Nenagh Biomass District Heating
Summary of Benefits

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1 Introduction

The positioning of Nenagh as an area with competitive advantage over other regions for inward investment by providing the opportunity to produce products with a low carbon footprint is the main driving force behind this proposal.

This report is a short summary of the opportunity that currently exists for the town of Nenagh and North Tipperary to become a leader in the area of competitive local economic development, Sustainable and secure local jobs and a low CO2 emission town. The proposed development programme is designed to minimise both financial and technical risks and therefore a phased development plan is proposed.

1.1 History

Nenagh Town Council in 2010 tendered out for a development of a biomass heating system for the pool and the hotel, with potential for future expansion to the secondary schools and beyond. The capital cost at the time to install a prospective network were considered prohibitive and the project was scaled back to supply heat to the pool alone. This is now delivering 40% energy savings to the town council pool.

As a result of this, a detailed report was produced by the Tipperary Energy Agency under the SERVE project that outlined the requirements that would be necessary to install a Biomass DH network in the town of Nenagh. The report is available from the TEA. The main requirements identified from this report are the following:

- Large energy users (Arrabawn Dairy as main town energy user as an anchor tenant) plus abbey machinery, hospital, hotel) to commit to project
- Funding for infrastructure to be available (as a finance guarantee rather than a grant) as per ESB networks, Eirgrid, Bord Gais Networks and most District heating networks across Scandinavia and central and eastern Europe.
- Development Team with credible partners.

1.2 Policy

There have been many studies on the economic benefits of local energy infrastructure with particular emphasis on Biomass District Heating as a key tool for economic recovery and sustainability. A summary of the most relevant reports:

- An Oireachtas joint committee (Chaired by Willie Penrose T.D.) of Enterprise, Trade and Employment visited Gussing in Austria, where a poor rural area has been transformed over 20 years by the establishment of full locally sourced renewable energy infrastructure.[i]
- A Western Development Commission Report on the potential for biomass CHP in the West of Ireland [ii]
- The SERVE project report on the feasibility of Biomass DH in Nenagh

1.3 Key Stakeholders

The populous of Nenagh are the key Stakeholders in this innovative project. They fall into four main categories:-

1.3.1 Arrabawn Co Operative

Arrabawn is undoubtedly both the facilitator and greatest beneficiary from the project. It has a four point relationship:-

- It is the main user of thermal energy equating to over 50% of the total output of the energy centre.
- It is the landlord as the proposed site is located on their land
- It is a supplier of low grade heat which will convert a current waste stream into a valuable revenue generator.
- The local region will benefit from an addition € 4 - €7 million per annum much of which will be paid to the farmer shareholders of the Co Operative.

1.3.2 Other large commercial and industrial users.

This category will include mid-scale users such as Hotels, swimming pools, civic offices, hospital industrial premises.

