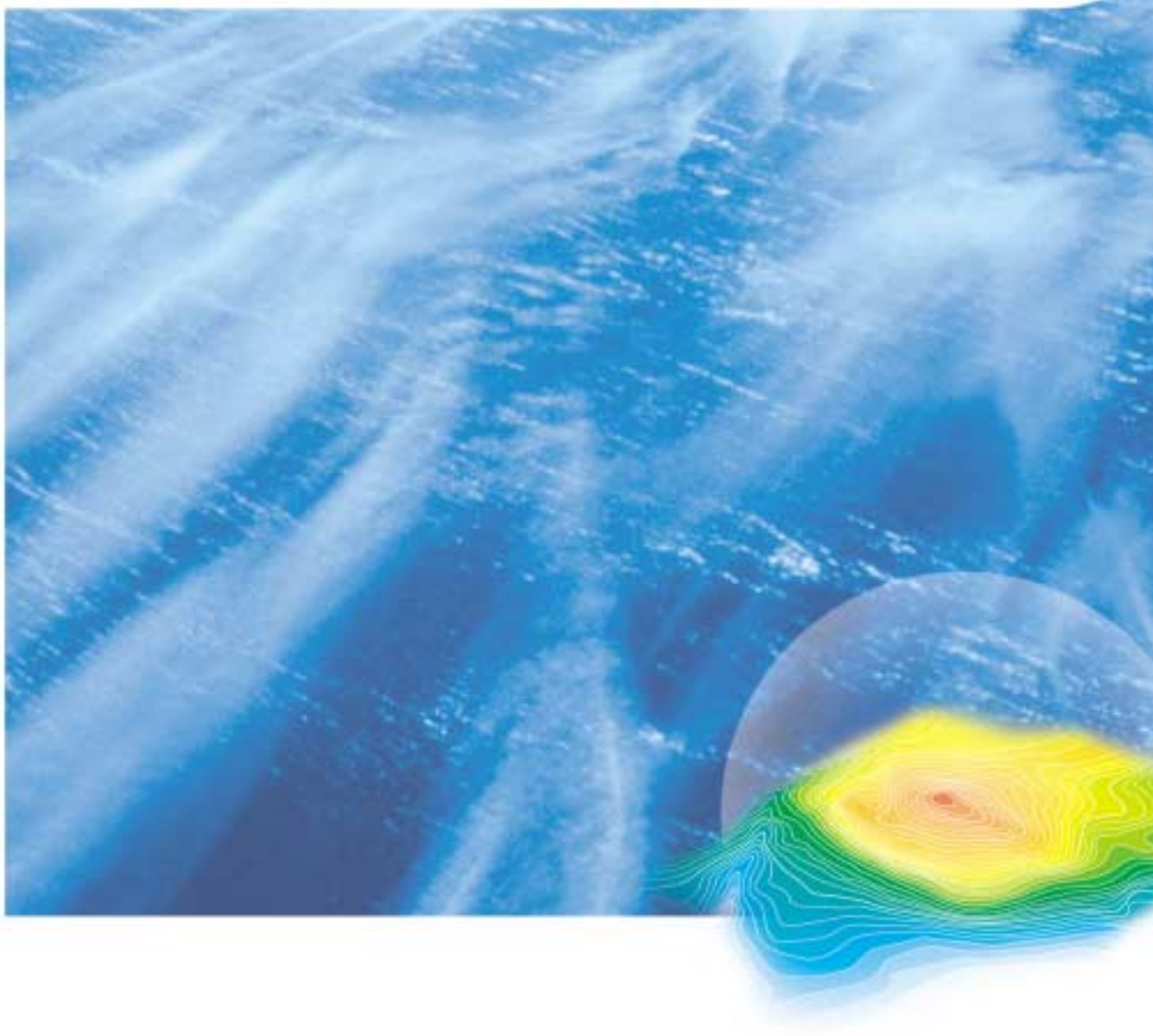
SUSTAINABLE ENERGY IRELAND



A Resource Study on

Recovered Vegetable Oil and Animal Fats

A Study completed by Clearpower ltd. on behalf of
Sustainable Energy Ireland (SEI)

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Contents

Executive summary

The use of animal fats (tallow) and recovered waste vegetable oil (RVO) in animal feed is under threat due to new EU regulations imposed following the BSE crisis.
Ireland now has an opportunity to exploit its annual production of tallow and RVO for use as renewable fuels. This can help reduce fossil fuel imports, secure energy supply and reduce CO_2 emissions, while at the same time provide an industry solution in terms of a new end use.
The main objective of this study was to quantify the current and potential future supply of both tallow and RVO, assess the current and future demand, and to evaluate the scale and availability of any surplus that could be used as fuel.

Using a structured approach and proven analytical techniques, it has been shown that:

– 78,000 tonnes of tallow is produced annually in the eight rendering plants in the Republic of Ireland, a volume set to fall gradually in line with a slow reduction in the national herd. There is currently no surplus tallow produced, and for many grades of tallow the market into animal feed will continue. However, given current tallow market conditions and fossil fuel prices, 22,000 tonnes of low-grade non-BSE risk tallow could be diverted for use as a fuel.

(Tallow: All figures in tonnes)	**2003**	**2010**	**2020**
Total tallow produced	*78,200*	*71,700*	*63,400*
Risk material	*34,400*	*31,800*	*28,100*
Non risk material	*43,800*	*39,900*	*35,300*
Volume used as boiler fuel within the rendering industry	*42,000*	*38,000*	*34,000*
Lower grade non risk material with biofuel potential	*21,900*	*20,000*	*17,600*

– 29,000 tonnes of waste vegetable oil is produced annually across the island of Ireland, rising gradually over the next decade in line with population and economic growth. 14,500 tonnes of this is currently recovered as RVO, leaving a potential 14,500 tonnes surplus to be disposed of by other means. Only 5,000 tonnes of this surplus is 'realistically' recoverable. 97% of the RVO currently goes into animal feed in Ireland or the UK, a practice that will be banned from November 2004. The market for Irish RVO is already shifting however, and unless attractive new local markets can be encouraged the entire volume will be sold to biodiesel processors in the UK or Europe.

(RVO: All figures in tonnes)	**2003**	**2010**	**2020**
Waste vegetable oil supply	*29,200*	*32,300*	*37,500*
RVO	*14,500*	*17,900*	*24,000*
Potential surplus	*14,700*	*14,400*	*13,500*
Realistically collectable surplus	*5,300*	*4,000*	*1,400*
RVO available for biofuel	*5,300*	*21,900*	*25,400*

Introduction

Throughout Europe, renewable energy is now getting the political and economic emphasis required to make a meaningful contribution to reducing dangerous emissions. In parallel, there is now real concern that with global fossil fuel reserves diminishing and held in increasingly unstable areas of the world, the EU must take action to secure energy supplies.

- The EU is committed, under the Kyoto protocol, to reducing greenhouse gas emissions to 8% below 1990 levels by the period 2008-2012.
- EU member states have each introduced significant new policies to encourage the development of different types of renewable energy. Overall, the EU has called for an increase in the contribution from renewable sources to total energy consumption from the present 6% to 12% by 2010.
- It is widely expected that an EU wide system of taxing carbon emissions will be introduced within the next 2-3 years, which will follow the "polluter pays" principle. Within this context, Ireland has much to do to reach challenging targets

Although starting late, Ireland is now placing considerable emphasis on its renewable strategy, offering long term purchase contracts for renewable power and committing significant additional funds through the National Development Plan[1] and Sustainable Energy Ireland[2] to encourage the industry as a whole.

- Ireland's Kyoto target is to limit CO_2 emissions growth to 13% above 1990 levels by 2012. This level has been significantly exceeded, and in a business as usual scenario, is expected to be 35% above 1990 levels by 2010. This will result in significant financial or economic penalties.
- Ireland currently imports greater than 90% of its primary fuel needs. This is amongst the highest in the EU and means that Ireland has potentially the lowest security of supply within Europe.
- Renewable energy in Ireland currently accounts for only 2% of usage and approximately 5-6% of capacity.

In addition, many of the renewable energy conversion technologies have now come down the price and risk curve, making renewable energy projects a lower risk/better return prospect for investors:

- Wind turbines and biomass combustion/power conversion technologies are well proven and robust
- Liquid biofuels for use in transport and heating are well proven, and in common use around Europe

[1] www.ndp.ie

[2] www.sei.ie

Biomass will be the largest source of renewable energy

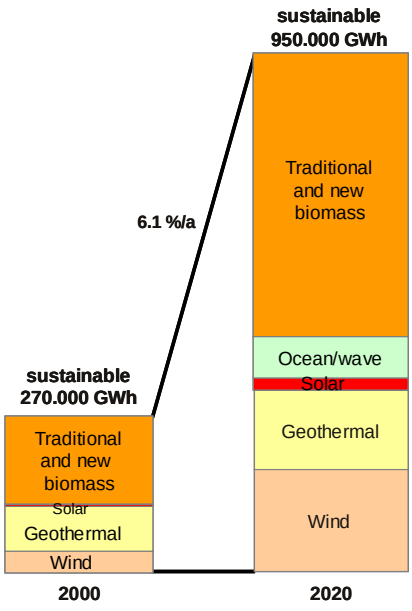
In terms of renewable energy, *electricity* production from the wind has a high media profile and often takes centre stage. However, in developed countries such as Ireland, electricity represents only 16% of our final energy consumption, with the balance made up largely of fossil fuelled heating and engine/transport requirements. Wind is also variable, not predictable, and cannot stand alone in terms of an electrical solution. Biomass represents a very significant source of renewable fuel, and can be used to directly replace fossil fuels to produce *controllable or despatchable* heat or power, plus drive engines for transport. Produced locally, it can offer valuable price stability and security of supply that imported fossil fuels cannot.

Biomass is essentially recently grown organic matter such as wood (e.g. sawdust, forest thinning), agricultural residues (e.g. straw, poultry litter), energy crops (fast growing trees like poplars or willows, and grasses like elephant grass), methane captured from decomposition (landfills, manures, municipal waste water treatment) or oils such as from rapeseed or sunflowers. It begins as energy from the sun that is stored in plants through photosynthesis. Biomass energy utilises the energy content of this organic matter to produce heat and power, or drive engines.

We have used biomass for heating for thousands of years, however biomass is probably the most under-utilised renewable resource in the Western World today, despite the fact that many conversion technologies are well proven and represent little risk. Studies (Ramage 1997, p.295) have shown that on an annual basis about a twelfth of the estimated 400Bn tonnes of the total annual global biomass resource could be accessed for energy use, which could deliver 50% of global TPER (Total Primary Energy Requirement). However, today biomass only contributes an estimated 14% (Ramage & Scurlock 1996, p.139) of global TPER, (much of this as non commercial small scale heating/cooking in developing countries), and only 1% of Irish TPER.

Most large energy players now recognise biomass as a major renewable growth opportunity in the short and medium term, as indicated by figure 1 opposite.

Figure 1: Siemens Energy Services research (2002) illustrating conservative predictions for sustainable energy growth globally



Using biomass for energy is carbon dioxide neutral. The organic matter fixes CO_2 from the atmosphere as it grows, and then releases it when it is converted to energy, with a net zero effect, as illustrated in Figure 2 below. Combusting fossil fuels, on the other hand, release CO_2 trapped for millennia, increasing the overall global levels of CO_2.

