

Forth Energy's proposed biomass power station for Dundee: Biofuelwatch and Friends of the Earth Tayside response to the Report to the Policy and Resources Committee

The Report recommends that Dundee City Council does not object to Forth Energy's biomass power station application. We believe that this recommendation is deeply flawed, and appeal to Councillors to consider the implications that a plant this size will have on Dundee.

Forth Energy have failed to provide a satisfactory assessment of the likely air quality impacts of the power station. Specifically, assessments of the impacts of nitrogen oxide and particulate emissions are misleading and inaccurate. Our arguments are further detailed in Appendix A.

Nitrogen oxide emissions

Forth Energy have chosen to use a different method for calculating conversion rates from nitrogen oxide to dioxide than the assumed method recommended by the Environment Agency and SEPA, thereby halving predicted nitrogen dioxide emissions. Further still, Forth Energy used the recommended methodology in their assessment for the Grangemouth application but have provided no explanation for the difference. However, if the 70% conversion rate had been used in this case, then annual mean nitrogen dioxide concentrations would be exceeded at five receptor locations as listed in Table 11 of Forth Energy's Addendum 2. Given the persistent current breaches of the NO₂ objective in Dundee and their health impacts, we believe that those additional impacts would be unacceptable.

To contextualise the scale of these emissions, we've compared them to equivalent car emissions, and found that the overall air pollution generated by the plant would be equivalent to that from approximately 1.9 million cars year-round in terms of nitrogen oxide emissions, and 51,000 cars in particulate emissions. Whilst not directly comparable to the power station stack emissions, they highlight just how polluting this plant will be. See Appendix B for calculations.

Particulate matter and heavy metal emissions

Forth Energy have failed to consider all of the possible sources of PM emissions, and have claimed that virgin wood contains no metals, thereby excluding all but the up to 30% of the waste wood feedstock from these emissions calculations. No attempt to measure PM_{2.5} levels has been made, despite these being the most harmful to human health, and Forth Energy's methodology for assessing the impacts of wind dispersal contradict Dundee City Council's own reports.

Further considerations

While air quality impacts remain the most substantial to consider ahead of the determination meeting, significant issues around efficiency, heat distribution, sustainability and climate impacts remain. These are summarised in Appendix C. In addition, this development remains a poor choice for Dundee, with each job created subsidised by around £1 million every year, and the likely negative impacts on

tourism and Dundee's re-developed Waterfront.

Conclusion

It is imperative that Dundee Councillors decide to vote to object to this application. The impacts of this proposal are poorly assessed with conclusions geared to suiting the developer, and not towards honest assessments of the likely impacts of this plant on the people of Dundee.

Biofuelwatch and Friends of the Earth Tayside
21 June 2013

Appendix A

Observations about the new Air Quality Assessment:

The new Air Quality Assessment shows in Table 11 that, if the standard method of estimating the conversion of nitrogen oxide (NO_x) emissions to nitrogen dioxide (NO₂) is used:

- existing breaches of the annual mean NO₂ objective will be worsened by between 0.4 and 1.1 µg/m³ at three receptors;
- the annual mean NO₂ objective will be breached at two more receptors, where it is not currently being exceeded;
- at two receptors where NO₂ levels are close to the objective, NO₂ levels will be increased by 0.4 and 0.7 µg/m³ and reach 37.2 and 39.6 µg/m³ respectively, which indicates two more possible breaches of the objective.

Given the persistent current breaches of the NO₂ objective in Dundee and their health impacts (more on those below), we believe that those additional impacts would be unacceptable.

This does not appear to be disputed in Forth Energy's new documents. Instead, they are claiming that the standard methodology of converting NO_x to NO₂ should be ignored and that, in this particular case, at most 35% of NO_x converts to NO₂ in respect of long-term average concentrations. By doing so, they have cut the predicted additional long-term average NO₂ impacts by half.

The Environment Agency's guidance on converting NO_x to NO₂ – which we understand is followed by SEPA, too – states: "*Worse case scenario: 35% for short-term and 70% for long-term average concentration should be considered. If PEC (process contribution + "relevant background concentration") exceeds the relevant air quality objective, then proceed to step 3. 3. Case specific scenario Operators are asked to justify their use of percentages lower than 35% for short-term and 70% for long-term in their application reports.*"¹ 70% is thus the standard conversion rate

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and while the Environment Agency allows developers to put forward evidence about any variation from that rate in specific local circumstances, we have never before come across a case in which a developer has argued that only 35% of NO_x stack emissions is converted to NO₂ over the long term.

We understand that Forth Energy's claim is not backed up by the widely accepted science on NO_x conversion, to a large extent because the low 35% conversion rate relies on chemical processes that depend on solar radiation and that can thus only happen during daylight hours, not when it is dark.