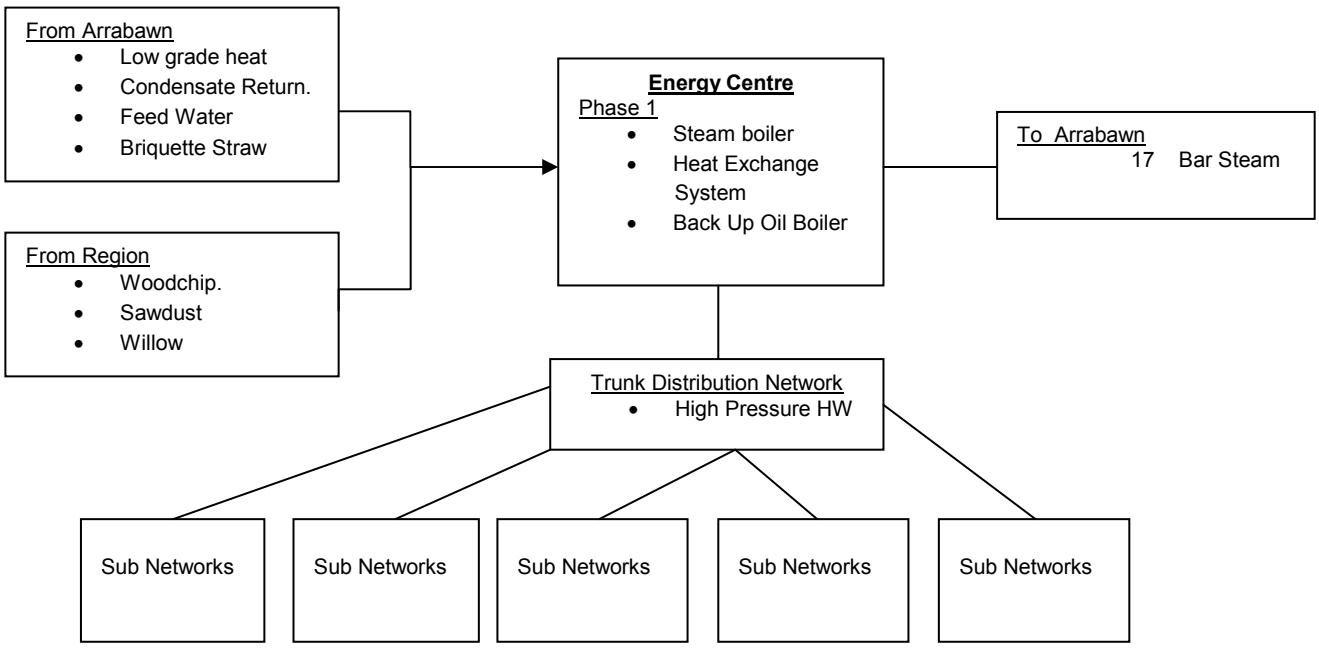
1.3.3 Retail premises and offices

High street shops, professional offices, and small business

1.3.4 Domestic Users

Domestic users in the town of Nenagh currently spend in the region of 8 Million Euro per annum on heating fuels, supporting a very small number of fuel retail jobs. With energy prices increasing at 8% P.A and real wages decreasing a trend towards significant fuel poverty is approaching.

1.4 Project Overview



2 Project Description

The project would be broken into two parts:

1. The biomass boiler and energy centre
2. The district heating network

2.1 Energy Centre:

Based on the energy use of Arrabawn and the contracted size and cost of a similar plan in 2012 in Wexford, the following structure is relatively certain:

The critical statistics are as follows: -

- Arrabawn peak load: 14 MW (20 Tonnes Steam)
- Maximum district heating peak load: 26 MW (Serve Report)

At this point in time the demand from Arrabawn is known and therefore can be factored in to the capacity calculations. The uptake from the district heating system is not yet established. The following strategy is recommended:

- Install a 14 MW steam boiler.
- Recover the waste heat stream from Arrabawn
- Design the infrastructure to cater for an additional hot water boiler if demand from the DHS increases.
- Install a 20 MW oil boiler as backup.

2.1.1 Energy Centre Budget

Plant Item	Million
14 MW steam boiler	€ 3.5
20 MW Oil Boiler	€ 0.5
Fuel Handling	€ 0.5
Building	€0.5
Heat Exchange Integration	€0.3
Total Energy Centre	**€ 5.3**

2.2 District Heating Network:

There is currently a feasibility study underway to establish theses costs with a higher degree of certainty. The initial “budget estimate” of the network has been established at €5.3M to connect every house in the town. This would not be completed in the primary project, as only the main heat users, and provision for the secondary network would be installed in the primary project. A schematic of the DH network is outlined below:

Figure 2-1: Nenagh town DH primary and secondary network

3 Cost Analysis

3.1 Arrabawn

The cost of energy for a large dairy in 2012 is a significant part of the total costs. There are currently two dairy's in the process of building similar large biomass installations that are utilising oil currently. There are a further two that are actively looking at biomass as an alternate to natural gas. The significant volatility in natural gas prices, coupled with high standing charges are leading to a move towards biomass.

Estimating the capital and running costs of the three fuels in the following table. Energy use is estimated at 88,000 MWh per annum (2010 figures).

	Price per kWh (NCV)	Carbon	Standing Charges	Capital Cost	Interest on Capital @4.5%	Total
Gas (3.3c/kWh GCV)	3.5	0.19	0.0027	0.09	0.05	3.83
Wood Chip	2.5			0.60	0.16	3.27
Oil	5.5	0.26		0.00		5.76

Figure 3-1: Energy cost components based on 2012 benign gas costs.