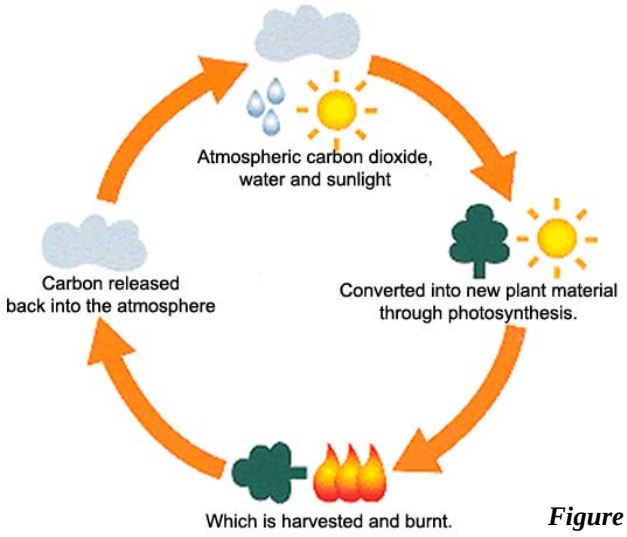


Figure 2: Illustration of the CO_2 neutral cycle for biomass energy

Ireland has a specific opportunity to exploit its current and future RVO and tallow resource, as the current non-energy uses are coming under threat

While the vast majority of land based biomass is in the form of wood, some specific niche biomass fuels are attractive because of their high calorific value. Tallow and RVO are two such categories, both traditionally used as additives in the animal feed and pharmaceutical industries.

The traditional uses for RVO and tallow are under threat from new EU regulations. The players involved in Ireland are actively seeking alternative uses. Both RVO and tallow are commercially used in other countries as biofuels. Utilising this fuel resource within Ireland can reduce dependence on imported fossil fuels, reduce CO2 emissions and boost the rural economy.

Today, the vast majority of the RVO in Ireland is recycled into animal feed in the UK and Ireland. This practice will be effectively banned from November 2004 due to the full implementation of an EU Directive brought in following the 1999 Belgian dioxin-in-chickens incident, (which was traced to RVO), and by the linking of foot-and-mouth disease to the feeding of food wastes to animals in the UK. Ireland and the UK were granted a one-year derogation on this Directive, which all other EU countries implemented in November 2003. If no alternative RVO use is found in the Republic, two possibilities arise:

- Collection will shrink, with the inevitable result of more being dumped into sewers and land-fills or
- The collected RVO resource will be exported outside the jurisdiction of the State to be used for biofuel production in countries with more attractive tax/fuel excise regimes, or as an animal feed supplement outside of the EU.

Tallow and meat and bone meal (MBM) are produced when offal and carcass/butchers wastes are processed at rendering plants. Tallow is used as a supplement in animal feed and has uses in the pharmaceutical industry, while MBM has had a variety of uses in the animal feed and fertilizer markets. Historically, rendering completed the important 'last step' in the livestock/meat industry, converting the carcasses from the meat factories into two useful products. However, following BSE concerns over the past number of years the entire EU rendering market has been subject to much change and regulatory pressures. Certain categories of MBM and tallow are now considered a dangerous/risky waste and are costly to dispose of in the current Irish environment. Rendering is moving from a perceived profit-generating step into an essential cost for the overall industry.

Given these threats, Ireland urgently needs to encourage alternative uses, and to support the establishment/evolution of supply chains to service these uses. In the absence of a managed transition, the country will be in an expensive and difficult situation towards the end of 2004.

Effective re-use of Ireland's RVO and tallow for energy represents an opportunity both to reduce dependency on imported fuel (secure supply/improve balance of payments), to reduce carbon emissions (contribute to meeting challenging Kyoto targets) and to boost local economies;

- It is roughly estimated that a 30,000 tonne industry, producing enough fuel for 15,000 vehicles would reduce CO_2 emissions by about 100,000 tonnes per year.
- If 15,000 cars ran on biofuels, Ireland would need to import roughly 25,000,000 litres less petrol or diesel[3].

RVO can be used to fuel diesel engines as processed biodiesel with no engine modifications (ACREVO 1998). Blended diesel fuels[4] are also showing significant commercial promise in other European countries. The EU has introduced the Liquid Biofuels Directive (2003/30/EC) that sets reference targets for each member state to achieve. The targets proposed begin with 2% of the national fleet by December 2005, extending to 5.75% by 2010, "calculated on the basis of energy content of all petrol and diesel for transport purposes placed on their markets".

Providing alternative uses for RVO and tallow will result in less risk of surpluses being dumped illegally and will minimise high waste disposal fees. Additionally, there is a high complementarity between RVO and rapeseed as both can be used to make biofuel. Using RVO to generate fuel may help kick-start oilseed rape crop for fuel in Ireland, which could provide a sustainable year round crop for Irish farmers.

[3] based on an annual kilometres of 12,000 km, with average fuel consumption of 12 km per litre

[4] Produced in the UK by companies such as www.greenergy.com

Study objectives

The overall objective of this study was to assess the current and future supply and demand for RVO and tallow in Ireland and to evaluate the availability of any surplus as a source of liquid biofuels. The RVO study and the Tallow study are essentially two separate studies grouped under one heading.

To assess RVO supply, collection and demand, the overall project objective was separated into four specific areas of analysis focusing on the island of Ireland:

1. Understanding the current and future supply and geographical distribution of RVO
    - How much is produced today?
    - Where is this produced?
    - What factors are likely to cause this quantity to change over the coming years?

2. Identifying the level and methods of collection throughout the country
    - Who is currently collecting RVO in Ireland?
    - How much are they collecting and from whom?
    - Are they charging or paying for collection, and if so, how much?
    - To whom do they supply the collected RVO?

3. Understanding the current value of and market for the current volume produced
    - What are the current end uses?
    - How much is used in these ways and what is the value and market price paid?
    - How are these uses likely to vary in the coming years? What will cause the change?
    - What other potential uses could there be?

4. Evaluating current and future surplus RVO
    - How much uncollected surplus exists
    - How has this changed over time and what has caused it to change?
    - What is currently done with this surplus?
    - What is the economic value / cost of disposal in this way?
    - What is the likely future surplus, given potential changes in supply or current uses

To assess tallow raw material supply, production and demand, the overall objective was broken into four main areas of analysis, focusing on the Republic of Ireland only (it is a controlled national supply chain).

1. Understanding the current and future supply of raw material to the rendering plants
    - What is the current and predicted future national herd size?
    - What numbers are slaughtered locally versus exported live?
    - What volumes of raw material enter the rendering plants
    - What is the tallow yield per tonne of raw material?
    - How are the overall volumes likely to change over the coming years?

2. Identifying the volumes of tallow produced in each of Ireland's 8 rendering plants
   - What volumes of tallow does each renderer produce, now and in the future?
   - What are the different classes of tallow produced?
   - Does this volume change during the year?
   - Is the capacity of the rendering plant fully utilised?
   - Apart from supply, what other factors may influence this volume?

3. Understanding the current value of and market for the current volume produced
   - What are the current uses?
   - How much is used in these ways and what is the value and market price paid?
   - How are these uses likely to vary in the coming years? What will cause the change?
   - What other potential uses could there be? Why are these not currently exploited?

4. Evaluating current and future surplus tallow
   - Is there surplus after all current uses are taken into account?
   - How has this changed over time and what has caused it to change?
   - What is the likely future surplus, given potential changes in supply or current uses

Lastly, for both RVO and Tallow, we wished to assess other issues (apart from raw material supply) that could influence the ability to produce biofuels in Ireland

Having identified if there is a current or future surplus available, the possible constraints on bio-fuel production in Ireland were assessed as follows:
   - Availability of production / refining facilities
   - Potential to arrange logistics of produced volumes to major customers
   - Likely levels of demand for domestically produced bio-fuel
   - Controls from the government/excise perspective
   - Limitations from the regulatory perspective
   - Competition for the raw material from biofuel production factilities in other EU countries
   - Local supports available

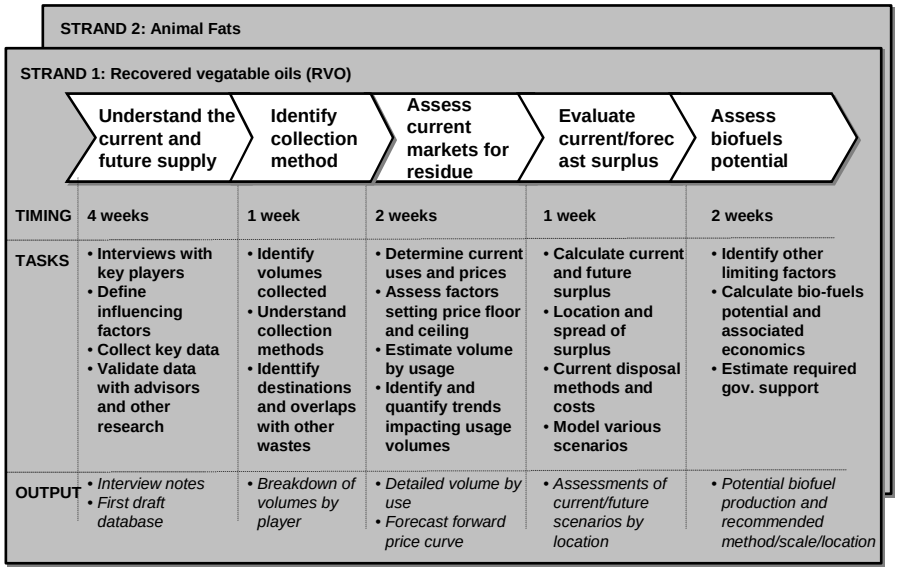
What are the economics of biofuel production?
   - Up front capex
   - Likely delivered raw material cost
   - Plant O&M
   - Cost per litre of finished product

What is the optimal format, size and location of possible biofuel production facilities?
What is the level (if any) of government support to make this a viable business?

Methodology and analysis approach

The project was divided into two parallel strands, one focused on RVO and one focused on tallow. The structured approach within each strand was similar in process but varied in terms of analysis and people interviewed. A summary of the process followed for each strand is presented in Exhibit 1.

Exhibit 1: Analysis approach within each strand



Strand 1: Recovered Vegetable Oils

Phase 1: Understand and the current and future supply of waste vegetable oil

Waste vegetable oil is produced in the catering industry (mainly hotels and restaurants), fast food outlets, food processing companies and domestic houses. Given these diverse sources, accurate quantification of the potential volume produced/available for collection was not a straightforward task.

Three different methodologies were used to triangulate an answer.

Firstly, a top down approach was employed, which focused on tracking the use of fresh vegetable oil imports once they entered the island:

- Using 2002 Central Statistic Office (CSO) statistics for overall vegetable oil imports, the overall volumes of vegetable oil entering the Island[5] were assessed.
- Then, using careful assumptions, industry statistics and known animal feed production volumes, the volume of this clean imported vegetable oil currently used in the animal feed market was estimated (taking into account the current use of recovered vegetable oil in animal feed).

[5] Local vegetable oil production (rapeseed oil) remains negligible.

