis as well as a personal commitment to sustainable rural development. He was the Project Manager for the preparation of the first Mid-West Regional Authority's Planning Guidelines.



**David McDonnell, Limerick Farmer**

David is a dairy and poultry farmer from the Shanagolden area of County Limerick. He is a past student of the Salesian Agricultural College, Pallaskenry, the Farm Apprenticeship Scheme, Teagasc's Advanced Dairy Cert Programme and the University of Limerick. He farms in partnership with his brother Richard, supplying liquid milk to Kerry Co-op and free range chickens to Shannonvale Poultry in Clonakilty. He

is a member of both the IWEA (the Irish Wind Energy Association) and IrBEA, (the Irish Bioenergy Association). He is currently beginning construction of a farm-scale biogas plant on the family farm which is hoped to be operational by the end of the year.



**Tommy Cooke, ICMSA**

Tommy is a member of the National Council of ICMSA and past Chairman of ICMSA Rural Development Committee. He farms on the Kilkenny/Tipperary border adjacent to Thurles. Mr. Cooke is recognised as an expert nationally in the field of the adaptation of renewal energy for farming and the wider agri-processing purposes.



**Jim O'Mahony, Teagasc**

Jim is Teagasc Programme Manager for Tillage Crops and Renewable Energy. He is a graduate of UCD qualifying with a Masters in Plant Breeding in 1975.

Following his graduation Jim worked with the Department of Agriculture and Food on variety testing on crops. He joined Acot as a crops specialist, followed by his appointment as Chief

Adviser in Tillage. Jim was appointed to his current post of Programme Manager in 2004.



**Charles Shier, Bord na Mona**

Charles is Strategic Development Manager with Bord na Móna Energy Ltd. The aim of the unit is to build a portfolio of renewable generating assets backed by flexible thermal plant. He is a graduate of the Universities of Durham and London, with qualifications in botany and landscape ecology. He has worked with Bord na Móna since 1978 in a number of roles including cutaway peatland development, organisational strategy and

commercial positions in the horticulture and energy businesses.



**Tom Bruton, Bioxl**

Tom is a graduate of the Ecole des Mines de Paris with a Masters in Renewable Energy Technologies and also has a Diploma in Biomass Energy Technologies from the Universidad de Zaragoza. He holds a degree in Agriculture and Food Engineering from UCD. He runs a consulting business called BioXL since 2004. Prior to this he held various engineering and project management roles in Ireland, Belgium and Australia.

Mr Bruton is a former Secretary of the Irish Bioenergy Association and is currently the nominated country representative for AEBIOM, the European Biomass Association.



**John Finnan, Teagasc**

John is a graduate of NUI Maynooth. He worked with Teagasc at its Crops Research Centre, Oak Park from 1990 to 1999 on various projects. He obtained a PhD from TCD in 1995. Dr. Finnan worked with the EPA from 2000 to 2007 before returning to Teagasc in April 2007 to head the non-food crops research programme. John is based at Oak Park, Carlow



**Matt Dempsey, Irish Farmers' Journal**

Matt is Editor and Chief Executive of the Irish Farmers' Journal and a member of the Irish Commission on Bioethics. Educated at Clongowes Wood College he obtained his B.Agr.Sc., (1st Hons.) in 1969 at University College Dublin. He produced agricultural programmes in RTE Radio from 1969 to 1973 and was EEC Correspondent for the Irish Farmers' Journal from 1973 to 1978. He completed a

Postgraduate Study with UCD in 1978. He was Chairman of Agricultural Institute from 1986 to 1988 and he held the post of President Irish Grassland Association from 1998 to 1999. He was also President of European Agricultural Publishers Association and Member of Oxford Farming Conference Council from 1993 to 1996.



**Tony Killeen, Department of Agriculture, Fisheries and Food**

Tony Killeen is a native of Co Clare, and a graduate of Mary Immaculate College, Limerick. He is a former teacher, and was first elected in 1992.

Before commencing his current post as Minister of State at the Department of Agriculture, Fisheries & Food (with special responsibility for Fisheries and Forestry), he was appointed Minister of State at the Department of Communications, Energy &

Natural Resources, and the Department of Environment, Heritage & Local Government, in June 2007. He was previously Minister of State at the Department of Enterprise, Trade and Employment (Labour Affairs).

He was Chairman of the Joint Oireachtas Committee on Education and Science, from 2002 to 2004, and a former Chair of the Oireachtas Committee on Members' Interests in Dáil Éireann. Tony Killeen was a member of the British-Irish Parliamentary Body, and served as Chairman, and Vice-Chairman of Clare County Council, from 1985 to 1997. He was Chairman of Co Clare VEC, from 1991 to 1994, and he was a former National Chairman of the Fianna Fáil Councillors' Association.



**Padraig Walshe, Irish Farmers' Association**

Padraig Walshe is the 12th President of the Irish Farmers' Association. He was elected in December 2005 and took up office in January, 2006. A native of Durrow in County Laois, he and his wife Ella run a dairy and beef farm. They have four children. He is a member of the Board of FBD, the Agricultural Trust and Bord Bia. He leads the IFA Social Partnership negotiating team.

Padraig Walshe was Chairman of the IFA National Dairy Committee 1998-2002 and IFA National Treasurer from 2002-2006. He also served as Chairman of Laois IFA. He is a former President of Macra na Feirme from 1987-1989.



**Martin Finucane, Department of Communications, Energy & Natural Resources**

Martin is Principal Officer in charge of the Sustainable and Renewable Energy Division in the DCENR. He is responsible for the development and promotion of renewable energy policy and energy efficiency policy in Ireland.



**Aaron Forde, Connacht Gold Co.op**

Aaron is Chief Executive Officer of Connacht Gold Co-op since 1 March 2004. He is a Director of the Irish Dairy Board and County Mayo Radio and a member of the Audit Committee of Sligo County Council. Prior to that he was a Director of Thomas McDonogh & Sons with responsibility for the fertilizer and feed trading businesses of the Group.

Mr Forde has considerable experience in the agri-food sector having served as Managing Director of Adams Food Ingredients from 1993-2001 and previously held senior positions with Kerry Foods and Laird Foods, part of Food Industries plc. A Graduate of University College Cork with an Honours B.Sc (Food Business) degree and diploma in Dairy Science.



**Hans van den Boom, Rabobank, Food & Agri Sector Manager**

Hans is Food and Agri Sector Manager with Rabobank. He has worked with Rabobank for fifteen years (mostly in the food and agri related sector). For the last three years his primary expertise is advice and financial expertise in bioenergy projects. He regularly meets with investors (mostly farmers) to assess their projects and support their financial needs for

renewable energy projects in the Netherlands and Belgium.



**Conor Ryan, Arrabawn Co.op**

Conor was appointed Chief Executive Officer of Arrabawn Co.op in July 2005. He is a graduate in Business Studies of the University of Limerick and completed an MBA with DCU in 1999. Mr. Ryan joined the Kerry Group in 1984 and held various commercial and management positions including that of Managing Director, Mainland Europe, Middle East and Africa of the Kerry Foods Flavors Division. He is a member of the Irish Dairy Board since 2006 and a board member of the National Dairy Council.



**James McGrath, Teagasc**

James is Assistant Director, Teagasc Advisory Services and is a graduate of UCD where he obtained BAgSc.

James began his career with Teagasc as an Agricultural Adviser in Co Mayo, with responsibility for drystock. In 2001 he took over responsibility for the Opportunities Programme for Farm Families in Mayo as coordinator. He presented the daily Teagasc programme on Mid-West Radio from 1990 to 2002. In 2002, he was appointed Chief Agricultural Officer in Co Leitrim. In 2006, he was appointed National Manager of the Teagasc Options Programme and took up his current post of Assistant Director Advisory Services Northern Units in 2007.

## **The Outlook for Biofuels**

*Bernard Rice, John Finnan*

*Teagasc, Oak Park Crops Research Centre, Carlow*

### **Summary**

While some progress has been made in developing an Irish infrastructure for biofuel production and use, feedstock and product price volatility, competition from unfairly-subsidised imports and uncertainty about future support policies are holding back investment in further development. Failure to expand our production capacity will increase our dependence on imports to meet EU substitution targets. The handling of two major policy issues i.e., the change to an obligation system for transport biofuels and the development of a National Action Plan, as required by the recent Renewable Energy Directive, will have a major bearing on the development of biofuel production in Ireland in the coming decade. The obligation system must give Irish producers at least a level playing pitch in their competition with imports; favouring highly sustainable first-generation fuels would achieve this objective as well as maximising greenhouse abatement and fuel supply security. The National Action Plan should focus on the biofuels best suited to Irish production, and propose a set of measures to maximise their production. Since the amount of biomass needed to meet the heating/electricity targets far exceeds current availability, production of energy crops needs to be rapidly expanded. Research to reduce costs and streamline the production of willow and miscanthus is urgently needed.

### **Introduction**

The biofuel industry in Ireland has suffered severe turbulence in recent times. Market conditions have been very difficult. Pure plant oil (PPO) production has been hit hard by high rapeseed prices. Both PPO and biodiesel markets have been badly affected by “B99” biodiesel imports from the US, subsidised by both the US government and the Irish taxpayer and providing big profits for fuel importers. At present, all biofuel sectors have been affected by the dramatic fall in oil prices. We have also had damaging public debates on two issues: the role of biofuels in food price increases and the sustainability of some biofuel production. All this, combined with uncertainty about future support policies at home and abroad and the extent to which these will affect the competitiveness of Irish biofuel production, are a source of concern among current and potential developers and investors.

In spite of these problems, some progress has been achieved:

- Four pure plant oil units have been built,
- Our first significant biodiesel plant has come on stream in New Ross,
- The use of woodchips for commercial heating has grown steadily,
- Our first significant wood pellet plant has started production in Knocktopher, and
- About 2,000 ha of perennial energy crops (miscanthus and willow) have been established.

In the longer term, the agreement that has just been reached on an EU Renewable Energy Directive will have a major effect on biofuel developments in member states over the next ten years (Commission of the European Communities, 2008). In the new Directive, the target to produce 20% of our total energy from renewable sources by 2020 has been retained. A significant change is that this target refers to final consumption rather than primary generation, so heating or CHP will be favoured in comparison with straight electricity

generation. The transport target has been modified to the achievement of the 10% target from all renewable sources, not solely biofuels. The extent to which this alters the biofuel target depends largely on the progress made with electric cars charged from renewable non-bio electricity.

The first test of member states reactions to the Directive will be in their submission of National Action Plans in pursuit of the Directive targets; the template for these plans is to be drawn up by June 2009 and the plans submitted by June 2010. It is to be hoped that these plans will not just re-hash existing support schemes but will take a comprehensive view of each link in the chain of measures needed to bring the various technologies to commercial realisation.