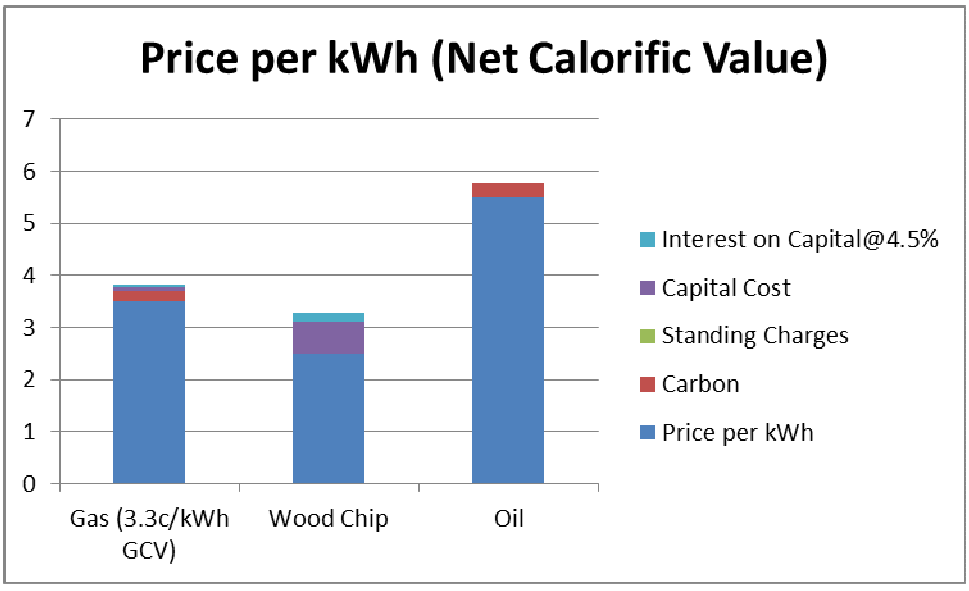
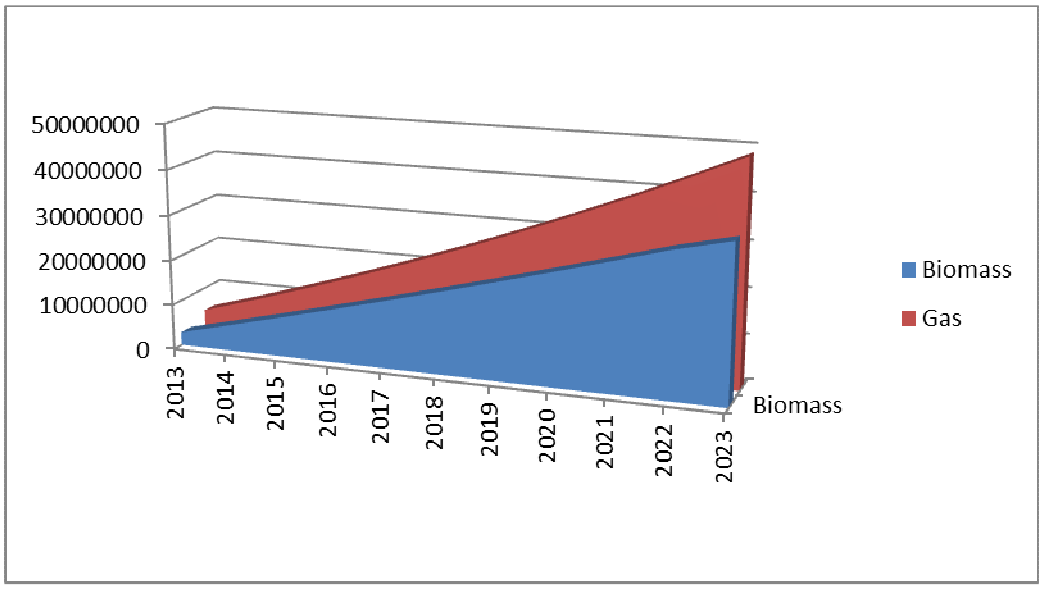


Figure 3-2: Energy cost components.

This would yield a total energy cost per annum of:

Gas	€3,369,550
Biomass	€2,875,000
Oil	€5,068,800



Taking a 4% increase per annum of gas prices (8% is the actual price rise over the last 5 years), and 2% per annum for gas, holding interest rates and all other prices steady, in 10 years' time, Natural gas will have cost the dairy €14M more than gas.