- The animal feed and human consumption markets are the two markets for vegetable oil imports. Subtracting the animal feed requirement for fresh vegetable oil from the total imports gave an indication of the annual volume entering the cooking/human consumption market.
- Using known rates of conversion of incoming (clean) vegetable oil to outgoing (used) waste oil in the catering and fast food industries[6], assumptions were made as to the volume of this fresh vegetable oil that could become available for collection. In this estimate, the volumes used in the manufacture of margarines, mayonnaise and other oil based foods were discounted.

Secondly, total population was used as the start point, as well as known OECD (2002), Irish (Rice et al. 2001 p.2) and Austrian figures (Mittelbrach 2003) for estimated vegetable oil consumption and recoverability per capita:

- Taking current and predicted Republic of Ireland (ROI) and Northern Ireland (NI) population figures from the Central Statistics Office, OECD estimates of vegetable oil consumption per capita in Ireland were used to give estimates of total island wide consumption.
- The same calculation was made using Irish estimates of vegetable oil consumption per capita.
- Since the activity levels of the catering and hospitality sectors (and therefore volumes of RVO produced) are linked to general activity in the economy and tourism sector, industry standard predictions for economy/tourism growth over the coming years were employed to understand potential trends in future waste vegetable oil supply.

Thirdly, the issue was approached from the bottom up, analysing the number and distribution of potential waste vegetable oil producers across the country:

- GIS software coupled with detailed geocoded databases was used to analyse the concentrations of fast food outlets, restaurants/hotels and retail foodstores across the country. This analysis along with certain assumptions of volumes of RVO produced per establishment allowed a further sense check for the 'top down' supply numbers.

Finally, the assumptions on RVO current and potential supply were validated as part of the focus interviews with key industry players in phase 2.

The key deliverables of this phase of the project were:

- First section of the RVO excel model illustrating estimates of RVO supply across the island.
- Detailed text to support various supply assumptions in the model

Phase 2: Identify the level and methods of collection throughout the country

With regard to RVO collection, a second complex situation had to be dealt with:

- There is a network of collection companies in Ireland, collecting a wide range in terms of weekly individual volumes. Many of these companies will deal with other waste materials in addition to RVO under an umbrella contract for a specific client (e.g. used dry cleaning chemicals, garage forecourt waste, paper/packaging, plastics). The smaller collectors sell their collected volumes to the larger collectors/aggregators who clean the oil using a range of rudimentary cleaning processes (up to 30% of the collected volume can be contaminants such as solids or water).
- Additionally, in Ireland, there is very little published data on RVO volumes (a situation replicated across much of the evolving waste industry), and different players may enter and leave the RVO collection market according to specific client contracts that they may have. This is especially true for smaller collectors, or for those companies where RVO collection is not a core activity. Many of the collection companies will also exaggerate their collection volumes in an attempt to portray themselves as larger players.

[6] Validated through focus interviews with both producers and collectors

To overcome the difficulties of volume quantification in the RVO collection sector, a multi-faceted approach was taken:

- Firstly, William Deevey was co-opted onto the advisory panel. William is Managing Director of Goldstar Oils, one of the larger and well established RVO collection operations in Ireland, who collect waste through Bolton RVO Ltd. William helped to ensure that the focus interview questionnaires were constructed to avoid any misrepresentations of information, and also provide a valuable source of 'on the ground' experience. Care was taken to respect the confidentiality of any information collected during the course of the interview work.
- Secondly, a representative cross section of the waste producers and waste disposal companies was interviewed to get an industry view on volumes produced and disposed, and a validation of the assumptions with regard to the major collectors.
- Thirdly, each of the major collectors was interviewed face to face, running through a detailed focus interview questionnaire (attached in Appendix 1). The RVO collection data from the interviews was sense checked against separate information from the buyers in the animal feed and UK biodiesel industries (see phase 3).
- Finally, live case study research figures were used (personal communication, Mittelbach, Dr. M. 21st Nov, 2003)[7] to estimate the *realistic* collectable rates per capita in Ireland, rather than simply the total volumes arising.

The key deliverables of this phase were:

- Detailed focus interview notes showing the assessment of volumes collected
- A detailed breakdown of collection players, volumes collected by player and interaction between players.
- Section 2 of the RVO model completed, showing collection rates and volumes for the current and predicted future years.
-

Phase 3: Understand the current value of and market for the volume collected

The major activities in this phase included:

- A synthesis of the outputs from interviews with the RVO collectors to determine key current uses and prices paid.
- A series of interviews with end users (animal feed mills, UK biodiesel players) to cross check the numbers and get a separate perspective on the market
- Identifying other potential uses not currently exploited and understand why this is so.
- Calculating factors that create a price floor and ceiling. For example, what is the maximum that animal feed companies are prepared to pay for RVO, and why?
- Calculating or estimating quantities consumed by animal feed companies.
- Identify, and estimate impact of, various factors that could affect these quantities.
- Building an understanding of whether biofuels could actually offer a higher value usage for any of the residues and therefore displace current uses. If this was feasible, what would be the impact of this displacement on the affected sector or value chain?

The key deliverables of this phase of the project were:

- A detailed understanding of RVO usage and usage trends
- Analysis of price sensitivity for the different uses

[7] Dr. Mittelbrach has completed significant work in this area, and published a number of research papers, and is currently involved in commercial RVO collection for Biodiesel production in Austria.

Phase 4: Evaluate current and future surplus of RVO and animal fats

The major activities in this phase included:

- Using the output of phases 1-3 to calculate likely current and future total surplus and realistically collectable surplus.
- Understanding how the surplus is currently disposed of. What are the costs associated with this and who bears them?

The key deliverables of this phase of the project were:

- Assessment of current and future surplus volumes.
- Understanding of the current treatment mechanisms for the surpluses, and the associated costs.

Strand 2: Tallow

Phase 1: Understand the current and future supply of material to the rendering plants

The major activities in this phase included

- Using CSO statistics from 2002 total livestock herd numbers in the Republic of Ireland were established for the major livestock groups. Existing research (Shirley & Young 2003 pp 23-58) was combined with national CSO assumptions to investigate factors that may impact future livestock production/herd numbers in Ireland, allowing predictions to be made as to national herd growth/fall.
- Supply to the rendering plants is largely dictated by levels of slaughtering at the meat processing plants. Using CSO stats for overall carcass weight slaughtered and known industry figures for % carcass weight which ends up as waste at the processing plant, total volume of waste carcass available to the rendering industry from the meat plants could be assessed (a).
- Using the overall carcass weight numbers and known live weight versus carcass weight stats, the live weight basis of livestock arriving for slaughter was calculated. A proportion of this live weight becomes available to the renderers in the form of offal and other non-valuable viscera/parts. (b)
- Separately, individual retail butchers produce waste when they process the carcass further prior to sale to consumers. (c)
- Using (a), (c) and (b) total potential volume of raw material supply available for rendering could be estimated.
- To estimate the total potential tallow that could be produced from this volume, known figures for the conversion rate of tallow produced per tonne of raw material rendered (15%) were used. These conversion rates were obtained directly from the rendering industry during focus interviews with key players.
- The volumes of raw material actually arriving at the rendering plants are lower than the total potential tonnage available, as certain volumes move directly into pet food or waste disposal
- Direct focus interviews with the eight rendering plants and subsequent further correspondence and discussions with key executives allowed the validation of assumptions on the % of this total raw material actually arriving at the renderers.
- 2002 Statistics from the Department of Agriculture for total tallow production coupled with fact driven discussions with Mr McDowell[8] (personal communication, 8th Oct, 2003) allowed further validation of the macro picture of raw material supply/tallow production in the Republic of Ireland.

The key deliverable of this first phase of tallow research was the first section of the excel model clearly outlining current and future raw material supply nationwide.

Phase 2: Identify the volumes and types of tallow produced in each of the rendering plants

In Ireland, there are only eight major rendering plants producing tallow. Irish rendering plants are currently divided into **either** 'Category 1', processing of parts of carcasses considered higher risk in terms of BSE, **or** 'Category 3', for the processing of low risk material. Category two is still under deliberation in terms of the precise definition. The eight Irish plants divide into four Category 1 and four Category 3.

Detailed focus interviews were conducted with a senior executive from each of these companies to get a detailed and accurate picture of their current production, markets and perception of the impact of certain factors in the future.

[8] Mr McDowell is the President of the Irish Meat Renderers Association

The volumes claimed by the individual renderers were sense checked against tallow production figures for 2002, sourced from the Department of Agriculture.

To further sense check the data gathered in the focus interviews a meeting was held with Mr Michael McDowell, who has valuable industry knowledge both as a former owner of a rendering plant and now as an industry representative.

The key deliverables of this phase were:

- Detailed focus interview notes showing assessments and volumes of each category of Tallow produced
- Second Section of the Tallow excel model illustrating past, present and predicted future volumes of Tallow production

Phase 3: Understand the current value of and market for the current volume produced

Currently, the tallow produced in the four Category 1 plants, or 'Category 1 Tallow' cannot be used in animal feed. It can only be used as a fuel within the rendering plant that produced it or as a fuel within the rendering industry within the country that produced it, or else it must be destroyed by incineration. This is an EU Parliament ruling brought in following findings that the BSE prion, (a very robust protein found in contaminated materials) can be transferred by cross contamination. The rendering plants use the Category 1 tallow to produce the steam required to render the carcasses. Category 1 tallow cannot be used as a general biofuel outside the rendering industry, and as such it has no other legal market.

The 'Category 3 Tallow' goes to animal feed and the pharmaceutical industry.

The major activities of this phase included:

- A synthesis of the outputs from interviews with the key industry players to determine key current uses and prices paid.
- A series of interviews with end users (eg.animal feed mills players) to cross check the numbers and get a separate perspective on the market
- Identify other potential uses not currently exploited and understand why this is so.
- Calculate factors that create a price floor and ceiling. For example, what is the maximum that animal feed companies are prepared to pay for category 3 tallow, and why? What is the maximum plants are willing to pay for Category 1 tallow as a fuel?
- Identify, and estimate the impact of, a number of factors that could affect final demand for current quantities produced

The key deliverables for this phase were:

- A detailed understanding of current Tallow usage and trends
- Section three of the tallow model illustrating current and future demand for the various categories of tallow.

Phase 4: Assess current and future surplus

The major activities in this phase included:

- Using the output of phases 1-3 to calculate likely current and future surpluses in the current regulatory environment
- Assessing how changes in the regulations that govern the classification of the raw material or tallow may affect future production
- Building an understanding of whether biofuels could actually offer a higher value usage for any of the classes of tallow and therefore displace current uses.

The key deliverables of this phase of the project were:

- Scenario based assessment of current and future surplus volumes.

Potential for tallow and rvo as a fuel in Ireland

With the knowledge of the potential volumes available and the price the market would demand, the issues which could influence ability to use the tallow/RVO for biofuel production in Ireland were assessed

The major activities in this phase included:

- Building an understanding of the factors which could limit Ireland's ability to produce biofuels in an economic quantity. Possible reasons could include an insufficient quantity of raw material to make a meaningful quantity of bio-fuel, or an improved market for the raw material outside of Ireland.
- Assess the implications of blending the tallow/RVO material together, from a regulatory and consumer perspective
- Assess the economics of using the surplus as fuel for heating, electricity or transport, taking into account upfront capex requirements, expected O&M cost and various estimates for the delivered cost of the raw material
- Estimate to what degree, if any, government support would be needed to make this a sustainable enterprise

The key deliverables would be:

- Understanding of the potential to produce bio-fuels in Ireland
- Economic analysis of biofuel generation in Ireland
- Recommendation of preferred end use, and format/location/size of fuel processing capacity.