Before trying to formulate the National Action Plan for Ireland, it is essential that we clarify what we want it to achieve. It should include the objectives behind the original EU Biofuels Directive, (i.e., supply security, environmental benefits and rural enterprise development) but could also include other national objectives (Commission of the European Communities, 2001). The following are proposed as the objectives of the Irish plan:

1. To achieve a rate of substitution of biofuels into the transport fuel market that approximates to the substitution required by EU Directives.
2. To provide an opportunity for native raw material producers and processors to maximise home production and processing.
3. To incentivise farmers to use biofuels to supply their own fuel needs.
4. To provide a platform on which second-generation biofuel technologies can be built .
5. To minimise the cost to exchequer (i.e. tax-payer) and motorist.
6. To maximise fuel supply security benefits.
7. To maximise greenhouse gas benefits.
8. To minimise the disruption of food production.

The Action Plan will need to address the reality that achievement of the Directive targets will require the energetic use of biomass on a much increased scale. At a rough estimate we will require well over four million tonnes of energetic biomass, as against our present use of well short of one million tonnes. In drafting the Action Plan, we need to decide the balance we wish to achieve between home production and imports, and the process technologies that should be Irish priorities. The Action Plan will be critical to biofuel development in Ireland in the coming decade, and agriculture needs to make its collective voice clearly heard in its drafting.

Do we need Irish biofuel industries based on current technologies? Yes, for a number of reasons:

1. Oil prices are currently very low, but they will rise again as economies come out of the present slump.
2. Existing food market prices are very volatile; alternative markets would have some stabilising effect.
3. The costs and sustainability of biofuel imports will be recurring issues.
4. The need to generate rural employment is once again with us.
5. Failure to meet EU targets will eventually lead to substantial penalties.
6. Those who argue that we should wait for second generation technologies want to build the second floor with no ground floor.

## **Transport biofuels**

### **Obligation system to replace excise relief**

A significant Irish policy development in recent months was the publication of a Government discussion paper proposing an obligation system on oil companies as an alternative to the current excise relief system (Department of Communications, Energy and Natural Resources, 2008). It may be assumed that the support system that emerges from this consultation will be part of the National Action Plan to be submitted to the European Commission in 2011.

The publication of the consultation paper is welcome; with the current excise relief programme expiring in 2010, it is vital that the follow-up programme be put in place quickly to remove uncertainty about the future of Irish biofuel production. The support mechanism proposed is the issue of certificates per unit of biofuel placed on the market, and an obligation on fuel suppliers to redeem certificates to match their mineral fuel sales at the specified substitution level for that period.

Although the document recognises the role that biofuels could play in providing Ireland with an emergency fuel supply, it is disappointing that the many other benefits that would accrue from native biofuel production are not acknowledged. While we must accept that any biofuel support scheme must allow free competition within member states, there is still scope to devise a scheme that would improve the opportunities of native producers.

Most transport biofuels are derived from farm produce, and their use on farms would help to secure food production in a fuel crisis. Several EU states have devised fuel excise systems to stimulate on-farm biofuel use for this reason. This possibility deserves to be examined in Ireland.

The document somewhat overstates the move to obligation systems among member states. Sweden for example, one of the most successful adopters of biofuels, will stay with excise relief at least until 2013. France and Germany will not complete the phasing out of excise relief until 2012. However, in the current financial climate it is unrealistic to expect that a full excise relief scheme covering an increased volume of biofuel could be maintained indefinitely. Therefore, we need to examine whether an obligation system can be devised that would maximise opportunities for Irish producers, even though the option of a selective top-up of excise relief may still be needed in some sectors of the biofuel market.

### **The arguments against biofuels**

The obligation document lists the issues that have been used to tarnish the image of biofuels in recent times: little or no reduction of carbon emissions, raising of food prices and damage to vulnerable ecosystems. While these are legitimate concerns on a global scale, they have little relevance to current or planned Irish biofuel production. The food-fuel argument has already collapsed, with the increase in grain production leading to a rapid fall in prices and grower profit margins. With cattle numbers projected to fall and pig and poultry production under threat, Irish cereal growers will need new markets just to sustain their current production area. A big increase in our tilled area to produce arable biofuel crops will not happen. But Irish biofuel production can actually assist food production, by maintaining the tillage area and promoting the production of animal protein feed (DDGS, rape cake etc).

Ecosystem damage is already a big issue for many developing countries, and competition for scarce water resources will be a problem for the future. These have little relevance in an Irish context, with a stable tillage area, comprehensive cross-compliance requirements linked to the Single Farm Payment, and an abundance of rain.

## **Greenhouse gas (GHG) mitigation by transport biofuels**

On greenhouse gases, the EU Renewable Energy Directive is proposing an emission reduction of at least 35%, increasing to 50% in 2017, for any transport biofuel to count towards national target achievement. The obligation proposal also mentions the possible inclusion of a more favourable treatment of biogas and second generation biofuels to take account of their expected more favourable greenhouse gas balance. One of the strengths of the biofuel production either in place or in planning in Ireland to date is its high level of sustainability. Since it is virtually all based on home-produced raw materials the traceability of those feedstocks is also high. Current and planned Irish production could be classified as follows:

1. Biodiesel production by Green Biofuels, Ecoola, Eco Fuels and Greyhound Recycling is mainly from recovered vegetable oil (RVO) and tallow. An SEI-commissioned study carried out by Dutch consultants Ecofys has shown that the GHG emissions from RVO-biodiesel are over 80% lower than those from diesel (Sustainable Energy Ireland, 2004). Tallow biodiesel might be expected to give a similar value. Estimates in the Commission Directive confirm these figures. Second-generation biofuels will improve little on these levels.
2. Biodiesel produced from rapeseed oil (RME) would reduce emissions by more than half according to the Ecofys study, less than half according to the Commission. Any newly constructed sensibly-located plant should be able to exceed 50% GHG reduction.
3. Pure plant oil emissions can be estimated from the Ecofys report, from the Commission document and also from the Elsayed report (Elsayed et al, 2003). All would suggest a reduction of 55-60% compared with diesel.
4. For ethanol, Carbery Milk are producing a by-product feedstock from whey so it is probably safe to assume that their GHG emission is over 60% less than petrol. Inefficient corn-ethanol plants may well produce emissions similar to petrol, and these have aroused public doubts about all bio-ethanol production. But no such plants exist here.

Ethanol Ireland, an Irish company, is currently working on plans to build a substantial wheat-to-ethanol plant in Waterford port. A modern efficient plant such as this proposal, using CHP and possibly a renewable source of plant energy as well as capturing the CO<sub>2</sub> emitted during fermentation, could achieve a GHG reduction of up to 70%. It could also provide an alternative market for home cereal production and help to stabilise grain prices and the production area.

Therefore, current and planned Irish biofuel production has a high sustainability and traceability level with big GHG reduction levels and no other issues of environmental or social significance. While second generation biofuels have the potential to increase biofuel production per hectare their GHG emissions will not be much better than the current Irish plants. Even if/when second generation technologies become commercially viable Ireland will have a major challenge developing low-cost biomass supplies for such plants. The aim of the new scheme should be to reward appropriately those biofuels certified as achieving a very high standard of sustainability and in so doing to facilitate the continued development of high-sustainability first generation biofuel production to the maximum extent that feedstock resources will allow.

There is an opportunity for Ireland to develop a scheme that takes a lead in rewarding sustainable production regardless of feedstock, technology or generation. Certificates should

be allocated in proportion to certified greenhouse gas abatement above a minimum abatement level of 35%. The certification process should include feedstock traceability. Taking account of a Commission suggestion that two certificates be allocated to second generation biofuels, a possible allocation rate for the Irish scheme might vary on a sliding scale from one share at 35% GHG reduction to two shares at 85%.

### **Certificate trading**

The whole basis of the obligation/certification system is dependent on the effective operation of a certificate trading system in which the certificates attain a value close to the fossil fuel excise and the buy-out penalty. The early stages of CO<sub>2</sub> trading have provided an example of what can go wrong with this type of market; a repeat of that experience would sound the death-knell for most Irish biofuel producers. Any monies collected as penalties should be used to top up the certificate price as in the UK RTFO scheme. The temptation for government to use the scheme as a revenue source by setting a low buy-out penalty and retaining the proceeds needs to be firmly resisted

### **Other issues**

All the biofuels for which certificates are issued should be in compliance with the most appropriate quality standard e.g. EN14214 for biodiesel, DIN 51605 for pure plant oil, prEN 15376 for low-blend ethanol etc. Import of poor-quality fuels will not only damage home production it will antagonise motorists and reduce biofuel use.

In the debate about the obligation system, other biofuel support measures should not be forgotten. On the feedstock side, the carbon premium and top-up payment need to be maintained in as far as possible. On the market side, Sweden in particular has made very good use of a range of promotion measures. Conversion of public vehicle fleets to use biofuels, capital grants for processing, distribution and dispensing facilities, VRT and road tax reduction, reduced parking and congestion charges; have all helped to increase the appeal of biofuels to the motorist. The application of similar measures in Ireland needs to be seriously considered as part of the Action Plan.

## **Biofuels for heating and electricity production**

### **Markets**

There are many different heat/electricity market opportunities for biomass feedstocks, either already developing or still to find a niche:

1. The use of pellets for home heating was kick-started by the boiler/stove grants available under the SEI Greener Homes Scheme. The growth in pellet use has been sluggish for a variety of reasons: initial uncertainty about pellet supply and quality, a few well-publicised installation problems and more recently the fall in oil and gas prices. With the established Balcas plant in Enniskillen and the recently opened D-Pellets plant in Knocktopher pellet supply is no longer an issue. It is vital that the quality of pellets, boilers and installation are all maintained at a high level to re-assure consumers who wish to change to a native, renewable fuel.
2. The heating of commercial buildings, mainly hotels, by woodchip boilers has been advancing steadily with up to 100 installations either operating or approved for SEI ReHeat Scheme grants. User reaction has been positive but many new installations are being delayed by the uncertain economic climate. A pool of woodchip suppliers is developing and with some more additions most areas of the country will be covered.

Farrelly Bros in Kells are making a substantial investment in willow production for heating use. A woodchip quality assurance scheme is in discussion between SEI, COFORD and the chip suppliers.

3. The open-fire and hand-fed stove market is still substantial and is largely supplied by log-wood and briquettes. From the SEI annual energy balance, it appears that the domestic peat briquette market is equivalent to about 150,000 tonnes of dry biomass (Sustainable Energy Ireland, 2008).
4. The 30% peat substitution target set out in the Government's White Paper for the three peat-burning stations would require biomass to replace about 0.9 million tonnes of peat (Department of Communications, Marine and Natural Resources, 2007). Assuming net calorific values of 8 and 12 MJ/kg for peat and biomass respectively, about 0.6 million tonnes of biomass would be required to meet this target.
5. The Government White Paper also contains a 2020 target of 800 MW<sub>e</sub> of electricity "with an emphasis on biomass-fuelled CHP". Even half this target would require about two million tonnes of biomass. The technology for very small CHP plants is still some way from commercial reality; a 35-140 kW Stirling-engine-based unit will be installed in Oak Park this year. Units from 1 to 5 MW would be more economic and could use mature technologies, but they would require a very large local heat demand. Therefore, it is difficult to see CHP based on biomass combustion making a big contribution to the White Paper target.