Further detail on nitrogen oxide assessments:

Nitric oxide formed in the combustion process is almost instantaneously converted to nitrogen dioxide by thermal reaction with a number of oxidising agents including oxygen, VOCs, and ozone. Forth Energy is apparently unaware of this basic chemistry and bases its model on the thermal oxidation of nitric oxide to nitrogen dioxide by ozone. The model relies on a direct relationship between ozone concentration and the concentration of nitrogen dioxide in ambient air. Visual inspection of the weekly and monthly measurements for Fort William on the web site www.scottishairquality.co.uk show that the opposite is true – namely nitrogen dioxide levels peak when ozone levels are at their minimum. This is in line with the well established chemistry by which the concentration of nitrogen dioxide in the atmosphere is mitigated during daylight hours by a photochemical reaction with oxygen, reforming nitric oxide along with ozone. At night, this mitigating reaction cannot take place and, unless there is a sufficiently high concentration of ozone in the atmosphere which is unlikely in an urban situation. As has been noted by the WHO conversion to nitrogen dioxide then becomes 100 %, conversion with no chance of deposition as neither the hydroxyl nor the nitrate radicals are present.

Forth Energy has made no attempt to monitor ozone concentrations anywhere in Dundee and has guessed at a hypothetical value to derive its more favourable and fictitious conversion factors. The limit set for an hourly annual mean concentration of nitrogen dioxide is 40 µg/m³. In its submission Forth Energy set out to demonstrate that this limit would not be breached at various receptor points. It must be borne in mind, however, that the EU target is to reduce total nitrogen oxide emissions by 60% by 2020 so that, in the future, emissions from the proposed biomass plant would have an even greater impact than they would do at present. Using data from the Scottish Air Quality web site for the years 2010 - 2013 it has been shown in Appendix 1 that the percentage conversion to nitrogen dioxide in the nitrogen oxide mix is uniformly 70 %, which is also the percentage recommended by SEPA, and not the values suggested by Forth Energy. In consequence annual mean nitrogen dioxide concentrations would be exceeded at five receptor locations as listed in Table 11 of Forth Energy's Addendum 2 (p 30).

Forth Energy's application in the context of Dundee City's existing air quality objective breaches:

SEPA, in their original response to the application stated:

"If air quality in the vicinity of the development does not improve as anticipated in the addendum to the Environmental Statement we are likely to be unable to grant a

PPC [i.e. an operating] Permit”.

Since then, air quality in the local area has not improved. Dundee City Council’s latest 2012 Air Quality Updating and Screening Assessment² states:

“The 2011 monitoring data confirm the continuing need for the AQMA and the subsequent Air Quality Action Plan (AQAP). Concentrations of these pollutants are above the objective and have increased in many areas of the city since the AQMA was declared. The greatest increases in pollutant concentrations have been recorded along the city centre bus corridor, the north-west arterial route and associated access roads, major junctions on the Kingsway and at Stannergate Roundabout.”

The main change proposed by this assessment is that the scope of the AQMA should be widened to include breaches of the hourly as well as the long-term average NO₂ objective. Several of the locations where the NO₂ objective is being consistently breached, including around the Stannergate Roundabout, are close to the site of the proposed power station. Three automatic monitoring stations (Lochee Road, Seagate and Meadowside) as well as 19 diffusion tubes measured exceedances of the NO₂ standard. Exceedances of the PM₁₀ standard were recorded at Union Street, Victoria Road, Logie Street, Lochee Road, Seagate and Meadowside.

The 2012 Updating and Screening Assessment further shows that hourly PM₁₀ exceedances have been occurring at different sites when the wind was blowing from the direction of the Port, i.e. the proposed site for the power station. This was the case at Lochee Road, Logie Street, Victoria Road, Seagate, Union Street and Broughty Ferry Road. The Assessment does not record the wind directions that correlate with exceedances of the NO₂ objective but we presume that those would match those linked to breaches of the PM₁₀ objective.

While Forth Energy are correct in saying that most of the existing NO₂ and PM₁₀ missions are from road traffic, we can see nothing in planning policy to suggest that this should have any bearing on the this application. It is precisely because of the existing high air pollution levels that an additional significant source of both pollutants should not be permitted.

We are deeply concerned to note that, according to NHS Tayside statistics, the death rate from respiratory illnesses is higher in Dundee than in Angus and Perth & Kinross and that those diseases are twice as prevalent in Dundee as in nearby rural areas. As the World Health Organisation has shown, NO₂ and small particulate levels at many locations in Dundee are already high enough to be expected to increase the risk of ill health and premature death.