Results

Strand 1: Recovered Vegetable Oils

Summary of findings

- Waste vegetable oil supply will rise gradually from 29,000 tonnes in 2003 to 32,000 tonnes in 2010, driven largely by population growth, economic activity and tourism.
- Production and subsequent collection is directly linked to population centres.
- 14,500 tonnes of RVO will be collected in 2003. Recovery rate (collection) is currently running at 50% of total supply, but 73% of *realistically* collectable supply
- Recovery rate has and will continue to be driven by a combination of the market price for collected material and the pressure from Local Government forcing the producers to adequately dispose of their waste vegetable oil
- The main market is into animal feed in the UK and Ireland, with a small fraction currently going to biodiesel production in the UK.
- The market is very price sensitive, collection is currently circa €20 per 120 litres collected, and crudely filtered RVO is worth circa €170 per tonne
- There is a current non collected surplus of 14,500 tonnes, although it is estimated that a surplus of only 5000 tonnes is 'realistically recoverable' by the collectors at the current market price
- There will be a relatively sudden surplus of 14,500 (currently collected) tonnes at a market price of circa €180 per tonne or lower from November 2004 when the animal feed ban is enforced
- In the absence of a competitive local biofuel market, the Irish resource will be exported 'raw' to the growing UK and European fuel markets

TABLE 1: RVO SUMMARY PROJECTIONS

Notes	Variables/Assumptions		
	% Fresh oil supplied to restaurants recovered as waste	0.4	%
	Animal Feed Production on Island	4,200,000	Tonnes per annum
	Vegetable oil in animal feed	1.5%	Finished weight
	NI Population growth	0	% per annum
	ROI Population growth	2%	% per annum
	Tourism growth NI	2%	% increase in numbers pa
	Tourism growth ROI	1%	% increase in numbers pa
	RVO Collection growth	3%	% per annum
	BR estimates of veg oil recoverable per capita	0.0045	tonnes per capita
1	OECD estimates of av veg oil consumption per capita in Ireland (EU)	0.015	tonnes per capita/p.a
2	Austrian estimates of potential veg oil recoverable per capita	0.005	tonnes per capita/p.a
3	Austrian estimates of realistic veg oil recoverable per capita	0.0035	tonnes per capita/p.a

		ACTUAL					PREDICTED							
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2020
	Factors effecting supply													
	Economy: ROI GNP % change	7.8	8.1	5.9	3.6	1.2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
4	Population: NI, (000's)	1,691	1,688	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685
5	Population: ROI (000's)	3,744	3,786	3,839	3,897	3,975	4,054	4,136	4,218	4,303	4,389	4,476	4,566	5,566
	Population: Island	5,435	5,474	5,524	5,582	5,660	5,739	5,821	5,903	5,988	6,074	6,161	6,251	7,251
	Tourism: annual visitors NI	1,600	1,632	1,665	1,698	1,732	1,767	1,802	1,838	1,875	1,912	1,950	1,989	2,425
	Tourism: annual visitors ROI	5,943	6,266	6,329	6,392	6,456	6,520	6,586	6,651	6,718	6,785	6,853	6,922	7,646
	Total fresh vegetable oil imports (island)			132,000	133,000									
	Total vegetable oil used in animal feed (island)			63,000	63,000									
	Recovered vegetable oil used in animal feed (island)			12,000	12,000									
	Fresh imports remaining for human consumption (island)			81,000	82,000									
6	*Irish Human veg oil consumption*	*81,525*	*82,110*	*82,860*	*83,730*	*84,899*	*86,092*	*87,308*	*88,549*	*89,814*	*91,105*	*92,421*	*93,764*	*108,763*
	Waste vegetable oil produced													
7	Estimate 1 (Irish methodology)	24,458	24,633	24,858	25,119	25,470	25,827	26,192	26,565	26,944	27,331	27,726	28,129	32,629
8	Estimate 2 (Catering Industry research)	32,610	32,844	33,144	33,492	33,960	34,437	34,923	35,419	35,926	36,442	36,969	37,506	43,505
	Estimate 3 (Austrian methodology)	27,175	27,370	27,620	27,910	28,300	28,697	29,103	29,516	29,938	30,368	30,807	31,255	36,254
	Average of three estimates	*28,081*	*28,282*	*28,541*	*28,840*	*29,243*	*29,654*	*30,073*	*30,500*	*30,936*	*31,381*	*31,834*	*32,297*	*37,463*
9	*Realistically recoverable*	*19,023*	*19,159*	*19,334*	*19,537*	*19,810*	*20,088*	*20,372*	*20,661*	*20,957*	*21,258*	*21,565*	*21,878*	*25,378*
10	**Collection**													
	Frylite				2,500	2,575	2,652	2,732	2,814	2,898	2,985	3,075	3,167	4,256
	ROF				4,000	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	6,810
	MT				4,000	4,120	4,244	4,371	4,502	4,637	4,776	4,919	5,067	6,810
	BG				3,000	3,090	3,183	3,278	3,377	3,478	3,582	3,690	3,800	5,107
	Others				600	618	637	656	675	696	716	738	760	1,021
	Total Collected				*14,100*	*14,523*	*14,959*	*15,407*	*15,870*	*16,346*	*16,836*	*17,341*	*17,861*	*24,004*
	Uncollected surplus													
	Total uncollected surplus				14,740	14,720	14,695	14,685	14,630	14,590	14,544	14,493	14,435	13,459
	Realistically collectable surplus				5,437	5,287	5,129	4,964	4,792	4,611	4,422	4,224	4,017	1,374
	Collection as % of total				0.49	0.50	0.50	0.51	0.52	0.53	0.54	0.54	0.55	0.64
	Collection as % of realistically collectable				0.72	0.73	0.74	0.76	0.77	0.78	0.79	0.80	0.82	0.95
	End Use: Scenario 1: No change in Irish fuel excise													
	Animal Feed: Ireland				3,500	3,090	2,833							
	Animal Feed: NI and UK				10,600	11,333	10,126							
	Animal Feed: Outside EU													
	Transport Fuel: Ireland													
	Transport Fuel: Export					100	2,000	15,407	15,870	16,346	16,836	17,341	17,861	24,004
	Heating Fuel: Ireland													
	Heating Fuel: Export													
	Generator fuel: Ireland													
	Generator fuel: Export													
	End use: Scenario 2: Local excise reduction on a par with EU countries competing for raw material													
	Animal Feed: ROI				3,500	3,090	2,833							
	Animal Feed: NI and UK				10,600	11,333	10,126							
	Animal Feed: Outside EU													
	Transport Fuel: ROI							15,407	15,870	16,346	16,836	17,341	17,861	24,004
	Transport Fuel: Export				-	100	2,000	-	-	-	-	-	-	-

Current and future waste vegetable oil supply will rise gradually from 29,000 tonnes in 2003 to 32,000 tonnes in 2010, driven largely by population growth, economic activity and tourism

Waste vegetable oil production across the island will rise gradually over the coming decade, at a rate of approximately 1.4% per annum. Table 1 summarises the overall results for the RVO research, and shows the estimated slow rise in supply to 2010 and 2020. The detailed notes to accompany table 1 can be found in Appendix D.

Production and subsequent collection is directly linked to population centres

Figure 3 below illustrates the concentrations of waste vegetable oil producers, directly linked to population centres. The deeper red zones indicate higher concentrations.

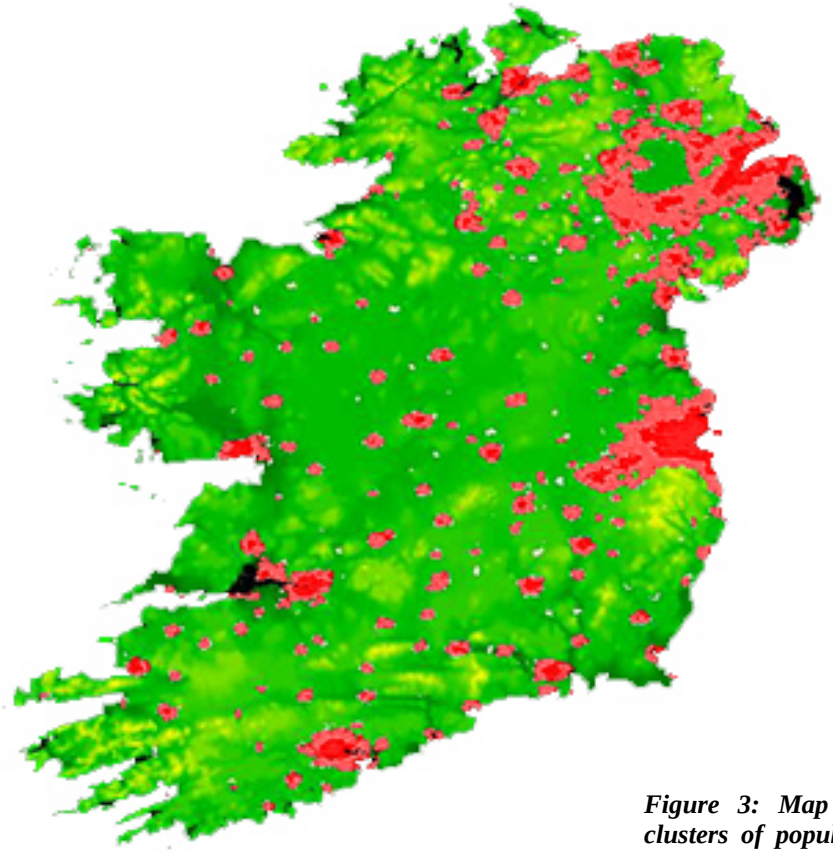


Figure 3: Map of Ireland illustrating clusters of population, directly linked to clusters of waste vegetable oil supply

While location/concentration of the waste oil producers was relatively straightforward, the results from the bottom up quantification of the waste oil produced by specific location was inconclusive. This was due to the huge variety, size and unknown actual throughput of the individual restaurants/catering trade, making accurate or meaningful assumptions on volume of waste arising per establishment impossible.