3.2 Typical Domestic Customer

A typical domestic customer in Nenagh (annual average) uses oil for main heating fuel. Making a few assumptions, based on SERVE analysis:

- 2000 Litres of oil per annum is consumed
- Typical existing oil boiler efficiencies of 80% and a new gas boiler of 87%
- Oil cost of 90c/litre including VAT and carbon taxes
- Gas cost 5.6c/kWh ex Vat or 6.4c/kWh Inc. VAT +€180 P.A. Standing charges
- Biomass cost of 5c/kWh for heat
- Biomass standing charges of 300 per annum for the network operation and Capital re-payments
- Biomass heat cost of 5c Inc. Vat.

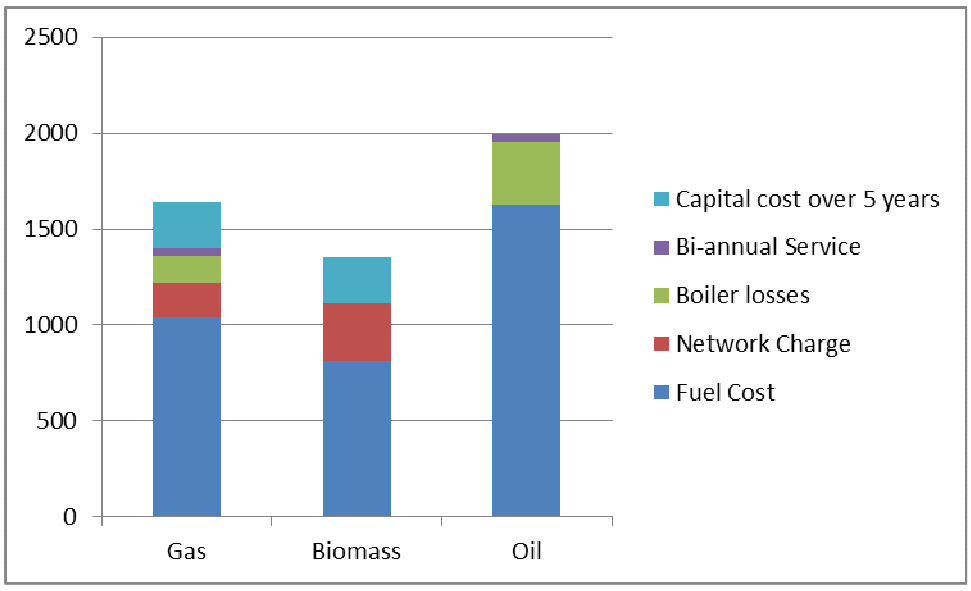


Figure 3-3: Typical Homeowner cost analysis

The above figures are still quite preliminary and require further refining. This is currently underway and will be completed shortly.

3.3 Business Model for the Network

The main network for the town will operate on a pass through cost basis. It will charge the heat supply company 2c/kWh for passing heat (just like the electricity and gas networks operate).

Taking this 2c/kWh and a very generous 0.5c/kWh operating cost, it will yield a repayment capacity of 190,000 for 25% of the town heat load and 560,000 at 75% of the town heat load. This would more than cover any potential costs of the distribution system over a 15-20 year term that is appropriate for infrastructure.

3.4 Business model for the energy centre

The energy centre would buy fuel, purchase waste heat from the dairy to pre heat the return water from the town. IT would also repay a loan on its development costs in addition to billing its customers.

Initial analysis shows that at a cost to the network customers of 4.4c/kWh (ex. Vat - 5c. Inc. VAT) and 3c/kWh to the dairy would ensure a high uptake of customers. This would more than compensate the capital costs, running costs and any further expansion costs as required.

4 Economic Benefits to the region

Assuming 80% of the energy requirements of Nenagh are supplied by biomass, significant local benefits will occur. There are several studies that estimate the socioeconomic benefits for this scale of plant. An analysis of biomass supply chain jobs in the Bioenergy Strategy for the Mid west region yielded 420 jobs for a supply chain supplying 279,000 Tonnes of Wood chip by 2020 or 1.5 Jobs per 1000 Tonnes. The Western Development Commission's (WDC) analysis assuming 2.5 Jobs per Million Euro invested in bioenergy by 2020. Using these figures and extrapolating down to this analysis would yield the 58-117 full time equivalent jobs to the area:

	'000 Tonnes Fuel	Jobs
Mid-West Study	279	420
Nenagh DH	78	117

	Euro Invested	Jobs
WDC Study	63M	146
Nenagh DH	25M	58

Figure 4-1: Estimation of Socioeconomic Benefits

It is therefore estimated that the Region would have a **total of 60-120 extra jobs** as a direct result of this project.