### **Feedstock options**

Pellets at the Balcas plant are producing from sawmill residues; the D-Pellets plant is using forest thinnings. If/when these feedstocks become less available the next possibilities are miscanthus or by-product materials such as cereal or rape straw or rapeseed cake. While all these materials have similar calorific values their suitability as fuels would all be to some degree inferior to wood. Therefore, they are more likely to be used in bigger commercial boilers rather than domestic stoves or boilers.

In the event of under supply of woodchip availability for commercial boilers, willow chips or miscanthus in pelleted or chopped form would appear to be the best alternatives. Pelleting is a substantial additional cost but greatly simplifies handling. A satisfactory system of transporting and chopping miscanthus and conveying the chopped product into a boiler has yet to be developed. Burning of whole bales would be a low-cost solution but control of stack emissions might be a problem.

A number of companies are currently exploring the potential of briquettes made from wood, miscanthus and cereal straw for burning in open fires or hand-fed stoves. The outcome of these efforts will be eagerly awaited.

The peat stations will be very concerned to use feedstocks that avoid the corrosion problems that have given them major headaches in recent years. Otherwise they should have the greatest flexibility to handle difficult fuels and as bulk buyers their prices are likely to be the lowest. Also, the Renewable Energy Directive will incentivise biomass use for heat or CHP rather than electricity. Therefore, the peat stations are likely to meet as much as possible of their needs from by-product or residue materials and use energy crops as a top-up.

The principle candidate energy crops are miscanthus and willow with hemp as a possible annual alternative. Miscanthus and willow are both perennial crops with an expected lifetime of up to 20 years. Both are expensive to establish but maintenance costs are low. The high establishment costs of these crops will continue to be a problem and ways of reducing them

must be found before the grants are reduced or phased out. Establishment of miscanthus has been somewhat erratic, and the harvesting, storage and planting of rhizomes needs to be researched with a view to improving emergence as well as reducing costs.

It would make very good national economic sense if we could transfer a small proportion of the land currently in unprofitable drystock to perennial biomass crops. This would reduce methane and CO<sub>2</sub> emissions and increase biofuel use and generate significant rural employment. All that is needed is a mechanism to provide a long-term guarantee of a realistic price to potential producers.

## **Biogas**

Finally, in spite of SEI's introduction of a 30% capital grant programme, a €0.12/kWhr feed-in tariff for the electricity produced, and a rapid expansion in other countries of the digestion of energy crops and organic wastes as well as animal manures, anaerobic digestion potential in Ireland remains untapped. Grid connection and planning problems, difficulties finding nearby heat uses and constraints for animal health reasons on the land-spreading of food waste digestate are all combining to hamper progress. Yet AD offers the best prospect for small-scale CHP and it could make some contribution to the White Paper 800 MW<sub>e</sub> target. It also opens up potential for the energetic use of high-moisture crops such as grass, and in the longer term it may be feasible to operate fuel cells from methane. In summary, biogas can play a unique role in our bio-energy portfolio if we can find ways around the problems that are holding it back.

Biogas has the potential to be used in several different ways:

- In boilers or CHP plants, with minimal upgrading;
- As transport fuel, after upgrading and with some vehicle modification;
- Injected into the gas grid, again after upgrading; and,
- As a fuel cell driver; this is still at a development stage, and fuel cell selection and feedstock upgrading are still in need of research.

For the near future, CHP is the most feasible option. However research is urgently needed on the economics and practicalities of digesting grass and other energy crops along with animal manures, on the techniques, cost and scale economy of biogas upgrading processes, and on the state of development of the use in fuel cells of hydrogen-rich gases such as bio-methane. Teagasc hopes to construct a digester at Grange this year to begin investigating some of these issues.

## **Conclusions**

Some key upcoming policy decisions will have a critical effect on how biofuel production and use develops in Ireland in the coming decade. The confirmation of ambitious substitution targets in the Renewable Energy Directive and the growing likelihood of mandatory penalties for non-compliance will raise the stakes considerably as 2020 approaches. Given the long time-lag in the build-up of biofuel capacity from the establishment of perennial energy crops to the development of processing facilities, action on the ground needs to begin without delay. The Action Plan required by the Directive will be a big test of our resolve to come close to achieving the 2020 targets.

The proposed Transport Biofuels Obligation System needs to be drafted in a way that is sympathetic to Irish production; one way of achieving this, while still allowing free EU competition, is to set and reward high sustainability standards. It will also be vital to ensure an active certificate market at a realistic price, by setting and adjusting the substitution level and buy-out penalty, providing a certificate brokerage service, using the buy-out penalty fund to support the market, and any other necessary measures.

Given the bulky nature of most solid biofuels, achievement of our heating/electricity goals will depend even more on native feedstock production. The biomass needed to come near the 2020 targets is far in excess of current Irish production. Transfer of some land from dry stock to energy crops would meet this need and also substantially improve our greenhouse gas balance. Given the long time-lag in such change, plans for its achievement need to be moved forward urgently.

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# SEI's Support Programmes for Bioenergy

Pearse Buckley  
Project Manager - Biomass



SEI is funded by the Irish Government under the  
National Development Plan 2007 – 2013 with  
programmes part financed by the European Union.

## SEI's Support Programmes for Bioenergy

Pearse Buckley  
Project Manager - Biomass



## Outline

- Context
- Greener Homes Scheme
- ReHeat Deployment Programme
- Biomass CHP / AD CHP Call for Proposals
- Renewable Energy RD&D Programme

## Context

**Government White Paper – *Delivering a Sustainable Energy Future for Ireland, 2007***

- 12% renewable heat
- 30% co-firing with biomass at the three peat power plants (to be achieved by 2015)
- 800 MWe of CHP with an “emphasis on biomass fuelled CHP”
- 10% biofuels

## Greener Homes Scheme



### “Phase III”

- Launched on 22<sup>nd</sup> July 2008 in conjunction with the revised Building Regulations
- Only existing homes are now eligible for support, occupied for at least 1 year
- Wood Gasification Boilers have now been added to the scheme
- SEI manages lists of registered products and installers



## Wood Burning Appliances



### Phase III Grant Levels



- Biomass boilers**.....€2,500
- Requires bulk storage for the fuel

## Wood Burning Appliances



### Phase III Grant Levels



- Biomass boilers**.....€2,500
- Requires bulk storage for the fuel
- Stoves**.....€ 800
- With **Back Boiler**.....€1,400

## Wood Burning Appliances



### Phase III Grant Levels



- Biomass boilers**.....€2,500
- Requires bulk storage for the fuel
- Stoves**.....€ 800
- With **Back Boiler**.....€1,400
- Wood Gasification Boilers**.....€2,000
- Requires a buffer tank for hot water storage
  - Uses wood logs only

## ReHeat Deployment

### Programme goals include:

- Increase the use of renewable heating systems in commercial, industrial, services, public sector and community organisations
- Carbon savings and fossil fuel displacement
- Increase customer awareness and confidence in renewable heating systems
- Increase Irish capability

## ReHeat Deployment

Programme launched: 5<sup>th</sup> June 2006  
Programme duration: to end 2010

### Technologies supported

Wood chip / pellet boilers

Solar thermal systems

Heat pump systems

### Est. capacity supported

175 - 225 MW<sub>e</sub>

12,000 m<sup>2</sup>

1.5 - 2 MW<sub>th</sub>

Expected CO<sub>2</sub> reductions ~160,000 tonnes per year

## ReHeat Deployment

### Eligible projects' characteristics:

- New automatic wood chip / pellet boilers installed in RoI
- Boilers carrying the CE mark
- High efficiency Boilers
  - For boilers ≤200 kW:  $73.9 + 7 \times \log(\text{kW})$
  - For boilers >200 kW: ≥ 90%
- Fuel complying with I.S. CEN/TS 14961:2005 or equivalent

## ReHeat Deployment

### Eligible Costs

- Boiler
- Feed mechanism
- Fuel storage
- Installation and commissioning

### Required information with the application includes:

- Feasibility study
- Fuel supply contract

## ReHeat Deployment

### Grant support:

- Grant of up to 30% of eligible costs
- Cost cap on eligible costs as in following table:

| Plant scale ranges<br>kW | Maximum Capacity Cost<br>€/kW |
|--------------------------|-------------------------------|
| ≤20 kW                   | €1,500 / kW                   |
| >20 kW and ≤50 kW        | €650 / kW                     |
| >50 kW and ≤250 kW       | €500 / kW                     |
| >250 kW and ≤500 kW      | €350 / kW                     |
| >500 kW and ≤1000 kW     | €250 / kW                     |
| >1000 kW                 | €150 / kW                     |

## Biomass CHP / AD CHP

### Programme goals include:

- Increase the deployment of biomass CHP/ AD CHP
- Produce energy and carbon savings
- Increase electricity system security
- Increase customer awareness and confidence in biomass CHP/AD CHP
- Increase Irish capability

## Biomass CHP / AD CHP

Programme launched: 24<sup>th</sup> January 2008  
Programme duration: to end 2010

### Technologies supported

Biomass CHP > 100 kW<sub>e</sub>

AD CHP > 50 kW<sub>e</sub>

### Est. capacity supported

5 - 15 MW<sub>e</sub>

0.5 - 2 MW<sub>e</sub>

Expected CO<sub>2</sub> reductions ~100,000 tonnes per year

## Biomass CHP / AD CHP

### Facilities with

- heat load over significant part of year
- adequate local biomass supply

## Biomass CHP / AD CHP

### Eligible projects' characteristics:

- New biomass CHP / AD CHP installed in RoI
- High efficiency CHP complying with EU CHP Directive 2004/8/EC
- Primary energy savings (PES)
  - For <1 MW<sub>e</sub> → PES >0%
  - For ≥1MW<sub>e</sub> → PES >10%
- CO<sub>2</sub> savings compared to fossil fuel alternatives
- Operation by 31<sup>st</sup> December 2010

### Eligible costs:

- External detailed design/project management
- Equipment
  - Prime mover and directly associated ancillary equipment
  - Fuel supply, processing and storage
  - Primary heat recovery equipment
  - Heat and electricity monitoring equipment
  - Electric switchgear
- Mechanical/electrical connections of plant items
- Specified building and civil engineering work

### Grant support:

- Cost cap on eligible costs defined in programme
  - E.g. for biomass CHP  $\geq 5 \text{ MW}_e \rightarrow \text{€}2,000/\text{kW}_e$
- Grant of up to 30% of eligible costs
- Indicative grant cap per project  $\rightarrow \text{€}1.5 \text{ million}$

### Required information with the application includes:

- Feasibility study
- Detailed business plan
- Detailed technical description
- Primary energy savings calculated per Directive
- Potential carbon savings using reference case details
- Details of fuel supply
- Details of grid connection
- Details of planning
- Project schedule

### Programme goals include:

- Accelerate development / deployment of competitive renewable energy
- Provide solutions to barriers
- Increase national capacity in RE
- Provide guidance to policy makers
- Support high quality projects which deliver value for money and encourage replication

Programme launched: 2002

### Programme Categories

### Support level

Shared Cost demonstrations

Up to 25%

Shared Cost R&D

Up to 45%

Commissioned Public Good

Up to 100%

### Application Guide and Application Form:

Greener Homes Scheme: [www.sei.ie/greenerhomes](http://www.sei.ie/greenerhomes)

ReHeat Deployment Programme: [www.sei.ie/reheat](http://www.sei.ie/reheat)

Biomass CHP / AD CHP: [www.sei.ie/bio\\_chpgrants](http://www.sei.ie/bio_chpgrants)

Renewable Energy RD&D: [www.sei.ie](http://www.sei.ie) see "grants"

Thank You.