14,500 tonnes of RVO will be collected in 2003. Recovery rate (collection) is currently running at 50% of total supply, but 73% of realistically collectable supply

Collection is dominated by a network of larger players and a range of smaller collectors, with loose affiliations between them. 70% of the collected volume is currently entering the Northern Irish animal feed trade, via Precision Liquids in Belfast. The focus interview work illustrated how the RVO collectors have formed a loose network of primary collectors and aggregators/cleaners, as outlined in Figure 4 below

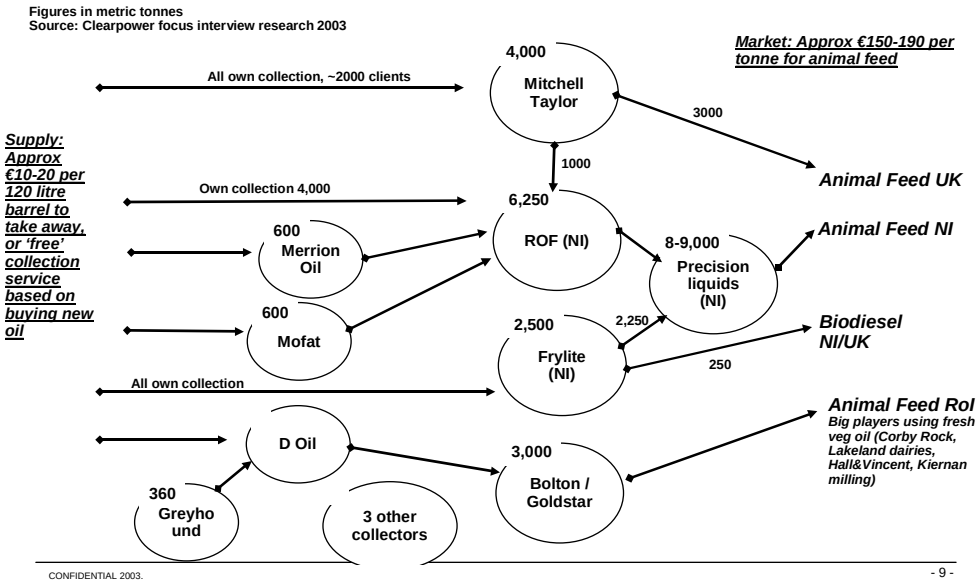


Figure 4: Illustration of the network of collectors and approximate current charges

Recovery rate will continue to be driven by the market price for the collected material and pressure from local Government forcing producers to appropriately dispose of their waste vegetable oil

Waste vegetable oil producers are coming under increased pressure from both Local Government waste regulations and generally improving hygiene/waste awareness standards to appropriately dispose of any waste they produce. Local Governments are increasingly requiring producers to prove that they are signed up with an authorised waste collector, and unauthorised waste collectors can be prosecuted. Most producers now generally see the used cooking oil as a waste issue rather than a potential resource. This was not the case five years ago, when mostly unlicensed collectors paid a small sum for the privilege of taking the waste oil for animal feed.
Some fresh oil suppliers (such as Frylite) factor in the collection costs to offer a 'free' collection service for those clients that purchase fresh oil from them. This practice seems to have enamoured Frylite with the catering industry over the past five years, as it is a trouble free service offer.

The main market is into animal feed in the UK and Ireland, with a small fraction currently going to biodiesel production in the UK

The majority of the collected volume currently goes into animal feed in Northern Ireland and the UK. Most of the Irish animal feed mills have already stopped using recovered vegetable oil, in light of the imminent ban, although Irish animal feed mills still take approximately 3000 tonnes per annum, mainly from Bolton/Goldstar. A small volume of RVO is currently going to biodiesel, and the major aggregators are all comfortable that biodiesel projects (more than likely in the UK) will take up the excess created when the animal feed ban is enforced. A 250,000 tonne biodiesel facility is currently being developed in Northern England.

The market is very price sensitive, collection is currently circa €20 per 120 litres collected, and crudely filtered RVO is worth circa €180 per tonne to the collectors

The collection price is very sensitive, and is a function of the rigour with which local government enforce waste regulations and the market available for the RVO once collected. The collection price is either factored into the service charge for providing clean oil, or as a straightforward fee charged to the waste producer, often as part of a larger waste management contract.

The RVO price roughly tracks the commodity market price for clean standard vegetable oil (i.e. sunflower, corn) at one third to a half of the price of the fresh oil.

There is a current non collected surplus of 14,500 tonnes, although it is estimated that a surplus of only 5,000 tonnes is 'realistically recoverable' by the collectors at the current market price

Based on the total volumes of waste oil produced versus collected, the analysis shows a surplus of approximately 14,500 tonnes, as illustrated in Table 1. However, much of this waste oil is produced at dispersed locations or domestic houses and would be logistically and commercially difficult to collect on an ongoing basis. A more meaningful figure is the *realistically collectable* figure of 5,000 tonnes, again as shown in Table 1. Interestingly, with projected collection growth rates outstripping growth rates for the supply of waste oil, the realistically collectable surplus will shrink over time.

There will be a relatively sudden surplus of 14,500 (currently collected) tonnes at a market price of circa €180 per tonne or lower from November 2004 when the animal feed ban is enforced

There is little doubt that the growing UK/EU biofuel markets will be in a position to pick up the Irish RVO volumes freed up when the animal feed ban is enforced. Larger aggregators already have deals broadly in place, and a continued transition in end-use of the RVO over of the course of 2004 is expected.

The industry believes that this transition may cause a short-term drop in prices as the market takes in the extra volume. However, given the predicated construction timeframe and scale of biodiesel manufacturing operations in northern England, the shift in end use of the Irish RVO may have little if any impact on the overall market price. The effect of a combination of the UK RVO and the Irish RVO shifting in tandem from one end use (animal feed) to a new end use (biodiesel) would however have an impact, with price dropping in the short term.
The global commodity price for vegetable oil will remain a calming factor on any large local price shifts in UK/Ireland. The global commodity price is subject to its own separate economic drivers.

In the absence of a local biofuel market, the Irish resource will be exported 'raw'

The industry players/collectors are generally supportive of local biodiesel manaufacturing, and most of the larger players are actively considering projects. However there is a general feeling that in the near term, the Department of Finance in Ireland will not grant the excise reductions required to make local biodiesel manufacture a competitive prospect.

Strand 2: Tallow

Summary of findings[9]:

- Annual raw material supply to Ireland's eight rendering plants will gradually fall from 496,000 tonnes today to 446,000 in 2010, as a result of the predicted slow fall in national livestock numbers.
- The plants are producing a total of 78,000 tonnes of tallow at present, a volume predicted to gradually fall in line with raw material supply to 71,000 tonnes by 2010.
- Ireland currently has four Category 1 plants processing specified risk material (SRM) and producing 34,500 tonnes of Category 1 tallow, and four Category 3 plants, processing non-risk material, producing 43,800 tonnes of Category 3 tallow.
- Current legal requirements mean that Category 1 tallow can only be used as fuel within the rendering industry or incinerated. Since 1999 all eight rendering plants have converted their boilers from mineral oil to tallow, and use a combined total of 42,000 tonnes of tallow fuel annually.
- The four Category 1 producers use their own tallow internally as a fuel and sell the surplus to Category 3 plants, at a price of approximately €150 per tonne.
- There is no surplus of Category 1 tallow today, however this may change if further raw material is classified as SRM, and Category 1 tallow output increases beyond the fuel requirements of the rendering industry.
- Category 3 tallow is used in the animal feed industry and the pharmaceutical industry, and 80% of Irish production is exported.
- Category 3 producers also use 7,000 tonnes of their own low grade Category 3 tallow to supplement the Category 1 tallow fuel purchased from the Category 1 plants.
- Market price for Category 3 tallow is dictated by the world vegetable oil and fats market. Current market is at €240-350 per tonne depending on the grade of tallow.
- The market for Category 3 tallow is set to continue, however it is becoming increasingly difficult and costly for Irish renderers to comply with the volume of strict regulations associated with its production.
- There is no surplus of Category 3 tallow, although at current market prices, the lower grade material could be diverted for use as a biofuel.
- The rendering industry works in a fast changing regulatory environment, making forward planning difficult. As the industry becomes more of a cost centre, its existence is threatened by the possibility of shifting to direct incineration of carcasses.

[9] Assuming no change in current regulatory environment

TABLE 2: TALLOW SUMMARY PROJECTIONS

Notes	Variables/Assumptions		UNIT
1	Change per annum in national cattle herd	-1%	
1	Change per annum in national Pig population	-3%	
1	Change per annum in national Sheep population	-2%	
1	Change per annum in national Poultry population	0	
2	Carcass weight v Liveweight (cattle)	55%	
3	% Live weight made up of entrails, head/feet and major organs	18%	
4	% Total raw material available that actually reaches renderers	85%	
5	% Total Carcass sent to renderer (tonnes)	25%	
	Kilos of tallow required to render one tonne of carcass	85	kg per tonne
6	Tallow yield per tonne of carcass	0.16	tonnes

		Actual					Predicted							
	ALL FIGURES IN 000's	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2020
	Factors effecting supply													
7	**National herd (headage)**													
	Total Pigs	1,732	1,732	1,763	1,782	1,729	1,729	3,457	3,457	3,457	3,457	3,457	3,457	3,457
	Total Sheep	5,318	5,056	4,807	4,828	4,731	4,731	9,463	9,463	9,463	9,463	9,463	9,463	9,463
	Total Poultry	13,637	13,586	13,211	13,208	13,208	13,208	13,208	13,208	13,208	13,208	13,208	13,208	13,208
	Total Cattle	6,558	6,330	6,408	6,333	6,269	6,207	6,145	6,083	6,022	5,962	5,903	5,844	5,285
8	Total Live weight slaughtered	2,105	1,933	1,947	1,838	1,813	1,789	1,765	1,742	1,719	1,697	1,675	1,653	1,461
	Total potential viscera available to renderers	379	348	351	331	326	322	318	314	309	305	301	298	263
	Total Eviscerated Carcass (tonnes)													
	Beef	641	576	579	540	535	529	524	519	514	508	503	498	451
	Pigs	251	231	241	231	224	217	211	205	198	192	187	181	134
	Sheep	90	83	78	67	66	64	63	62	61	59	58	57	47
	Poultry	126	123	123	123	123	123	123	123	123	123	123	123	123
9	Misc	50	50	50	50	50	50	50	50	50	50	50	50	50
	Total	1,158	1,063	1,071	1,011	997	984	971	958	945	933	921	909	804
10	**Post Processing carcass available to renders**	290	266	268	253	249	246	243	240	236	233	230	227	201
11	**Total potential raw material available to renderers**	668	614	618	584	576	568	560	553	546	539	532	525	464
12	**Total potential tallow production**	107	98	99	93	92	91	90	88	87	86	85	84	74
13	**Tonnes of raw material actually arriving to renderers**	568	522	526	496	489	483	476	470	464	458	452	446	394
14	Annual change in raw material available to renderers						-1.34	-1.33	-1.32	-1.31	-1.30	-1.29	-1.28	-1.18
15	**Tonnes Tallow produced at renderers**													
	Cat 1													
	Plant A Premier					10.4	10.3	10.1	10.0	9.9	9.7	9.6	9.5	8.4
	Plant B Monery					9.1	9.0	8.9	8.7	8.6	8.5	8.4	8.3	7.3
	Plant C College (Changed to Cat 1 from Cat 3 2003)					7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.1	6.3
	Plant D Waterford					7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.1
	Total Cat 1 production	*0.0*	*2.8*	*19.0*	*19.6*	*34.4*	*34.4*	*34.0*	*33.5*	*33.1*	*32.7*	*32.2*	*31.8*	*28.1*
	Cat 3													
	Plant E Dublin					20.8	20.5	20.2	20.0	19.7	19.5	19.2	19.0	16.8
	Plant F Slaney					4.8	4.7	4.7	4.6	4.6	4.5	4.4	4.4	3.9
	Plant G Western					7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.1	6.3
	Plant H Munster					10.4	10.3	10.1	10.0	9.9	9.7	9.6	9.5	8.4
	Total Cat 3 Low Grade Production (FFA > 5%)	39.6	39.0	45.0	29.9	21.9	21.6	21.3	21.0	20.8	20.5	20.2	20.0	17.6
	Total Cat 3 High Grade Production (FFA < 5%)	39.6	39.0	45.0	29.9	21.9	21.6	21.3	21.0	20.8	20.5	20.2	20.0	17.6
	Total Cat 3 production	*79.1*	*78.0*	*90.0*	*59.7*	*43.8*	*43.2*	*42.6*	*42.1*	*41.5*	*41.0*	*40.5*	*39.9*	*35.3*
	Total production	**79.1**	**80.8**	**109**	**79**	**78**	**77**	**76**	**75**	**74**	**73**	**72**	**71**	**63**
	Demand/Surplus													
	Cat 1 Tallow													
16	Demand: Fuel at 8 rendering plants	48	44	45	42	42	41	40	40	39	39	38	38	34
16	Demand: Fuel at Cat 3 plants	0	1	10	10	18	18	18	18	18	17	17	17	15
16	Demand: Fuel at Cat 1 plants	42	41	48	32	23	23	23	22	22	22	21	21	19
	Supply: From Cat 1 production	0	3	19	20	34	34	34	34	33	33	32	32	28
	Surplus/Deficit	-48	-42	-26	-23	-7	-7	-7	-6	-6	-6	-6	-6	-5
	Cat 3 Tallow													
	Demand: Top up fuel for boilers	-48	-42	-26	-23	-7	-7	-7	-6	-6	-6	-6	-6	-5
	Demand: For Feed / Pharmaceutical	31	36	64	37	37	37	36	36	35	35	34	34	30
	Surplus/Deficit													