There are other economic benefits:

1. Balance of payments. Assuming the region retained the energy costs versus purchasing fuel externally to the state, the value of this would be approximately 10 Million Euro. Primarily invested in the above construction, forestry and maintenance jobs.
2. The per annum annual savings to the businesses and householders would be worth approximately 1.5 Million Euro.
3. Over the next 20 years, using oil or gas (including the significant infrastructural cost) it would be safe to assume that the cost of energy on the global energy market is to rise. Taking a conservative 4% rise per annum (versus 8% over the last decade per annum), and 2% for CPI of Biomass, the above balance of payments would be a staggering 270 Million difference for the town of Nenagh.

	Cost	Savings	Balance of payments impact
Oil	310		
Gas	235	75	-75
Biomass	173	137	-270

Figure 4-2: Summary of Cost and balance of payment estimation over 20 Years in Millions of Euros

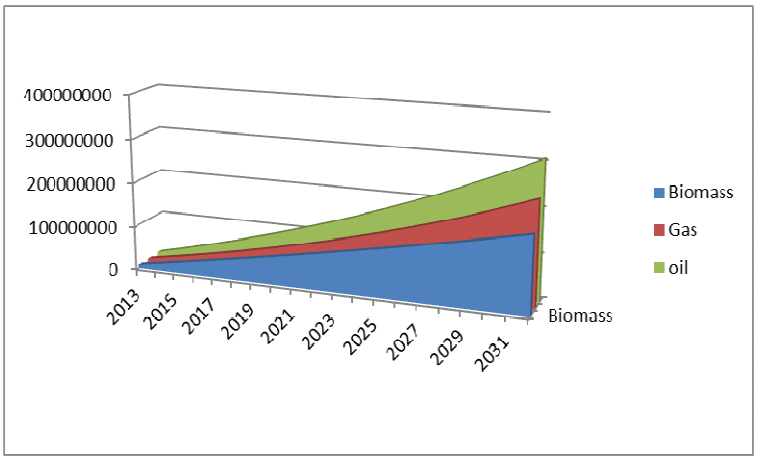


Figure 4-3: 20 year costs to local economy

5 Biomass Availability

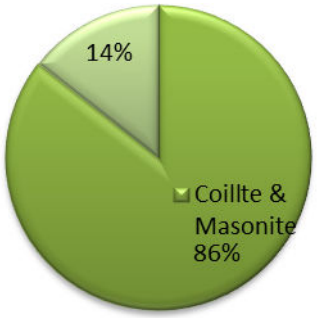
	000 M^3				
	2009	**2012**	**2015**	**2020**	**2028**
Coillte	2,291	2737	2844	2842	3184
Private	130	384	504	1240	3229
Total	**2,421**	**3,121**	**3,348**	**4,082**	**6,413**
High value product					
Finished Saw log (36%)	764	936	1,004	1,225	1,924
Finished Stake wood (2%)	48	62	67	82	128
Total	812	999	1,071	1,306	2,052
Low Value Market of harvest	**1,609**	**2,122**	**2,277**	**2,776**	**4,361**
Sawmill (60% moisture)	838	1,027	1,102	1,343	2,110
Pulpwood	731	1,029	1,104	1,346	2,115
Bark	54	66	71	87	136
Reclaim	200	200	200	200	200
Total low value market	**1823**	**2322.28**	**2476.64**	**2975.76**	**4560.84**
Uses - Low Value					
Board Mills	1286	1286	1286	1286	1286
Energy for board mills	431	431	431	431	431
Round Stakes	88	88	88	88	88
Bark	54	66	71	87	136
	1859	1871	1876	1892	1941
Available for commercial energy					
Commercial Energy	**-36**	**451**	**601**	**1084**	**2620**

Note.

1. The total error in 2009 is approx. 120K M^3 or 5% as commercial consumption was 54K M3 also there were exports of sawmill residue of 37K M^3.
2. The “Low Value” market is comprised of sawmills waste streams and pulpwood.
3. The actual data reported for 2009 forms the basis of the forecasted value analysis.
4. Forecasts are extracted from the Coford sponsored study compiled by Henry Philips. Some commentators reduce the recoverable product by up to 25%. Whilst this may be the case the reality still remains that low value 60% moisture product will remain in over supply.

5.1.1 Comments on current usages

The indigenous demand for saw log is not likely to recover for the foreseeable future; it is therefore assumed that export markets will be found for the available harvest. The sawmill sector is confident that this will realise as the mills are currently unable to source sufficient raw material to meet demand despite the depression in the construction sector.