[pearse.buckley@sei.ie](mailto:pearse.buckley@sei.ie)

01 808 2012

## **“Bioenergy Opportunities and the Carbon Challenge”**



**John Gilliland, Rural Generation Ltd  
National Bioenergy Conference  
February 2009**

## "Bioenergy Opportunities and the Carbon Challenge"



John Gilliland, Rural Generation Ltd  
National Bioenergy Conference  
February 2009

## Bioenergy is not New!! The International Experience



China – Heat from Domestic Anaerobic Digesters



## The International Experience



China – Heat from Crop Residues



## The International Experience



Germany, Rural Communities –  
160% Self Sufficient in Heat & Power



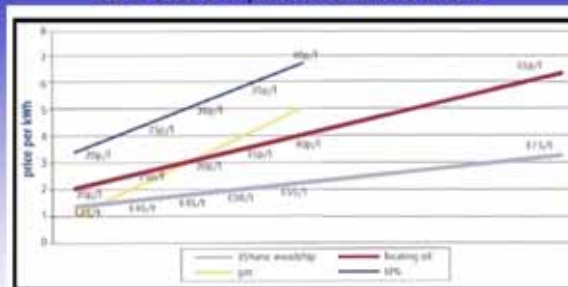
## Why should Ireland consider Bioenergy?

- To Save Money and Generate Wealth in the Rural Economy
- Energy Security - Ireland exports 80% of its Food, but imports 90% of its Energy!!
- To Reduce Carbon Foot Print of Agriculture and Food, while participating in an emerging "Carbon Economy."
- To help tackle Fuel Poverty!



## Saving Money !!

Heat Cost Comparison for different fuels



SDC "Wood Fuel for Warmth"

Wood prices @ 35% Moisture Content

Wood Chip is a Competitive Fuel – Oil @ 45c/l = €182/odt

## Job Creation

Estimated jobs created by development of a Wood Fuel Industry in Scotland (Evans 2004)

|                    |                                                                                    |
|--------------------|------------------------------------------------------------------------------------|
| Small CHP          | 1.5 jobs in fuel supply per MWe installed<br>+ 0.5 – 2 jobs per CHP installation   |
| Commercial Heating | 1.5 jobs in fuel supply per MWe installed<br>+ 1 job per boiler installed (200kW)  |
| Co Firing          | 1.5 jobs in fuel supply per MWe installed<br>+ 3 jobs per power plant installation |
| Merchant Plant     | 1.5 jobs in fuel supply per MWe installed<br>+ 4 jobs per power plant              |

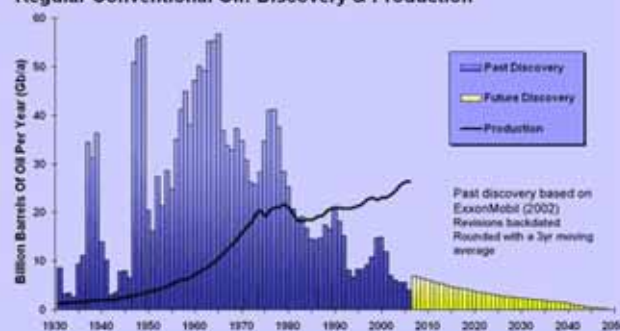
Ireland – 5,800MWe & 7,700MWt already installed!!



## Fossil Fuels – a Finite Resource

The drive for Alternatives & Energy Security

### THE GROWING GAP Regular Conventional Oil: Discovery & Production

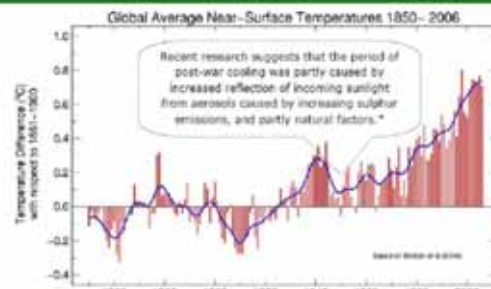


## Energy Security - Who do you trust?!!



We have a reliable record of surface temperature readings for the last 150 years which shows a pattern of global warming, particularly in the last few decades

Office of Climate Change



Global average surface temperature increased over the last hundred years (1906-2005) by 0.74°C with particularly strong warming since the 1970s

Figure courtesy of Met Office, Hadley Centre. \*Deser and Perren (2004) The Science and Politics of Global Science Change, Cambridge.

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## Carbon & the Food Chain New Market Place Developments!

### Food Chain, Carbon Accounting – PAS 2050 Standard

- Facilitated by British Standards Institute & launched Oct 08
- Supported by Food Industry (Ass. British Agric.; British Sugar; Cadbury; Co-op; Innocent; Muller; Pepsico; Sainsbury; Tesco)

### Public Opinion – Tesco Survey

- 97% would actively seek low carbon products if same cost
- 35% would seek them even if more expensive

NB – 60% of all Irish Food Exports are to the UK & Retailers already piloting this new Standard!!



## Walkers Crisps – Carbon Footprint Label "A 35gram bag has 75grams of CO<sub>2</sub>"



Product Life Cycle analysis is now becoming the norm!

## Measuring Carbon Foot Print of a Dairy Product

Table 3.2 – Contribution to Swedish dairy chain emissions

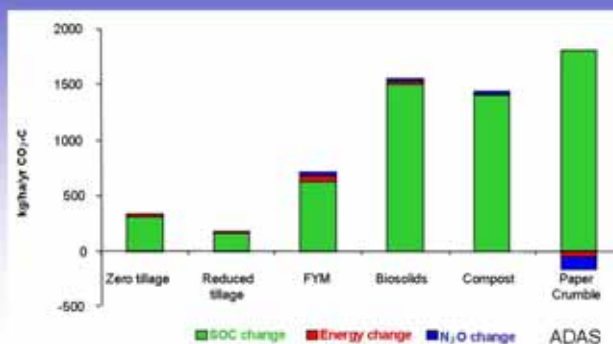
| %                    | 91%    | 1%           | 4%        | 2%                       | 2%           | Not included in % |
|----------------------|--------|--------------|-----------|--------------------------|--------------|-------------------|
| kgCO <sub>2</sub> eq | 11,873 | 102          | 523       | 250                      | 255          | 643*              |
|                      | ↑      | ↑            | ↑         | ↑                        | ↑            | ↑                 |
|                      | Farm   | In transport | Packaging | Processing (incl. waste) | Distribution | Consumer          |

Source: MK and the environment (Swedish Dairy Association). Converted from liquid milk at 7.25% milk solids.

The market place will demand us to take Carbon out of the Food Chain!!



## Carbon 'savings' from Reduced Tillage & different Organic Fertilisers

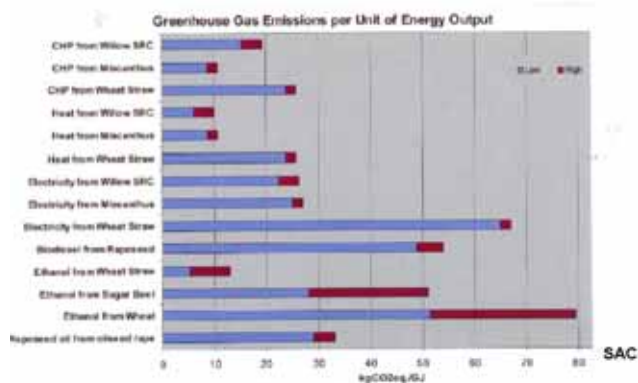


## Bioenergy, how does it compare?

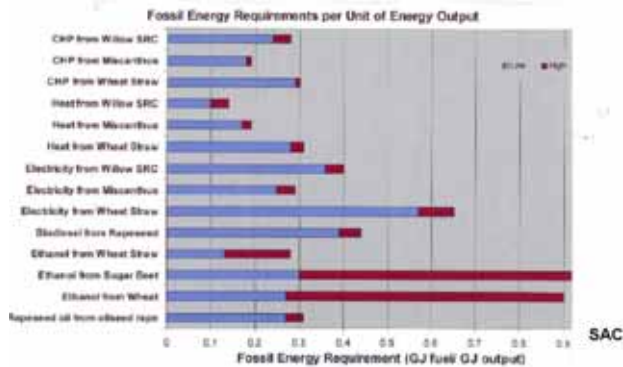
Figure 1 Indicative relative carbon abatement costs for a range of energy efficiency and renewable energy technologies\*



## The Differences between Bioenergies



## The Differences between Bioenergies



## My First Experiences of Renewable Heat

- 300KW Straw & Timber Boiler heating house & grain dryers, Cost €22,000; Annual Saving €6,000, Pay Back 3.5 Yrs
- No grant aid!! (1988-89)



## Developing a Bioenergy Industry Security of Supply Essential!!

### Sources of Biomass :- Wood for best combustion

- Forestry Wood Chip (12% of Land in ROI, 6% NI)
- Wood Pellets (BALCAS &/or Imports)
- Virgin Wood Waste (Contamination?)
- Willow (Indigenous, trialled since 1977, 3000 acres planted)



## Developing a Bioenergy Industry Quality of Fuel Supply Essential!!

### Wood Chip Drying & Grading -



Essential for Consumer Confidence!



## Developing a Bioenergy Industry Good Design Of Boiler Installations Essential!!



Training, Heat Accumulators, Exchangers, etc.  
Over 60 installed to date.



## Developing a Bioenergy Industry Good Design Of Fuel Storage Essential!!



## Developing a Bioenergy Industry

### Understanding Woodchip Delivery Methods essential!!



## The Conversion Technology

Heat Only, 40% of all Irish energy consumption is Heat!!

Yet no Strategy for Renewable Heat!!