Current raw material supply to Ireland's eight rendering plants will gradually fall from 496,000 tonnes today to 446,000 tonnes by 2010, largely as a result of the predicted slow fall in total national livestock production

Table 2 shows how the current supply to Ireland's rendering plants is predicted to fall at an annual rate of 1% per annum, from a current supply of 496,000 tonnes of carcass to 446,000 tonnes by 2010. This predicted fall is attributable to:

- Increased competition from overseas lower cost livestock producers, causing a decline in beef, pig and sheep production
- Decreased dairy production as a result of the newly introduced de-coupling (removal of livestock payments) policy by the EU, which is expected to push marginal producers out of dairying

The detailed notes to accompany table 2 can be found in Appendix D.

The plants produce a total of 78,000 tonnes of tallow today, a volume predicted to gradually fall in line with supply to 71,000 tonnes by 2010.

The predicted reduction in raw material will cause a corresponding fall in tallow production.
In talking to key players in the market it was made clear that there was already excess plant capacity in the rendering industry, increasing the likelihood of further merger or rationalisation activity in the near term, especially as volumes of raw material fall.

Ireland currently has four Category 1 plants processing specified risk material (SRM) and producing 34,500 tonnes of Category 1 tallow, and four Category 3 plants, processing non-risk material, producing 43,800 tonnes of Category 3 tallow.

In response to the BSE crisis all rendering plants in Ireland have been categorised to reflect the raw material stock that they render. Two categories of tallow are currently produced. Category 1 tallow is produced from the rendering of SRM which includes the vertebrae, brain and other parts of the carcass that are viewed to be high risk, and from entire animals that are considered at risk. Category 3 tallow is produced from all other parts of the carcass, and is treated as a low or negligible risk material. The classification of 'risk' and subsequent classification of raw material has been hotly debated within the EU and is subject to change. Figure 5 illustrates the distribution of the different rendering plants across Ireland.

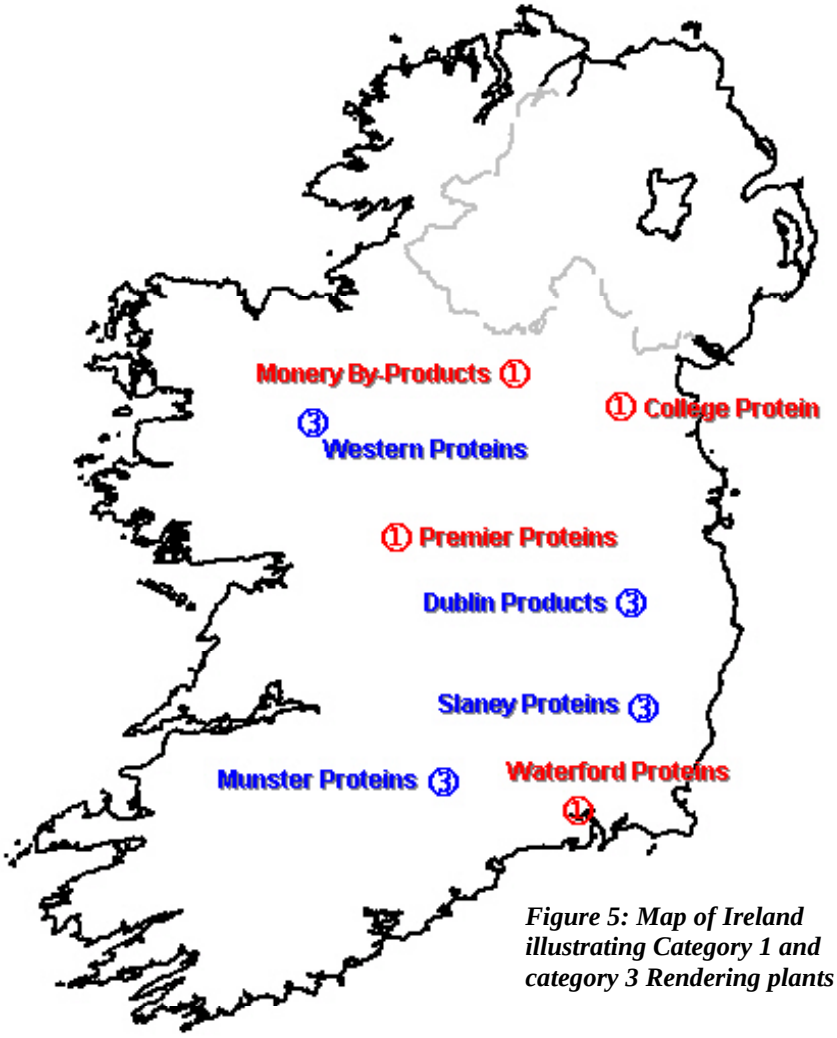


Figure 5: Map of Ireland illustrating Category 1 and category 3 Rendering plants

Current legal requirements mean that Category 1 Tallow can only be used as fuel within the rendering industry or incinerated. Since 1999 all eight rendering plants have converted their boilers from mineral oil to tallow, and use a combined total of 42,000 tonnes of tallow fuel annually.

The introduction of tallow classification in 1999 led to tighter EU regulatory controls being imposed on Category 1 tallow uses, banning the use of Category 1 tallow in animal feed, and seeking to have all the Category 1 tallow disposed of by incineration. This led to a surplus of Category 1 tallow, and an efficient way of disposing of this surplus was to convert the boilers at the rendering plants to use tallow rather than mineral oil. In light of this, the incineration regulations were relaxed to allow fuel use, but only within the rendering industry.

For certain rendering plants that were previously operating on light fuel oil at 30 cents a litre, making this transition was a successful commercial exercise in its own right, as the price paid for the tallow fuel at €150 per tonne was considerably better. The boiler refit is relatively straightforward, involving widening the fuel injector nozzle and putting in a system to preheat the fuel. Tonne for tonne, the tallow operates at only a 5% reduction in energy output over mineral oil. For the renderers previously operating on heavy mineral oil (priced lower at 23cent per litre) the benefits case was less obvious, but still existed.

The EU veterinary committee is currently making decisions as to the future disposal laws for Category 1 tallow. These decisions (now due in March 04) may result in all Category 1 tallow production having to be incinerated, rather than used as a fuel in the rendering industry. This will further add to the 'cost centre' status of the entire rendering industry. Both Category 1 and Category 3 producers would have to go back to using mineral oil with its associated higher cost.

The four Category 1 producers use their own tallow internally as a fuel and sell the surplus to Category 3 plants, at a price of approximately €150 per tonne.

The Category 1 tallow producers use their own tallow production as a fuel internally and sell surplus to Category 3 plants. The Category 1 producers currently (2003) render 216,000 tonnes of raw material, requiring 18,000 tonnes of tallow as fuel. With total Category 1 tallow production at 34,500 tonnes, this leaves a surplus of 16,500 tonnes for sale to Category 3 renderers. This is currently sold at a price of €150 per tonne, tracking below the price of heavy fuel oil.

There is no surplus of Category 1 tallow today, however this may change if further raw material is classified as risk material and subsequently Category 1 tallow output increases beyond the fuel requirements of the industry

With the changing regulations, it is feasible that certain categories of raw material will be classified as risk material. Butchers waste, which currently represents approximately 10% of the input to Category 3 plants, has recently (Dec 2003) been classified as risk material if the national body (in Ireland's case the Dept of Agriculture) cannot appropriately certify each load of waste. The rationale here is that uncertified butchers waste may have come into contact with risk material during the butchering or in the environs of the butchers facility.
It is not clear what the impact will be in the Irish situation, but if none of the current volumes (31,200 tonnes p.a) of butchers waste achieves the appropriate certification, and hence becomes Category 1 material, the output of Category 1 tallow could rise by nearly 5,000 tonnes.

If the output of Category 1 tallow rises beyond the requirements of the rendering industry, the price will drop significantly, and Category 1 tallow producers will likely burn excess fuel in their boilers to get rid of the surplus, or else be forced to dispose of it by costly incineration (exported).

Category 3 producers also use 7,000 tonnes of their own low grade Category 3 tallow to supplement the Category 1 tallow fuel purchased from the Category 1 plants

Category 3 producers currently render 274,000 tonnes of raw material and require 23,270 tonnes of fuel for their boilers. The Category 1 tallow producers supply 16,500 tonnes of this requirement, with the balance met by low grade Category 3 tallow.

Market price for Category 3 tallow is dictated by the world vegetable oil and fats market. Current market is at €240-350 per tonne depending on the grade of tallow.

Category 3 tallow is used in the animal feed industry and in the pharmaceutical industry. The price is driven by global commodity markets for tallow and competing products such as vegetable oils. 80% of Category 3 tallow produced at Irish rendering plants is exported.
There are two different grades of Category 3 tallow, classified on the basis of Free Fatty Acid (FFA) content.

- <5% FFA is classified as high grade tallow, currently achieving a market price of €300 -€350 per tonne
- >5% FFA is classified as low grade tallow, currently achieving a market price of ~ €240 per tonne.

The split between high and low-grade tallow produced is approximately 50/50 at each of the Category 3 rendering plants. The low-grade tallow is produced from the fats located closer to the guts and intestines of the animal.

The market for Category 3 tallow is set to continue, however it is becoming increasingly difficult and costly for Irish renderers to comply with the volume of strict regulations associated with its production.

To maintain Category 3 status, rendering plants must adhere to ever-stricter regulatory conditions. This is costly and is reducing returns on investment for the owners of the Category 3 plants. This issue is compounded further for investors by the unpredictability of the returns due to the rapidly changing regulatory environment.
The regulations for Category 1 plants are not as demanding, making Category 1 at times appear a more attractive prospect for a plant. There has been a significant shift to Category 1 production over the last two years. In 2003 College Proteins made the transition from Category 3 to Category 1, increasing overall production of Category 1 tallow by 14,500 tonnes between 2002 and 2003.
Currently there is no surplus of Category 1 tallow, however this may be impacted if there is further moves away from Category 3 production.