The dominance of Coillte over every aspect of the supply and demand of the market means that the conditions are managed and therefore are not subject to normal market forces. This is particularly relevant to the low value market (pulp wood and sawmill residue).

The board mills (Clonmel & Waterford and Masonite Carrick on Shannon) consume the vast majority of the sawmill residue. Other market segments are too small to influence the market. This dominance will remain as long as the mills stay in operation, their closure would have catastrophic effects on the entire low value end of the market.

5.1.2 Value Analysis

From the above data it should be noted that at least 50%, by volume, of the total harvest is included in the “low value” segment of the market i.e. chip or pulpwood.

5.1.2.1 Sawmill Residue

Commentators, generally, (except this one) assume that the board mills have a given right to supplies of low value product from sawmills. In our opinion the survival of the board mills is dependent on continued preferential treatment which delivers a managed price on their raw material and energy costs.

5.1.2.2 Pulpwood

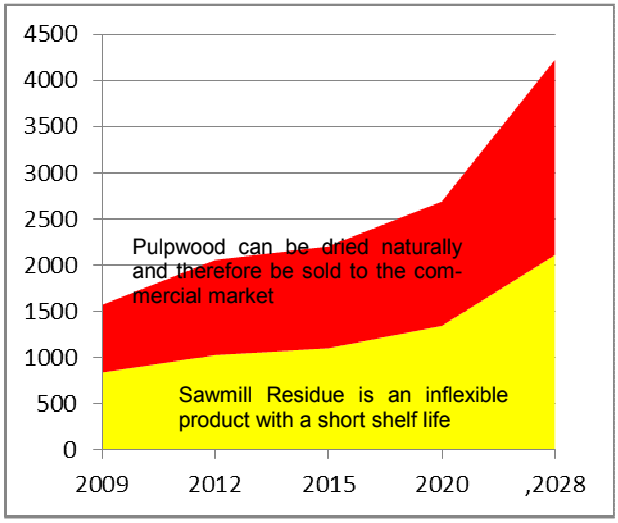
Coillte have now introduced a system whereby most pulpwood is retained by them at auction and therefore does not enter the market place. As they own a large proportion of the harvest this effectively means that they currently control the supply of pulpwood to the market at this time.
Over the coming decade the supply of low value product will grow by 200%, primarily from the private sector

5.2 Prices

Woodchip is a very competitively priced fuel source. The local price is dependent on sources available within the economic radius of the plant; however we have, over the past few months, compiled detailed studies for two processing plants where both, when compared to HFO yielded attractive and viable returns.
We do not see woodchip increasing in price for the foreseeable future (three to five years).