Farm 2000, Straw and Timber Boiler, Brook Hall Estate

Automated, Multi Fuel, Farm 2000 & Swebo Boiler



## The Conversion Technology

Brook Hall Estate



KWB Wood Chip/Pellet Boiler



KWB Automatic Feeder

90+ % efficient,  
Cost €27,000  
Saving €4,000  
Pay Back 6 Yrs



KWB Combustion Chamber



## The Conversion Technology



KWB 20kW Log Boiler, Strabane



## The Conversion Technology



Omagh College, Wood Chip/Pellet  
150kW KWB Boiler & 250kW Cabin Fire Energy Cabin



Cost €35,000, Saving €11,000, Pay Back 3.5 Yrs



## The Conversion Technology



150kW Multi Fuel Biomass, 20kW Solar, Co. Louth



All Grains, Wood Chip, Pelleted Straw/Miscanthus  
Net Saving Drying Grain in 2008, €17,000 (IFJ 08/11/08)



## The Conversion Technology

Atlantic Industries, Drogheda  
4MW woodchip/pellet Justen Steam Boiler



Essential to match right conversion technology  
to the right fuel source and site location!!



## Bioenergy Opportunities and the Carbon Challenge

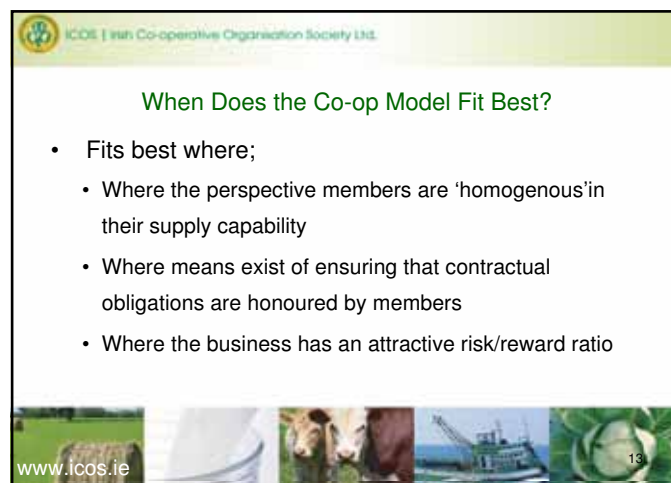
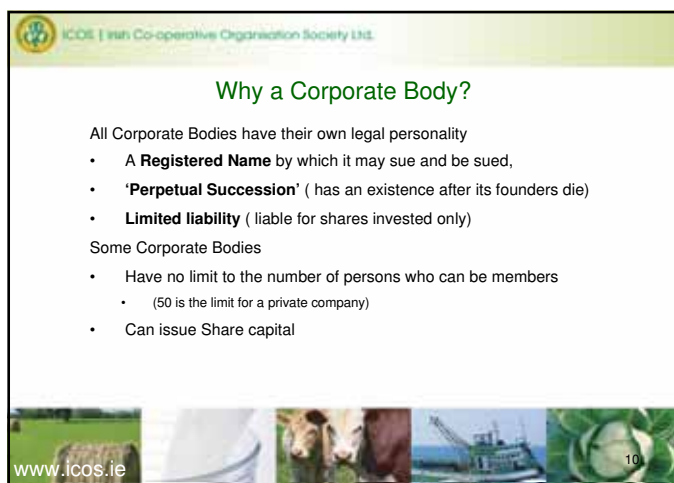
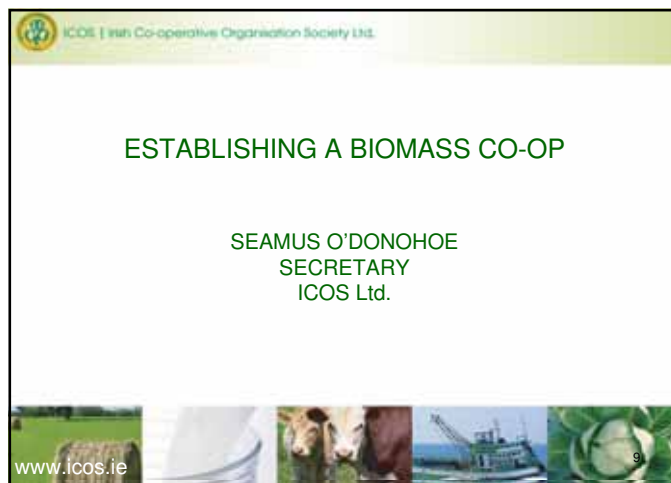
There are many opportunities and the Carbon  
Challenge can not be ignored!!

The Prize:-

- A vibrant Renewable Energy Economy embedded with in a safe & environmentally sustainable, Food Production system
- Better Irish Energy Security
- Alleviating Fuel Poverty
- Enhancing our International Reputation







ICOS | Irish Co-operative Organisation Society Ltd.

### Economic Justification

- Where there are clear co-ordination benefits in the business model
  - No 'procurement department', if members commit to supply
  - No search cost for raw materials
  - Possible to schedule processes
- Possibility of some market stabilisation when producer profits are low, processing profits are high
- Where there are profits to be captured further up the supply chain
- Where combined control of the raw material gives suppliers market power that they would not have as individuals
- Having a supplier owned co-operative in the Bio-fuel sector means
  - Suppliers get first hand market information on prices and costs
  - Help maintain a competitive market place

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ICOS | Irish Co-operative Organisation Society Ltd.

### Participation of Other Stakeholders

- Co-operative may need 'investors' other than the members producing the raw material
- Stakeholders
  - The Community ( potential customers)
  - User firms and businesses ( Other private firms, co-ops – hotels, processing co-op's etc)
  - Public Sector ( Hospitals, Schools, Local Authority Housing)
- Creation of Membership Categories
  - Varying rights and responsibilities
    - Share type allocated
    - Voting rights
    - Board representation
    - Financial reward

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ICOS | Irish Co-operative Organisation Society Ltd.

### Legal Incorporation & Reporting

- Seven Members
- Set of Rules
- Registration
- Must comply with the Industrial and Provident Societies Act 1893-1978
- Submit Annual and Triennial returns

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ICOS | Irish Co-operative Organisation Society Ltd.

### Making Society Operational (I)

- Business Promoters/Special Members
- Provisional Election of Officers
- Business Plan
- Rules
- Prospectus
- Registration of Co-operative
- Share & Membership Drive/Share Register
- Bank Account and Borrowing

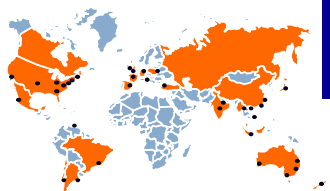
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### Making Society Operational (II)

- First General Meeting
  - Chairman's update
  - Statement of Affairs
  - Elections
  - Appointment of Auditor
  - Approval of Borrowing Powers
- Statutory Returns
- Back up and experience of ICOS adds value to the speed and quality of the business being organised.

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## Financing Bioenergy Projects

Hans van den Boom  
(Food & Agri Sector Manager)

Rabobank Food & Agri / ACC Bank





## Financing Bioenergy Projects

Hans van den Boom  
(Food & Agri Sector Manager)

Rabobank Food & Agri / ACC Bank



## Rabobank/ACCBank and Renewable Energy

- Food & Agri research => Clean Tech Desk
- Rabobank Group has set Clean Tech/Renewable Energy as a key strategic sector for the entire group
- Rabobank is a world leader in the Food & Agri and Renewables sectors
- The Netherlands
  - Wind => large market (Rabobank market leader)
  - CHP => large plans (incineration of waste, wood, manure)
  - Anaerobic CHP (digesters) - 100 plants in total, of which 75% are financed by Rabobank
  - Solar => developing market supported by new technologies
  - Gasification/pyrolysis dry biomass (less mature => longer-term prospects)

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## Ireland and Renewable Energy

- Less mature market than Netherlands
- Ambitious government targets
- Urgent action and increased incentives & grants are needed if targets are to be met
- Given current conditions in the Irish market (i.e. grid connections, available grants and tariffs), CHP and digesters offer the most potential
- My presentation will focus on CHP and digesters

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## Financing Bioenergy – Building a Strong Project

Who: Well-informed, committed customer with realistic expectations and strong motivation

Why: Challenging projects and a developing sector

Where: Location: Access to grid, availability of feedstock/ digestate

What: Proven technology, sufficient capacity

How: Realistic financial projections and cashflow. Network of peers and specialists

Biomass energy : not to be entered into lightly

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## Financing: A Checklist for Operators

- Have you visited a similar plant?
- Is it really turnkey? (allowance for contingencies)
- Experience of the builder/contractor
- Unanticipated start-up costs (for digesters, 5-15% in addition to total initial capital investment is not unusual)
- New, unproven technologies pose a risk
- Security of supply of feedstock
- Management of purchase and storage of feedstock (impact on capital expenditure, i.e. storage and on cashflow i.e. seasonal pricing)

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## Financing Bioenergy: Part of Existing Company or Stand-alone Startup

|                 | Existing company | Stand alone |
|-----------------|------------------|-------------|
| Own use         | ++               | -           |
| Capacity        | +                | ++          |
| Cash flow       | +                | ++          |
| Own equity      | +                | ++          |
| No of Investors | 1-3?             | 1-50        |

Contract S

Cost Price

No Other Cashflow

20 – 50%

Company Structure

TAILORED FINANCE BASED ON VARIABLES

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## EURO'S SAY MORE THAN WORDS - Two Examples

|                            | AE Digester      | CHP (wood)         |
|----------------------------|------------------|--------------------|
| Input                      | 25.000 tonne     | 15.000 tonne       |
| Output Power               | 1 Mw electricity | 0,9 Mw electricity |
| Output Heat                | 1,15 Mw          | 4,4 Mw             |
| Investment (All in)        | € 3,75 million   | € 4,0 million      |
| Investment Grant (max 30%) | € 1,12 million   | € 1,2 million      |



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## Examples Continued: Projections, Year 1- Full Exposure

|                                     | AE Digester        | CHP (wood)         |
|-------------------------------------|--------------------|--------------------|
| Income electricity (12 ct/kwh)      | 950.000            | 860.000            |
| Gate fees                           | ??                 | ??                 |
| Heat sales/ Heat cost savings       | 50.000??           | 250.000 ??         |
| <b>TOTAL INCOME</b>                 | <b>€ 1.000.000</b> | <b>€ 1.110.000</b> |
| Feedstock                           | - 200.000?         | - 400.000          |
| Discharge digestate/ash             | - 100.000?         | - ??               |
| Labour + Technical Consultancy      | - 100.000          | - 40.000           |
| Maintenance (contracts!)            | - 100.000          | - 150.000          |
| General costs                       | - 50.000           | - 40.000           |
| Interest Payments (100% finance)    | - 155.000          | - 165.000          |
| <b>TOTAL COSTS</b>                  | <b>€ 705.000</b>   | <b>€ 795.000</b>   |
| Principal Repayments (10 year loan) | - 250.000          | - 270.000          |
| <b>NET CASH FLOW</b>                | <b>€ 45.000+</b>   | <b>€ 45.000+</b>   |

These income streams & costs are the most important variables to be managed

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## Cash is King!!!