There is no surplus of Category 3 tallow, although at current market prices, the lower grade material could be diverted for use as a biofuel

At a price of €240 per tonne, and 95% of the calorific value of light heating oil, lower grade Category 3 tallow can competitively substitute light oil as a heating fuel.
However, penetration has been nil to date due to:

- The cost associated with installing systems to store/preheat the fuel and widening the injection nozzle on the boiler,
- A poor public (or employee) perception of using animal fats for heating.
- Low awareness of the opportunity

The low-grade Category 3 tallow can also be esterified (removing the FFA content) and converted to biodiesel.

The rendering industry works in a fast changing regulatory environment, making forward planning difficult. As the industry becomes more of a cost centre, its existence is threatened by the possibility of shifting to direct incineration of carcasses.

Prior to the BSE crisis the rendering industry was a profit centre, producing two useful products with ready markets. Since the BSE crisis, MBM in particular has created a headache for the industry, with the cost of disposal being borne by both the industry and the taxpayer. The value of Category 1 tallow has also been significantly reduced due to tighter regulations. The net effect is a shift from rendering being a 'value creating' step towards being a 'value destroying' step in terms of the overall meat industry. With this current trend, the biggest threat to the rendering industry is the introduction of 'direct' carcass incineration, cutting out rendering altogether.

Potential for tallow and rvo as a fuel in Ireland

Tallow and RVO can be processed into either engine fuel to replace diesel (transport, generators) or heating fuel to replace light or heavy heating oil. In the EU, both markets are driven by a global commodity price for the current fossil fuels plus a Government excise or duty collected on each litre sold. The excise/duty element of the consumer price is variable between member states.

The available raw material will only be processed into fuel within Ireland if the price offered locally for the raw material is comparable or better than can be gained from the export markets.

The potential for use in transport fuel is high, but relies wholly on government excise decisions

Fresh vegetable oil is technically a preferred feedstock for the manufacture of biodiesel. However, with a price of below €200/t for cleaned RVO and below €240/t for low-grade tallow versus approx €450 per tonne for fresh vegetable oil, RVO and low-grade tallow are more attractive commercially as feedstocks.

With the correct cleaning/pre-processing techniques and the same standard biodiesel manufacturing process, RVO and tallow can both be successfully converted to biodiesel, and can achieve the European biodiesel fuel standards (EN14214).

Technically and operationally biodiesel is now a proven substitute for standard fossil diesel, and vehicle manufacturers are taking it into account in terms of engine warranties and designs.

As a result of the Liquid Biofuels Directive (2003/30/EC) most countries in Europe are either actively promoting biodiesel or are considering mechanisms to do so. The different excise regimes for the product in different countries has resulted in markets for the raw material developing faster in those countries where there is a more attractive tax regime for biodiesel.

Table 3 below compares Ireland to the UK in terms of costs and taxes for biodiesel production and sale. It illustrates that in order to encourage biodiesel production/sale in Ireland, the Irish Government need to reduce excise on biodiesel by 30 cents per litre. With excise currently at 36.8 cents (Budget 2004), this effectively means that without a significant reduction in excise duty on biodiesel, the raw material will simply move to the UK.

Notes	TRANSPORT		
		€ **Ireland**	€ **UK**
	Fossil Diesel		
1	Retail price excluding taxes	0.304	0.277
2	Excise	0.368	0.672
	VAT (IRL 21%, UK 17.5%	0.141	0.166
	Price to consumer	*0.813*	*1.115*
	Biodiesel		
	Raw material price (Clean RVO)	0.200	0.200
	Processing cost	0.100	0.100
	Retail price excluding taxes	0.300	0.300
3	Excise	0.368	0.387
4	VAT (IRL 21%, UK 17.5%)	0.140	0.120
	Minimum price to consumer	*0.808*	*0.807*
5	Price consumer will pay	0.813	1.115
	Profit/loss to compete for raw material	0.005	0.308

Notes

1 IRL - AA Ireland Irish Petrol Prices : December 2003,
UK - The AA UK Fuel Prices November 2003

2 IRL www.budget.gov.ie/2004/finres04.asp,
UK - www.hmce.gov.uk/forms/notices/bn31-03.htm

3 IRL Budget 2004 - as fossil, UK 20p less than fossil (Budget 2003)

4 As fossil

5 Consumer will only pay up to fossil fuel price

Table 3; Comparing biodiesel manufacturing/sale environment in UK versus Ireland

The potential as heating fuel is good, but the majority of the segment who have the operational rationale to convert are using heavy oil at 23 cents per litre.

In terms of calorific value, clean RVO and low-grade tallow have approximately 95% the energy content of mineral oil. The correct nozzle set up and fuel preheating system (in the case of tallow) is important to ensure effective fuel feed and combustion for heating systems.

At the large-scale end of the market, the rendering industry has proven that low-grade tallow is an effective substitute for heating oil, particularly profitable if the boiler was previously running on light fuel oil at €0.33 per litre. However, most large scale heat users using oil purchase heavy grade oil at 23 cents per litre, making the economics marginal in terms of a changeover to RVO or tallow.

The small scale or domestic market currently purchases heating oil at 33 cents per litre. This segment represents an attractive market for RVO and tallow for use as a fuel, however three main barriers must be overcome:

- Appropriate and fully supported boiler/fuel feed equipment at a price competitive with standard oil burners is not readily available
- Public perception of heating on waste cooking oil or animal fat
- Government taxes on home heating oil: excise at 4.736 cents per litre and VAT at 13.5%

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Appendices

Appendix A: List of organisations involved in analysis

Waste Oil Disposal Companies

- Frylite Cooking Oils
- Goldstar Oils / Bolton RVO Ltd
- Lehane Environmental
- Mofat
- Mitchell Taylor (Exports) Ltd
- Cashman
- ROF Services Ltd., Belfast
- Greyhound Waste
- Cork Waste Oils
- D Oils

Rendering Companies

- Federation of Irish Renderers (David McDowell, Chairman)
- Munster By-products, Caher (Goodman International)
- Waterford Proteins, Waterford (Goodman International)
- College Proteins, Co. Meath
- Dublin Products, Co. Wicklow
- Slaney Proteins, Co. Wexford
- Western Proteins, Co. Mayo
- Premier Proteins, Galway (IAWS)
- Monery By-products, Cavan (IAWS)

Fast food nationwide chains

- McDonalds
- Burger King
- Supermac
- Abrakebabra

Snack Food companies

- Champion Crisps & Snacks Ltd, Co. Dublin
- Largo Food Exports Ltd, Co. Meath
- Cantrell and Cochrane Group (Tayto Limited, King Foods Ltd.), Co. Dublin
- Savana Peanuts Ltd, Co. Cork

Animal Feed Compounders

- Lakeland Dairies , Co.Cavan
- Paul & Vincent Limited , Co.Longford
- Kiernan Milling Limited, Co.Longford

– Corby Rock Mills, Monaghan

Animal Feed Suppliers

- Precisions Liquids, Belfast
- Arkady Feed, UK
- Toepfer (Hamburg) Gmbh , Germany

Department of Agriculture

- Animal by-products division , Dublin.

Appendix B: Sample focus interview questionnaire

FOCUS INTERVIEW	**RVO Collectors:** **Clearpower/Sustainable Energy Ireland**
Interviewee (Individual, position, company name)	
Clearpower interviewer	
Date, location	

Background:

Currently, most used cooking oil collected from restaurants, chains and snack food companies is reused in animal feed. As you no doubt know, this practice has been banned under an EU directive, for health reasons – Ireland has a derogation until November 2004. This will leave a significant nationwide waste management issue to be solved. Increasing the price of collection and disposal will likely result in much volume disappearing illegally down drains/sewers etc.
In parallel, Ireland is one of many countries to sign up to reduce CO2 emissions under the Kyoto agreement, and the volume of RVO, as it is 'carbon neutral' (i.e the plants fix the carbon as they grow, releasing it on combustion, with a net zero effect) is potentially a source of renewable fuel to replace the more damaging fossil fuel alternatives.
Sustainable Energy Ireland (Irelands Renewable Energy Agency, funded with 220M under the NDP, www.sei.ie) has retained Clearpower Ltd,(privately held company, renewable energy experts, completed a number of similar studies) to complete a detailed study of the scale of the issue/resource, broken down by geography, and to use the known volumes plus feedback from the industry leaders (you), and their own expertise to make recommendations as to how to support and promote this potential new industry.
We need to accurately understand the scale of the issue form the ground up, in order to make relevant deductions, and it is important for the whole industry that this picture is accurate. We are interviewing players in each step of the supply chain to build up a detailed picture of current and potential supply.
This interview will take approx 45 minutes, and Clearpower/SEI will hold the information in confidence.

Summary:

To be completed after the interview
Major points covered,

Section 1: Overall Market in Ireland / NI

How do you see the overall structure of the market in Ireland / NI

Who do you see as the major sources – are there any particularly large producers that stand out? What volumes do you think are being produced?

Who are the major collectors, how do they operate, what volumes would you estimate they collect, from what primary geographical area, how is the charge changing over time?

Do you think there is much discrepancy currently between the volumes produced and the volumes collected? What makes you assume this? Is anyone treating their own waste or are they dumping it?

Is there any other current end use except animal feed?

What are the competitive products to RVO for the feed mills? What do they pay? Will they worry when it is banned?

Is there much RVO being exported for fuel use outside Ireland (e.g UK), what is the delivered price?

What is the impact of regulations driving what can and cannot be done with collected oil?

(Waste regulations from co. councils, Control of use in animal feed, EU directive on Biofuels)

Section 2: Your company within this market

How does your business operate within the market we have just spoken about?

What volumes do you collect per annum? How does this change through the seasons? What are the changes over the past few years? How does this volume split by geography?

What do you do with the collected volumes currently? What do you charge and how do you set this price?

Do you charge for collection? How much? Have you tested the elasticity in this price?

Who would you see to be your main competition? What volumes are they doing? Where?

SECTION 3: Potential new uses

How would you rank the attractiveness of potential uses for the excess volume? Why?
Export?
Heating?
Transport fuel?

What measures do you think could be employed to help stimulate the market for these new uses?

Which countries do you think have got it right – why?

From your understanding, will any RVO be recycled into feeds post Nov 2004?

Section 4: Policy options

Taking your company allegiance aside, if you were asked to craft the national policy to encourage the use of RVO as a biofuel, what do you think you would recommend?

Section 5: Summing up

Anything else you feel is relevant to bring up at this point?
(opportunity to influence government policy)

Appendix C: Sample of interview results

Summary of Interviews for RVO Collectors

Company Name :	Frylite
Interviewee:	Eamonn McCay
Geographical Coverage:	Nationwide/ Collection centres Galway and Strabane
Volume Collected:	2500 tonnes p.a.
Price Charged:	Include in price of fresh oil
Price Sold:	€240 per tonne
Clean up Oil:	Yes

Current Use for Volume Collected:

- 90% sold to Animal Feed Industry
- 10% to bio diesel producer in the UK (Liverpool)

Predicted change over next 5 years:

- Volumes will continue to grow, have been growing at approximately 5% p.a. over past five years.
- Stronger regulatory powers / law enforcement have increased the compliance of restaurants with regards to disposal.
- Environmental officers now seek assurances that restaurants are signed up to a licensed waste oil collector.