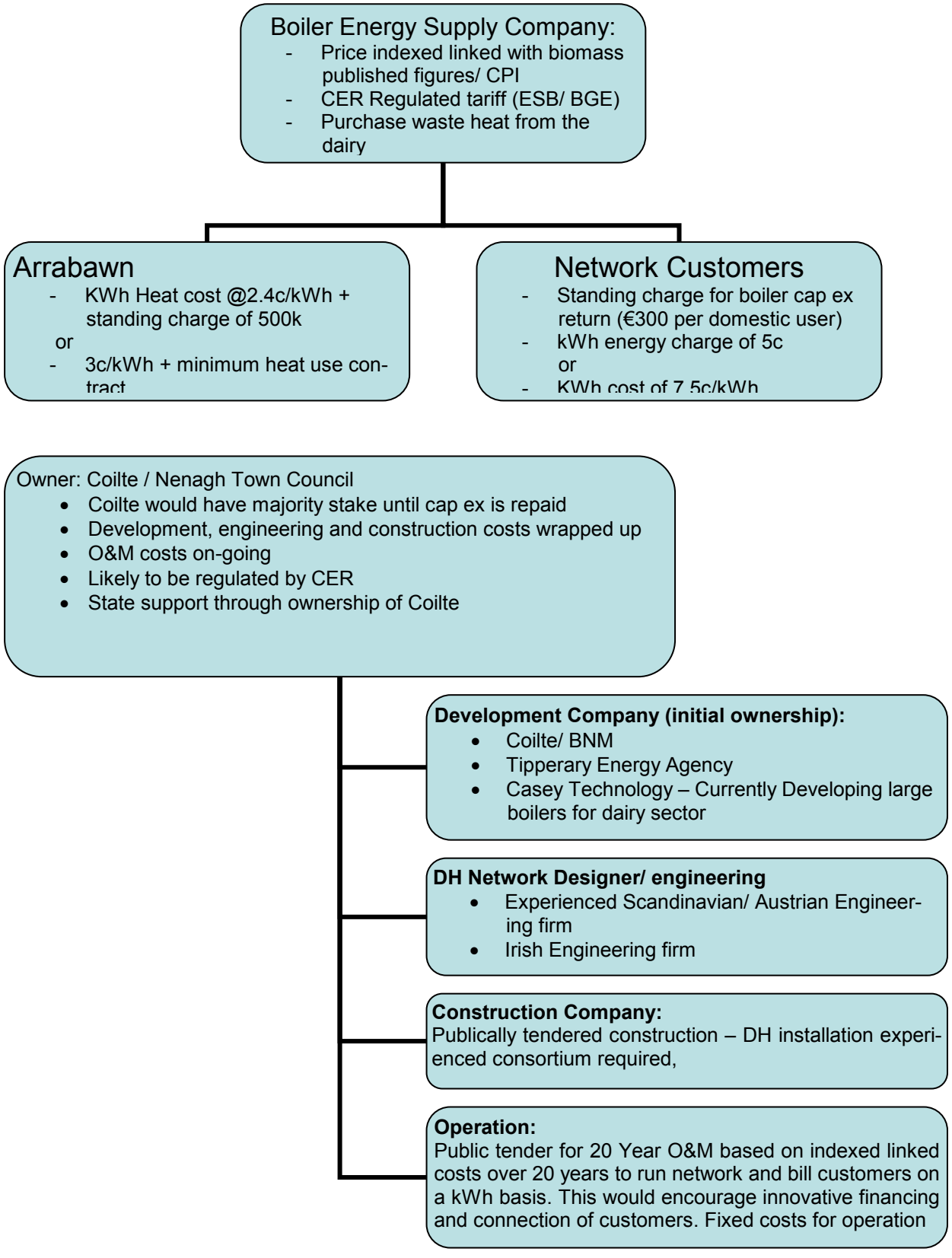
5.3 Conclusion to market analysis

- Milk processing plants should install biomass boilers capable of using fuel with up to 62% moisture because: -
    a. The sawmill residue will have high moisture content resulting in a short shelf life and therefore will be the lower end of the low value market.



6 Funding and Development Model

The model / structure for developing the project are still to be finalised, but a proposed model would look like the following:



The main elements of the development are the following:

1. Boiler ESCO company. This company would design build and operate the biomass boiler for a fixed term of 10-20 years. They would do this at an indexed linked regulated pricing model. At the end of the term, both the DH operator and the Dairy will be free to purchase heat from another location/ tender.

2. DH Development Company. This company would establish the DH network on a publically tendered basis, be always partially owned by the local authority and would be 100% publically owned completion of the 10-20 year payback period by local authority. The tariff charged would be fixed on a per kWh sold cost and would include for elements such as:

    a. Maintenance costs
    b. Pumping costs
    c. Heat losses
    d. Interest and capital repayments.
    e. Other expansions in services.

Many biomass contracts are established over long periods and indexed linked to CPI values to ensure they do not trend with global energy prices. Generally they include the following components:

- Small portion linked to AA Ireland road fuel costs
- Medium portion to CSO labour rates
- Large portion to Pulp wood price variation published by Teagasc.

This would ensure that the cost to the customers and value to the town remains appropriate and competitive.

7 Next Steps

1. Evaluate summary and establish an independent review of both Gas and Biomass proposals. (this is currently under way by BGE for gas and separately by the TEA and partners
2. Form an appropriate committee to progress establishment of correct solution.

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[i] Crowley, E. Penrose, W. et al. Report-The Potential to Establish Local Enterprises and Create Jobs based on the Generation and Utilisation of Energy from Renewable Energy Resource; [online] available from: http://www.oireachtas.ie/documents/committees30thdail/j-enterprisetradeemp/reports_2008/20080625.doc Accessed 06/06/12

[ii] Bruton, T. and Tottenham, F., 2008, Biomass CHP Market Potential in the Western Region, [online] available from: http://www.wdc.ie/wp-content/uploads/reports_BiomassCHPMarketPotential_Assessment.pdf Accessed 23rd April 2011