- Excellent performance can accelerate the net cash
- Proven cash is not the same as calculated cash
- Financing bioenergy is MADE TO MEASURE
- Profitable bioenergy requires serious commitment (should not be treated as an additional activity)



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## BRIDGING THE GAP: WHAT THE INDUSTRY IN IRELAND NEEDS



- More grants
- Higher feed-In tariffs
- Legislation and regulation for feedstocks and digestate/ash by-products
- Proactive industry lobby and peer community
- Experienced financiers and advisors

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## Summary



- Decide if you truly have a deep, long-term commitment to bioenergy
- Build a strong plan
- Develop a good network of people and a realistic businessplan
- Go to a bank who understands this inspiring sector.



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GOOD LUCK



# *Biomass Developments and Planning*

*Tipperary Institute*

Ciaran Lynch

Martin McCormack

## **Biomass Developments and Planning**

**Tipperary Institute**

### **Prepared by –**

*Peter Keavney, Managing Director Galway Energy Agency*

*Ciaran Lynch, Director of Rural Development, Tipperary Institute*

*Martin McCormack, Environmental Specialist, Tipperary Institute*

### **Key elements of planning**

- ☞ *Development Plan sets policy*
- ☞ *Development Management system grants licences for development*
- ☞ *Enforcement system ensures compliance*

### **Basic Principle of Planning**

- ☞ *All development needs permission unless the legislation says it doesn't*
- ☞ *Development*
  - *Erection of structure on in or under land*
  - *Change of use of land or structure*
  - *Intensification of use deemed to be a change of use*

### **Exempted Development**

- ☞ *The acts and regulations identify some forms of development that do not require planning permission provided they comply with certain conditions*
- ☞ *Some general conditions*
- ☞ *Some conditions specific to each type of development*
- ☞ *Recently a range of exempted developments for RE technologies*

### **Renewable Energy Technologies Exempted Developments**

- ☞ *Dept. of Environment, Heritage & Local Government*
- ☞ *SI No. 235 (2008)*
  - *Amendment to Planning & Development Regulations 2001*
- ☞ *Sectors Included:*
  - *Industrial, Commercial, Public Buildings*
  - *Agricultural Buildings/Holdings*
- ☞ *Technologies Included:*
  - *Combined Heat & Power (including Biofuel supply)*
  - *Biomass Heating Systems*
  - *Wind Turbines (including met mast)*
  - *Solar Panels (Thermal and PV)*
  - *Heat Pumps*

### **Combined Heat & Power Within the curtilage of an industrial building**

- *CHP Structure floor area not more than 500m<sup>2</sup>*
- *Not exceeding 10m height or 50m length*
- *Not less than 10m from any Public Road*
- *Not more than 8m high if within 100m of any Public Road*
- *Not less than 200m from any habitable dwelling/building etc*
- *Minimum 2 Flues, not more than 20m high and 1m diameter*
- *Noise levels < 43 dB(A), at nearest party boundary*
- *ONE such structure per SITE*
- *Structure for CHP Unit/Ancillary Equipment only*

### **Combined Heat & Power Within the curtilage of Commercial, Light Industrial, Public**

- *CHP Structure floor area not exceeding 300m<sup>2</sup>*
- *Not exceeding 8m height or 40m length*
- *Not less than 10m from any Public Road*
- *Not less than 200m from any habitable dwelling/building, etc*
- *Maximum 2 Flues, not exceeding 16m high and 1m diameter*
- *Noise levels not exceeding 43 dB(A), at nearest party boundary*
- *ONE such structure per SITE*
- *Structure for CHP Unit/Ancillary Equipment only*

## Combined Heat & Power

### Within Agricultural Holding

- CHP Structure floor area < 300m<sup>2</sup>
- Not exceeding 8m height or 40m length
- Not less than 10m from any Public Road
- Not less than 100m from any habitable dwelling/building, etc
- Maximum 2 Flues, not exceeding 16m high and 1m diameter
- Noise levels not exceeding 43 dB(A), at nearest party boundary
- ONE such structure per SITE
- Structure for CHP Unit/Ancillary Equipment only



## Biomass Heating System

### Industrial, Commercial, Light Industrial, Public

- Biomass Boiler House floor area not more than 20m<sup>2</sup>
- Fuel Storage Tank or Structure not more than 75m<sup>3</sup> capacity
- Neither Structure to exceed 3m height
- Not less than 10m from any Public Road
- Not less than 100m from any habitable dwelling/building, etc



## Biomass Heating System

### Industrial, Commercial, Light Industrial, Public (2)

- Maximum 2 Flues, not more than 16m high and 1m diameter
- Noise levels less than 43 dB(A), at nearest party boundary
- ONE such structure per SITE
- NO fuels derived from Animal Wastes
- NO fuels to contain any Dangerous Substances



## Biomass Heating System

### Within Agricultural Holding

- Biomass Boiler House floor area not more than 20m<sup>2</sup>
- Fuel Storage Tank or Structure not more than 75m<sup>3</sup> capacity
- Neither Structure to exceed 3m height
- Not less than 10m from any Public Road
- Not less than 100m from any habitable dwelling/building, etc



## Biomass Heating System

### Within Agricultural Holding

- Maximum 2 Flues, not more than 20m high and 1m diameter
- Noise levels less than 43 dB(A), at nearest party boundary
- ONE such structure per SITE
- NO fuels to contain any Dangerous Substances



## Other exemption issues

- ☞ Some other restrictions on exemptions in Article 9 of the 2001 Planning and Development Regulations
- ☞ If in doubt seek a declaration from the Planning Authority under Section 5 of the Planning and Development Act 2000
- ☞ Declaration of Planning Authority may be sent to An Bord Pleanála for review



## Other Project Planning Issues

- CHP – Electricity Grid Connection
- Summer Months Heat Demand
- Security and Quality of Fuel Supply
- Fuel Price Sensitivity Analysis
- Operational Hours – within Noise Criteria
- Transport of Fuels



## FUEL EMISSIONS

| <u>Fuel</u>                                  | <u>g CO<sub>2</sub>/kWh</u> |
|----------------------------------------------|-----------------------------|
| Electricity (current mix) 2007               | 601.0                       |
| Peat/Briquettes                              | 390.3                       |
| Coal                                         | 324.7                       |
| Diesel/Gasoil(Heating Oil)                   | 263.9                       |
| LPG                                          | 218.0                       |
| Natural Gas                                  | 197.7                       |
| Biomass Energy Systems (excluding transport) | 0                           |



## **Final Notes**

*Sustainability - management and control of local natural resources and limitation of avoidable waste with individual responsibility.*

*Invest in your environment or it will pay you back.*

**Thank You**



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# ***Making Anaerobic Digestion a Commercial Reality***

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## **National Bioenergy Conference**

David McDonnell  
Limerick

## Making Anaerobic Digestion a Commercial Reality

### National Bioenergy Conference

David McDonnell  
Limerick

## Background

- Dairy & Poultry Farmer
- Renewable Energy Experience in Wind Farming
- Practical Solution re: Nitrate, landfill Directives, Energy and Environmental Targets, Etc.
- Sustainable & Integrated Local Development
- New Business

## Making Anaerobic Digestion a commercial reality Overview

- Scale of Project
- 1. Large, Centralised Plant



## Making Anaerobic Digestion a commercial reality Overview

- Scale of Project
- 2. Small, Farm scale plants



## Making Anaerobic Digestion a commercial reality Introduction

What key areas do you need to know about to **Make It Happen?**

- Type and amount of feedstock (Not Wastes!)
- Type of Technology and Provider
- Site Location, access, etc.
- Planning Permission, Permits, Etc.
- Feasibility, Financial Model, Grant Aid and Bank Finance

## Making Anaerobic Digestion a commercial reality Making It Happen

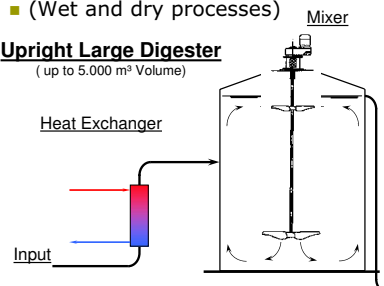
- Type and amount of feedstock



## Making Anaerobic Digestion a commercial reality Making It Happen

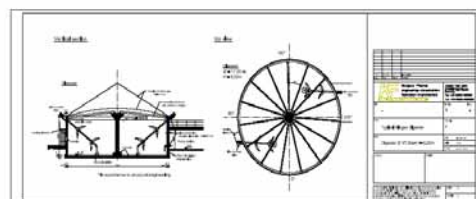
- Type of Technology and Provider
- (Wet and dry processes)

### Upright Large Digester (up to 5,000 m<sup>3</sup> Volume)



## Making Anaerobic Digestion a commercial reality Making It Happen

- Type of Technology and Provider
- Double Side mounted mixing Tank



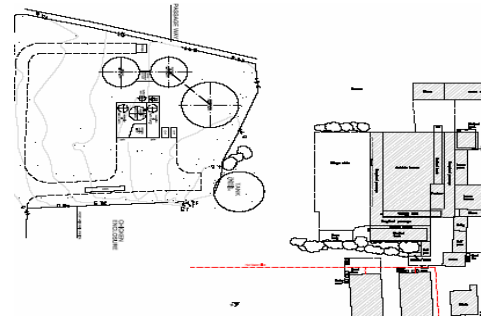
## Making Anaerobic Digestion a commercial reality Making It Happen



□ Site Location, access, etc.

## Making Anaerobic Digestion a commercial reality Making It Happen

### □ Site Location



## Making Anaerobic Digestion a commercial reality Making It Happen



□ Site Location, access, etc.

## Making Anaerobic Digestion a commercial reality Making It Happen

### □ Planning Permission, Permits, Etc.

1. Planning Consent
2. Waste Permit/Licence
3. Department of Agriculture, Animal By-Product (ABP) Approval (3 Stages)
4. ESB Grid Connection
5. Commission for Energy Regulation (CER) (Licences to construct and generate)
6. Neighbour/Public Consultation

## Making Anaerobic Digestion a commercial reality Making It Happen

### □ Feasibility, Financial Model, Grant Aid and Bank Finance

1. Financial Model-Cash flow
2. Electricity price – PSO List & REFIT
3. Gate Fee
4. Running costs
5. Grant Aid
6. Bank Finance

## Making Anaerobic Digestion a commercial reality Conclusion:

- Higher Electricity Price  
Currently €120/Mwh needs to be >€180
- Quicker and cheaper grid connection (CER)
- New Grant Aid (SEI)- Positive move
- Inter-departmental communication  
DECNR, DOE AND DAFF
- Department of Agriculture Fisheries and Food  
ABP Approval and Industry Co-operation
- Overall very long process!
- Very Good potential if some or **all** the above **can** be done.... "YES WE CAN" B.O.

Thanks for your attention!