Predicted change post Nov 2004:

- Have been actively investigating alternate uses when feed ban comes into force.
- Selling to UK Bio diesel company.
- Are in the process of moving to a new site where there are plans either to set up a bio-diesel plant or a plant for power generation, the economics of both are being investigated at present.
- Had not thought about putting RVO directly into boilers although it may be an option.

Company Name :	**Mitchell Taylor**
Interviewee:	Philip & Adrian Mitchell
Geographical Coverage:	Nationwide, Major Population Centres
Volume Collected:	4000- 5000 tonne p.a.
Price Charged:	€10.00 - €12 per 120 litres
Price Sold:	€240 per tonne
Clean up Oil:	NO

Current Use for Volume Collected:

- 95% sold to Animal Feed Industry in U.K. and N.Ireland 5% to bio diesel

Predicted change over next 5 years:

- Volumes will continue to grow.
- Stronger regulatory powers / law enforcement have increased the compliance of restaurants with regards to disposal.
- Environmental officers now seek assurances that restaurants are signed up to a licensed waste oil collector.

Predicted change post Nov 2004:

- Future of the RVO industry is dependant on producing a clean product that can then be traded as a fuel oil for Boilers etc.
- Very interested in setting up a cleaning plant if the right incentive was available.
- The importance of bio-diesel is being overstated by many in the industry. It would require changes in government duties for bio-diesel to compete with mineral oils.
- Would like to see the availability of incentives to put up plant to properly clean product, thus increasing the marketability of the product.

Company Name :	ROF Services
Interviewee:	John Gilroy
Geographical Coverage:	Ulster, Plus imports for ROI
Volume Collected:	4000 – 5000 Tonnes p.a.
Price Charged:	€10.00 - €12 per 120 litres
Price Sold:	€250 per tonne
Clean up Oil:	Yes

Current Use for Volume Collected:

- 100% sold to Animal Feed Industry in N.Ireland

Predicted change over next 5 years:

- Envisage that volumes will grow. Stronger regulatory powers / law enforcement have increased the compliance of restaurants with regards to disposal.
- Many Environmental officers now seek assurances that restaurants are signed up to a licensed waste oil collector.

Predicted change post Nov 2004:

- Have been in talks with bio-diesel producing company in the U.K. to take collected production.
- Also in talks with company in N.Ireland with view to a joint venture plant, economics are wholly dependant on collected volumes.

Company Name :	Greyhound Waste
Interviewee:	Paddy McBride
Geographical Coverage:	Dublin
Volume Collected:	600 Tonnes p.a.
Price Charged:	€10 per 120 litres
Price Sold:	Sub Contractor collects
Clean up Oil:	N/A
Current Use for Volume Collected:	Animal Feed

Predicted change over next 5 years:

- Envisage that volumes will grow.
- Stronger regulatory powers / law enforcement have increased the compliance of restaurants with regards to disposal.

Predicted change post Nov 2004:

Interested in trying to collect RVO themselves with a view to installing a bio-diesel plant to run their fleet of trucks.

Company Name :	Goldstar / Bolton
Interviewee:	William Deavey – Des O'Connell
Geographical Coverage:	Leinster/Munster
Volume Collected:	3000 Tonnes p.a.
Price Charged:	€20 per 120litres
Price Sold:	€250.00
Clean up Oil:	Yes, fairly advanced cleaning
Current Use for Volume Collected:	Animal Feed in Ireland

Predicted change over next 5 years:

- Expected to increase in volumes as regulatory enforcement increases.

Predicted change post Nov 2004:

- Biofuel use, probably export unless local project emerges.

Other waste management companies interviewed all of whom sub contract their waste oil collection:

Guardian Environmental
Merrion Oil
Pollution Control

Summary of Interviews for Rendering Plants

Company Name :	Dublin Products
Interviewee:	Gerry Tierney, MD
Location:	Dunlavin, Co.Wicklow
Volume Produced:	400 Tonnes per week
Tallow Grade:	Category 3 (Non-SRM)
Current Uses:	Animal Feed Industry
Price Sold:	€300 per tonne plus

ROI Supply :

- Current production of about 1450 tallow per week.
- 550 tonnes Specific Risk Material (SRM), is all used as fuel by the rendering industry.
- 900 tonnes of Non-SRM material used in the animal feed industry / pharmaceutical or soaps**.**

Predicted change over next 5 years (Future Uses / Fuel Potential)

- Current all SRM used by industry as fuel , with boiler conversions allowing for this.
- Decision to be made at end of Oct 2003 by the EU on this practice.
- Potentially all may have to be exported for incineration.
- With regards to non-SRM tallow , feed industry first option.
- Other options include Heating and electricity .
- Bio-diesel production not very attractive as produces by-products FFA/Glycerol which is difficult to get rid of.

What regulations impact you now / in future?

- Veterinary committee decision at end of Oct

Company Name :	College Proteins
Interviewee:	Michael Condra
Location:	Nobber, Co.Meath
Volume Produced:	250 Tonnes per week
Tallow Grade:	Category 1 SRM Material
Current Uses:	50% Internal for boilers 50% Sold to other renderers
Price Sold:	€150 per tonne

ROI Supply :

- Current production of about 75,000 tonnes per annum.
- 30,000 tonnes Specific Risk Material (SRM), is all used as fuel by the rendering industry.
- 45,000 tonnes of Non-SRM material used in the animal feed industry / pharmaceutical or soaps**.**

What regulations impact you now / in future?

Predicted change over next 5 years (Future Uses / Fuel Potential)

- Current all SRM used by industry as fuel , with boiler conversions allowing for this.
- Decision to be made at end of Oct 2003 by the EU on this practice. Potentially all may have to be exported for incineration..

What regulations impact you now / in future?

- Veterinary committee decision at end of Oct
- Potential for Carcass to go directly to incineration removing need for rendering plants
- Have applied for planning to install an incinerator to deal with Meat and Bone meal and would use tallow partly to fire it

Company Name :	Slaney By Products
Interviewee:	Brendan Dunne
Location:	Bunclody Co.Wexford
Volume Produced:	100 Tonnes per week
Tallow Grade:	Category 3 Non- SRM Material
Current Uses:	Pharm/ Animal Feed 80% Export
Price Sold:	€230 - €300 per tonne

What regulations impact you now / in future?

- The banning of SRM Tallow into the feed industry , has produced a source of energy that is cheaper than mineral fuel oil.
- All boilers have been converted to use SRM Tallow.

Predicted change over next 5 years (Future Uses / Fuel Potential)

- Current all SRM used by industry as fuel, with boiler conversions allowing for this. Decision to be made at end of Oct 2003 by the EU on this practice.
- Potentially all may have to be exported for incineration.

What regulations impact you now / in future?

- Veterinary committee decision at end of Oct

Company Name :	Western Proteins /
Interviewee:	Brian Cloonan
Location:	Ballyhaunis
Volume Produced:	210 MT per week
Tallow Grade:	Category 3 Non- SRM Material
Current Uses:	Animal Feed Industry
Price Sold:	€280 per tonne

What regulations impact you now / in future?

- The banning of SRM Tallow into the feed industry , has produced a source of energy that is cheaper than mineral fuel oil. Have converted boilers to use SRM Tallow.

Predicted change over next 5 years (Future Uses / Fuel Potential)

- Tallow may be come another cost to the industry as regulations tighten over its use in animal feeds

What regulations impact you now / in future?

- Veterinary committee decision at end of Oct
- EU agricultural policy and its effects on animal production numbers

Company Name :	Irish Meat Rendering Association
Interviewee:	David McDowell

ROI Supply :

- Current production of about 75,000 – 80,000 tonnes per annum from a carcass stock of about 500,000 tonnes. 30,000 tonnes Specific Risk Material (SRM), is all used as fuel by the rendering industry. 45,000 tonnes of Non-SRM material used in the animal feed industry / pharmaceutical or soaps**.**

What regulations impact you now / in future?

Predicted change over next 5 years (Future Uses / Fuel Potential)

- There is a strong interest within the industry to find alternate uses for tallow. Continually changing regulations makes it difficult for plants to plan into the future. The Rendering industry is reactive to policy shifts. The industry has become a cost centre as a result of legislation governing the disposal of meat and bone meal, whereas prior to changes in legislation the were contributors to the meat industry.

- Current all SRM used by industry as fuel, with boiler conversions allowing for this. Decision to be made at end of Oct 2003 by the EU on this practice. Potentially all may have to be exported for incineration.

- Sees the merger of 1-2 plants, volumes remaining steady. The biggest threat to the industry believes is the movement of cattle from meat plants direct to incineration thereby cutting out the need to render, as the cost of rendering increases.

What regulations impact you now / in future

- Veterinary committee decision at end of Oct

APPENDIX D: NOTES TO ACCOMPANY TABLE 1 AND TABLE 2

NOTES FOR TABLE 1: RVO SUMMARY PROJECTIONS

1 F.A.O figures (OECD 2002)
2 Using Austrian live findings(Mittlebach 1996), University of Graz
3 Austrian research shows that per capita consumption rates vary largely across the EU, from 12kg per annum to 30kg per annum
4 NI population growth static (UK popn Stats 1998-2002)
5 Population growth at 1% per annum (CSO Stats 1998-2002)
6 Estimated human consumption based on 2002 CSO population statistics
7 Ref Bernard Rice 4.5 Kg/pa per capita (Teagasc, Bio-diesel production based on waste cooking oil,1997)
8 Includes domestic consumption not readily available for collection
9 Based on Austrian figures from live experience of realistic collection rates per capita (Mittlebach 1996)
Collection has been increasing at 5% per annum (Clearpower focus interviews 2003), although this annual collection growth is
10 estimate to reduce to 3%

NOTES FOR TABLE 2: TALLOW SUMMARY PROJECTIONS

1 Predictions for changes in herd numbers (CSO 2002, Irish Farmers Journal, Supplement Nov 29 2003)
2 Carcass dead weight represents approximately 55% of total liveweight (Kepak industry source)
3 Represents the total potential of Live weight animal that is available to render prior to butchering/meat packing
4 Of the total potential that is available to render this is the current percentage that actually makes its way to the rendering plants
5 Percentage of carcass weight available to renderer post meat processing / butchering
6 Yield of Tallow per tonne of carcass (Industry sources)
7 Source: CSO Agriculture Department
8 Live weight of animals prior to slaughter
9 Includes deer, goats, horses
10 Over 90% of this material is from the meat processing plants with the balance coming from butchers waste (industry)
11 Figure calculated as aggregate of material available from total viscera available, total material post processing and total supply from butchering
12 Based on total potential supply and known tallow yield per tonne of raw material
13 Caculated from 2002 Tallow production figures : Source Animal By Products Division Dept. of Agriculture
14 Based on average decline in major livestock groups
15 2002 Tallow production figures : Source Animal By Products Division Dept. of Agriculture and Clearpower focus interviews 2003
16 Determined from total material arriving at renders multiplied by fuel usage per tonne carcass rendered

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