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# **Co-firing of Biomass with Peat**

Presentation to

## **National Bioenergy Conference 2009**

By

**Charles Shier**  
**Bord na Móna Energy Ltd.**

National Bioenergy Conference, 5 & 6 February 2009

BORD NA MÓNA 

## Co-firing of Biomass with Peat

Presentation to

### National Bioenergy Conference 2009

By

**Charles Shier**  
Bord na Móna Energy Ltd.

National Bioenergy Conference, 5 & 6 February 2009



## Governmental Targets for Co-firing

### ➤ White Paper on Energy, March 2007

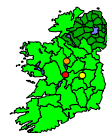
"We are setting the **target of 30% co-firing** at the three State owned peat power generation stations to be achieved progressively **by 2015**, beginning with immediate development by Bord na Móna of its **pilot project at Edenderry Power Station**.....We will **extend the REFIT** electricity support scheme to encompass co-firing..."

### ➤ National Climate Change Strategy, April 2007

"The Government has established a target for biomass to **contribute up to 30%** of energy input at peat stations **by 2015** .....The Government will **amend the REFIT** scheme to allow biomass from co-firing to avail of the tariff."

### ➤ 3 Peat-fired Stations

- Contracted peat use: 23.7 PJ/a
- Co-firing target: 30%
- Biomass required: 7.1 PJ/a



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## Key Issues to be Addressed

- Planning & IPPC licensing amendments
- Impact of co-firing on contracted peat sales
- Development of robust biomass supply chains
- Assessment of technical impact on plant
- Establish upstream (handling & storage) and downstream (plant impact) costs
- Recovery of all biomass costs – commodity, investment and downstream



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## Biomass Materials Suitable for Co-Firing

### ➤ Forest based materials    ➤ Waste based materials

- Roundwood
- Forest residues
- Sawmill residues
- Wood pellets
- Recovered wood
- Green waste
- Meat & bone meal
- Imported biomass

### ➤ Land based materials

- Energy crops
- Materials from cutaway peatlands



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## Biomass Availability – Estimated Volume & Costs

2015 co-firing target (30%): 7.1 PJ = 7,100 TJ

| Biomass Material   | Volume (kta) | Calorific Value (GJ/t) | Peat Displaced (TJ) | Delivered Price (€/GJ) |
|--------------------|--------------|------------------------|---------------------|------------------------|
| Forest roundwood   | 50 - 100     | 8.2                    | 820                 | € 6 - 10               |
| Forest residues    | 25 - 30      | 8.2                    | 246                 | € 6 - 10               |
| Sawmill residues   | 10 - 20      | 7.2                    | 144                 | € 5 - 6                |
| Wood pellets       | 5            | 16.8                   | 84                  | € 6.5 - 8              |
| Energy crops       | 10 - 50      | 12.6                   | 630                 | € 7 - 11.0             |
| BnM cutaways       | 5 - 10       | 11.4                   | 114                 | € 8 - 10.0             |
| Recovered wood     | 25 - 50      | 14.6                   | 730                 | € 6 - 7                |
| Green waste        | 7 - 15       | 12.5                   | 187                 | € 6 - 7                |
| Meat & bone meal   | 25 - 50      | 15                     | 750                 | ??                     |
| Imported materials | 200+         | 16                     | 3,395               | € 6.5 - 9              |
| <b>Total</b>       |              |                        | <b>7,100</b>        |                        |

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## Pilot Project - Progress To Date

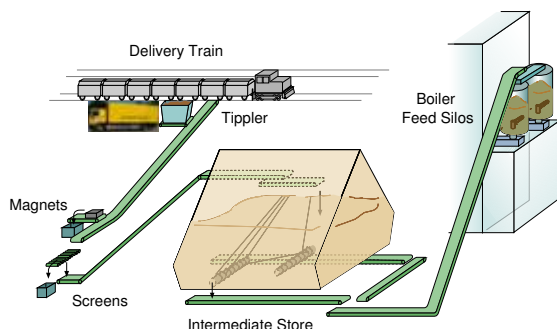
- Biomass co-firing trials have commenced at Edenderry;
- BnM targets: 20,000 t in 2008/09  
40,000 t in 2009/10
- ~17,700 tonnes co-fired in the year to December 2008;
- Trial materials: sawdust, wood chips, wood pellets, recovered wood, willow, miscanthus, olive pellets, palm kernel shells;
- Focus on handling issues – with delivery through the existing fuel handling system.



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## Fuel Handling at Edenderry



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## Co-firing: Biomass Materials Tested in 2008

Biomass Deliveries to end December 2008: 17.7 kt

| Biomass Material             | Weighed Tonnes | Energy Tonnes |
|------------------------------|----------------|---------------|
| Wood Chip / Forest Residues  | 6,726          | 8,571         |
| Bogs / Marginal Land (Birch) | 628            | 979           |
| Sawmill Residues             | 8,584          | 6,688         |
| Wood Pellets                 | 494            | 1,025         |
| Miscanthus                   | 194            | 296           |
| Willow                       | 426            | 711           |
| Recovered Wood               | 118            | 210           |
| Green Waste (Kilberry)       | 455            | 433           |
| Meat & Bone Meal (MBM)       | 0              | 0             |
| Olive Pellets                | 54             | 114           |
| Palm Kernel Shells           | 52             | 100           |
| <b>Total</b>                 | <b>17,731</b>  | <b>19,127</b> |

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## Experience with Materials Tested

### Materials that flow readily:



Wood Chips



Palm Kernel Shells

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## Wood Pellets

### Wood Pellets flow readily:



### But dust is a hazard:



Delivery via a silo is a safer option

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## Miscanthus - 1

### Delivered by 'Walking Floor':



### Bridging on the intake grid:



Miscanthus particles are too long

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## Miscanthus - 2

### Chopped, baled & wrapped:



Particle size is satisfactory



But handling is labour intensive

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## Miscanthus – November Trials



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## Co-firing with Meat and Bone Meal (MBM)

- Jan. 2006: 1<sup>st</sup> revision to IPPC licence – allowed EPL to burn MBM, but required WID compliance;
- Nov. 2006: Category 3 MBM (low risk) was declassified as a waste material;
- July 2008: local resident withdrew case for a Judicial Review of ABP's decision to grant planning consent;
- Nov. 2008: PD for 2<sup>nd</sup> revision to IPPC licence received - ELVs applicable to combustion of peat, biomass & MBM;
- Storage silo & handling facilities will be installed in Summer 2009;
- Co-firing with MBM could commence from Sept. 2009



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## Biomass Costs and Recovery

- Current biomass commodity cost range: €6 – 8/GJ;
- All costs above the PPA peat energy price (€4.18/GJ) are currently being borne by BnM;
- 1<sup>st</sup> proposal for interim recovery mechanism based on '**PPA peat price + carbon**' - but proposal rejected by ESB-CS;
- 2<sup>nd</sup> proposal based on '**SEM price for energy component**' associated with biomass co-firing - currently under discussion;
- Biomass costs will increase with volume – higher priced materials, greater transport distance;
- In the longer term, **REFIT support will be required** to cover commodity and investment costs.

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## REFIT Subvention at Different Carbon Prices

### Example: for a biomass purchase price of €8/GJ:

| C Market Price (€/t CO <sub>2</sub> ) | Total Peat+C (€/GJ) | "Top Up" (€/GJ) | Subvention (€/a) |
|---------------------------------------|---------------------|-----------------|------------------|
| €15                                   | 5.90                | 2.10            | 14.9             |
| €20                                   | 6.47                | 1.53            | 10.9             |
| €25                                   | 7.04                | 0.96            | 6.8              |
| €30                                   | 7.61                | 0.37            | 2.8              |
| €35                                   | 8.18                | -0.18           | -1.3             |

- Subvention varies with the market price of carbon;
- With peat €4.18/GJ, break even support price is €33.40/t CO<sub>2</sub>.

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## Assessment of Technical Impact of Biomass

- Original co-firing idea proposed during Fortum's ownership of Edenderry;
- Similar plants in Finland were co-firing with biomass – no significant technical issues;
- A number of plants were also co-firing with MBM;
- Assessment of boiler condition at EPL is carried out by:
  - Annual crawl through inspection
  - Tube thickness measurements
  - Main focus has been on "erosion", no evidence to date of fire-side "corrosion"
- Full assessment of technical impacts - only possible after much larger biomass volumes



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## The Next Steps

1. **Volume** – to gain access to sufficient biomass to enable 30% co-firing initially at Edenderry, and later also at the two ESB plants;
2. **Price** – to ensure that biomass is delivered at a competitive price;
3. **Technical Assessment** – a programme to monitor the chemistry of co-firing & associated impacts;
4. **Cost Recovery** – to put in place a mechanism that enables all costs to be fully recovered by the power plant owners.

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## Developing Biomass CHP in Ireland

Tom Bruton, Fred Tottenham

*(adapted from "Biomass CHP Market Potential in the Western Region: An Assessment" a report prepared by BioXL for the Western Development Commission in 2008, available to download at [www.wdc.ie](http://www.wdc.ie))*

CHP is the combined production of heat and power in a single process. Biomass CHP is a highly efficient means of generating electricity as it allows the use of lower grade thermal energy that cannot be converted into electricity.

CHP has historically been a large-scale industrial technology, particularly for biomass. In Ireland, 88% of installed CHP capacity is in industry. Most existing CHP capacity is fossil fuel based, with just three existing biomass CHP installations on the island of Ireland, all approximately 2 MWe. This would previously have been considered the minimum threshold for economic viability based on standard steam turbine technology.

### **Technology**

With higher oil prices and policy drivers in favour of renewable fuels, many previously marginal technologies are becoming viable, including smaller-scale biomass CHP applications. If biomass CHP is to develop at a smaller scale, it will predominantly be through technologies such as steam engines, Organic Rankine Cycle (ORC) units, gasification systems and perhaps hot air turbines and Stirling engines. Biomass CHP at a smaller scale than 2 to 3 MWe is becoming widespread. Examples can be seen in Germany, Belgium, Austria and Denmark. Between 2004 and 2006 there was an EU-wide growth rate of 11% in terms of electricity produced from biomass CHP.

Based on commercially available technologies, biomass CHP is possible for users with a continuous heat load of at the very minimum 600 kWth. Such a heat load might typically be required by a hotel (>150 rooms) with a pool, or by a hospital.

Even so, a major challenge facing the promotion of biomass CHP will be to identify sites with a large enough 'year round' heat load. To a large extent, these are the same obstacles facing both fossil fuelled CHP and district heating systems.

In July '08, the cost of heat produced from woodchip and natural gas was comparable for large heat users. With the additional capital cost associated with biomass CHP equipment it is exceptional that biomass CHP is chosen where natural gas is available.

However, biomass is substantially cheaper than oil or LPG and the additional capital cost may be offset by lower running costs.

The typical case studies presented in this report indicate that under favourable heat load and fuel costs, biomass CHP represents a real commercial opportunity, with simple payback of approximately three years. In order to promote decentralised CHP, projects must be located to exploit their proximity to both the biomass resource and significant heat users.

### **Market assessment for Western Region of Ireland**

BioXL, carried out a bottom-up market analysis of the Western Region in 2008 and identified 119 potential sites, of which potentially 22 could install biomass CHP under a medium development scenario. The market projections suggest a medium scenario target for the region of 42 MWe by 2020.

[www.bioxl.ie](http://www.bioxl.ie)



The sites above 5 MWe are likely to be large industrial users, such as the board mills, pharmaceutical, cement and food manufacturers and potentially a substantial district heating scheme. The sites between 1 MWe and 5 MWe are likely to include a further selection of manufacturing sites, including food processors, medical devices and other industrial sites, as well as potential district heating schemes. The potential sites below 1 MWe include a number of hospitals, hotels with over 150 bedrooms, a number of feed mills and other manufacturing sites, as well as slightly smaller scale district heating.

Substantial social and economic benefits resulting from the growth of biomass CHP were identified. The medium market projections would potentially result in a direct gross investment of €138 million and create approximately 321 jobs by 2020. A requirement for 500,000 tonnes of woodchip was estimated, displacing approximately 370,000 tonnes of CO<sub>2</sub>-equivalent from fossil fuel sources.

### **Issues for development**

Experience of biomass CHP in Ireland and awareness of the technology is relatively low. Training in biomass CHP technology should be considered for energy professionals in Ireland. This would be most effective as part of a national CHP support programme and could be delivered at a regional level. Addressing biomass CHP during the existing workshops and seminars on energy and biomass would enhance the knowledge of biomass CHP in Ireland.

The REFIT tariff of €120/MWh for electricity generated by biomass CHP, which was announced in 2007, is competitive, based on both economic analysis and comparison with international schemes. Long-term, stable, feed-in tariff support schemes have had a very positive market impact in other countries.

The 30% capital funding available through SEI's biomass CHP programme is a significant support to the industry, however the duration of this programme may prove a barrier to development. Projects must be completed by 2010 in order to avail of support. Given the lengthy planning process and construction times that can be encountered by biomass projects, this is a significant restriction. Other pre-conditions of the grant programme pose significant cost and therefore risk for a project developer. SEI's programme also offers up to 40% financial support for carrying out biomass CHP feasibility studies. A higher level of funding of feasibility studies would be a comparatively low-cost method of stimulating the industry.

Within the European markets there is a clear link between district heating networks and the application of CHP technology. If biomass CHP is to be seriously considered the barriers to district heating must be reduced. There are currently no direct supports for district heating infrastructure therefore a parallel support for district heating should be considered, which would facilitate a greater number of potential CHP sites.

In the short term all CHP technology will be imported. If Ireland develops significant research and manufacturing capabilities for CHP technology this would lead to significant indirect job creation. Biomass CHP development is strongly influenced by the regional research capacity on the topic. Many of the innovations first occurred in the areas where the technology was subsequently demonstrated and refined before looking to the export market. Regional research centres need to develop core competences relevant for the combustion of biomass. Greater participation in relevant international research projects should be encouraged.



In order to stimulate regional deployment of biomass CHP, all sites with a continuous heat load above 600 kWth should be encouraged to investigate the applicability of biomass CHP technology. The market segments to be targeted are the high-load heat users, particularly the forest products' manufacturers and sawmills, who have existing supply of wood products, on-site wood residues and the infrastructure to handle biomass.

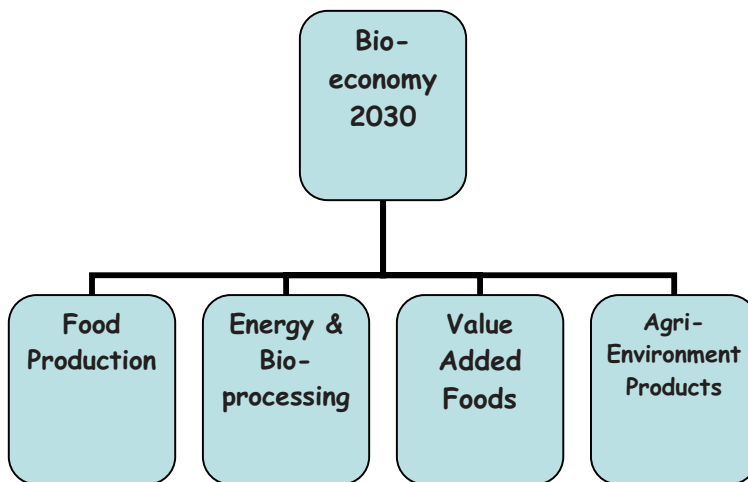
[www.bioxl.ie](http://www.bioxl.ie)

## **Best Practice for Energy Crops Teagasc Research and Experience**

**John Finnan  
Teagasc Crops Research Centre**

### **Introduction**

Research on energy farming at Teagasc spans an unbroken period of over 30 years. This long history of research reflects the potential Teagasc sees in this area. Our recently published Foresight report (Towards 2030) identified energy and bio-processing as one of four pillars of the Irish agricultural economy in 2030.



The bioenergy research programme at Oak Park is expanding to meet the demands of this developing sector. The programme currently includes research in the following areas:

- Energy crop agronomy;
- Bio-remediation;
- Harvesting and storage;
- Combustion;
- Pelleting;
- Combined heat and power;
- Anaerobic digestion; and
- Life cycle analysis.

This talk focuses on Teagasc's experience and research with three energy crops - willow, miscanthus and hemp.

### **Willow**

Research with short rotation coppice commenced in 1977 when the first trials were laid down in Oak Park. Willow quickly proved to have greater coppicing ability compared to other species and yields exceeding 10 tonnes of dry matter per hectare were obtained from small plot trials eight to nine years after sowing. However, yields then started to decline rapidly due to severe attacks from the *Melampsora* rust fungus whose attacks

increased in severity and earliness from year to year and resulted in severe defoliation of willow trees.

Willow plantations across Europe also experienced severe problems with rust in the mid 1980s. As a consequence, two willow breeding programmes were established to breed higher yielding varieties of willow which would be more resistant to rust. Additionally, research has shown that the use of varietal mixtures is a highly effective strategy which minimises the impact of rust on a willow plantation. The use of varietal mixtures has also been shown to be an effective strategy against pollen beetles, another major pest of willow. The advantages of willow mixtures are not confined to their effect of disease however. Significantly greater yields are obtainable from willow mixtures compared to the corresponding yields of their component varieties. This arises because of better resource capture. Varieties in a mixture compete with each other, they grow taller and their roots extend further as a result. Yields from mixtures are also much more stable between different sites whereas the yields of single varieties show considerable variation between different sites.

Teagasc research on willow re-commenced in 2007. Willows sown at Oak Park are now sown as a mixture of seven different varieties.

### ***Cutting Back***

Willows are cut back (coppiced) after the first year of growth. Trials on the best machinery for cutting back have been conducted at Oak Park and include finger bar mower, rotary mower and topper with a single flail.

The results demonstrated that the finger bar mower (although slow) gave the cleanest cut. The rotary mower and the topper had a greater tendency to split the stems and damage the stools making them more amenable to infection and providing less support for subsequent growth.

### ***Storage of Willow Chips***

Research at Oak Park shows that fresh willow chips cannot be stored in unventilated piles. In such piles, self-heating causes a rapid temperature build-up to over 50 °C. Allergy-inducing fungi develop in these piles with the associated risk to workers of serious bronchial infection. Respiration measurements reveal that willow chips need to be dried down to below 25% before they can be stored safely without ventilation.

A simple low-cost ventilation system has been developed at Oak Park for use on farms. The system consists of a clamp of willow chips constructed from pallets or similar material covered by a breathable tarpaulin. The willow are dried by blowing air through a ducting for 12 hours a day. The work has revealed that willow chips can be dried from >50% moisture to <20% moisture in a period of approximately four months at an electricity cost of less than €5 per wet tonne. No self heating occurs and harmful fungi do not develop.



### Miscanthus

Three plantations of miscanthus were established at Oak Park during 1994. They are currently in their 14<sup>th</sup> year and still yield >10t DM/ha in good years, there have been no serious incidence of disease. N response trials revealed that the crop can respond to nitrogen application. Experience with miscanthus harvesting shows that crops are typically harvested at moisture contents in excess of 30%. Research work also shows that large bales harvested at >30% moisture will dry down over the summer months once they are stored in a shed or outside under cover, this is the case for both round and large square bales. No heating has been found to occur under these storage conditions. In contrast, bales stored outside without cover continue to accumulate moisture and deteriorate.

### Hemp

*Cannabis sativa* is an annual spring crop which can yield up to and exceeding 12.5 t/ha of whole stems. It has modest fertilizer requirements and it is possible to grow the crop without the use of herbicides, insecticides or fungicides. However, the crop is sensitive to frost, does not tolerate waterlogging or soils with low Ph. Teagasc experience in 2008 showed that there was disease pressure from two fungal diseases *Botrytis* and *Sclerotinia*.

Hemp has been the subject of three different periods of research by Teagasc. Previous interest in the crop was as a source of fibre. However, more recent interest is in the use of hemp as an energy crop either as a combustible material or as a second generation biofuel. The following are results from previous and more recent research on hemp at Oak Park.

#### *Sowing Date*

Higher yields are obtainable from early sowing with a steady decline in yields with delayed sowing. However, hemp is sensitive to frost. Therefore, in most parts of the country it is recommended that sowing be delayed until towards the middle of April to avoid the risk of damage due to late frosts. Late sowing, however, will entail a yield penalty and may give weeds a competitive advantage in some instances.

#### *Seeding Rate*

The quality of the fibre from hemp stems increases with plant density and higher seeding rates are typically used. However, where stem yield is the primary objective higher yields can be obtained from lower seeding rates. In seeding rate experiments, reducing the rate to 30 kg/ha resulted in a significant increase in stem yield. Additionally, the low seed rate treatments had less disease pressure.

#### *Varieties*

Previous work at Oak Park shows that dioecious varieties were particularly high yielding. Recent field trials in 2008 with French monoecious varieties showed that late maturing varieties were superior in yield to early and mid maturing varieties.

#### *Fertilization*

Nitrogen response trials were carried out at three sites during 2008. The response to nitrogen fertilizer peaked at 120kg/ha

#### *Harvesting*

The density and height of a mature hemp crop can cause problems when cutting and baling hemp with existing farm machines. Hemp harvesting trials carried out by Teagasc during the late 1990s concluded that :

*Cutting Operations:* Rape swathers and drum mowers proved unsuitable for cutting hemp. Disc mowers handled the crop easily but needed a follow-up windrowing operation.

*Collecting:* Belt type round balers proved suitable and had no problems baling the crop. Fixed chamber balers proved satisfactory but less suitable than belt type models. Precision-chop forage harvesters with maize headers proved capable of harvesting hemp as long as the crop is still green.

#### **Concluding Remarks:**

Teagasc has a long history of involvement with bioenergy research. The programme is now expanding and there has been a significant investment in facilities at Oak Park. The research programme will continue to support the growth of this sector which is considered pivotal to the future of the Irish agricultural industry.