Observations about predicted PM₁₀/PM_{2.5} emissions from the proposed power station:

The Addendum does not amend the information and claims about the predicted stack emissions contained in Forth Energy’s original 2010 Air Quality Assessment. We are concerned that the predicted PM₁₀/PM_{2.5} stack emissions may be an under-estimate

of what can be expected from a power station that size. Forth Energy predicts that the power station would emit 37,440 kg of PM10 a year (all of it presumed to be PM2.5). However, when compared to monitoring figures from the US Environmental Protection Agency for a 50 MW biomass power station in Burlington, Vermont³, Forth Energy's predictions appear unrealistically low. The Burlington power station uses Best Available Techniques for NOx and PM10 mitigation (as Forth Energy propose to do) and the main difference, apart from the fact that it is half the size, is that it only burns untreated virgin wood. Forth Energy's predicted figures, compared to those recorded in Burlington are just over two thirds half the rate of PM10/PM2.5 per MWh. We can see no credible reason for such a prediction. Furthermore, Forth Energy contradicts itself by predicting that a lot more fine ash will be emitted through the smokestack than is considered in its air quality assessment.

Particulates are now considered to be extremely harmful to health and there is no safe threshold for exposure as the harm is believed to arise principally from their size and density rather than their chemical composition. The annual hourly mean targets for Scotland are 18 IJg m⁻³ for the larger particles and 25 ug m⁻³ for the PM2.5.

Forth Energy considers only particulate matter derived from minerals. Forth Energy acknowledges that, despite the application of Best Available Technique, PM10, PM2.5 and larger dust particles will be released from combustion of biomass and light fuel oil within the main boiler in addition to emissions from the auxiliary boiler, fuel storage and processing areas. It states that metals are not present in virgin wood so the model considers only the potential impact of up to a potential 30% non virgin wood in the feedstock. In this context Forth Energy is presumably referring to heavy metals and not to the 12 000 tonnes per annum of ash destined for land fill which is largely made up of a caustic mix of compounds of calcium, potassium, and sodium contaminated with boron and heavy metals. Even so the assumption is not correct as trace minerals are vital for plant growth Non virgin material from North America does pose an additional hazard as wood from agricultural or industrial sources may be treated with preservatives containing copper, chromium, and arsenic or with "micronized" copper.

Based on its dispersal model Forth Energy anticipates the annual hourly mean concentration of PM10 particulates of between 0.04 and 0.21 \.Ig/m³ or up to 1.2 % of the target annual hourly mean of 18 \.Ig/m⁻³, Despite WHO's cautions about any level of particulate emissions Forth Energy claims this amount is negligible. No effort has been made to monitor PM2.5 particulates anywhere in Dundee.

The data used in the dispersion model applied by Forth Energy is also suspect owing to an overemphasis on the annual hourly mean rather than hourly mean figures and the consequent assumption that only westerly winds need be considered. Inconsistency in its approach is shown in the sampling of a selection of heavy metals at a location near Craigie Avenue that was undertaken solely during October and February 2011 on the basis of an unsubstantiated claim that " concentrations of these substances tend to be at their greatest in the atmosphere" during these months. "

Forth Energy further states "All currently identified PM10hotspots are upwind (i.e.

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west) of the development." A conflicting observation comes from Dundee City Council's recent Air Quality Action Plan Annual Progress Report in which it is stated that the frequency of daily mean concentrations exceeding the hourly limit "occurred during light winds with 19 during easterly winds and 15 during westerly winds. There was also a large number during March and April." Statistics recorded at Dundee Airport and readily available on <http://www.windfinder.com/show> that easterly winds are likely to be significant during April, May and June. Yet again Forth Energy displays a lack of understanding of the role of particulates with regard to human health and a lack of acknowledgement of local ambient conditions.

Appendix B

The results of the calculations are as follows:

Assumptions:

Average UK car mileage: 8,430 or 13,566 km

(<http://www.racfoundation.org/motoring-faqs/mobility#a15>)

50:50 ratio of diesel to petrol cars in the UK

(<http://www.guardian.co.uk/business/2010/aug/05/diesel-car-sales-overtake-petrol>)

NOx emissions for cars:

Average petrol car NOx emissions: 23mg/km

Average diesel car NOx emissions: 31mg/km

([http://www.lordgrey.org.uk/~f014/usefulresources/aric/Resources/Fact Sheets/Key Stage 4/Air Pollution/26.html](http://www.lordgrey.org.uk/~f014/usefulresources/aric/Resources/Fact%20Sheets/Key%20Stage%204/Air%20Pollution/26.html))

Assuming 50:50 petrol to diesel ratio, average is **27mg/km = 0.00027kg/km = 0.37kg/yr**

Particulate Matter emissions for cars:

Petrol cars produce 0 PM emissions, and diesels produce 100mg/km. Taking an average of 50mg/km = 0.00005kg/mile = **0.68kg/yr**

(<http://www.air-quality.org.uk/26.php>)

Dundee Exhaust Gas parameters used in dispersion modelling (Scenario 1):

Dundee Plant NOx emissions: 24.5g/s or **705,600 kg/yr** (at 8000 hours total)

Dundee Plant PM10 emissions: 1.2 g/s **34,560 kg/yr** (at 8000 hours total)

(Forth Energy Appendix C - Air Quality

<http://www.forthenergy.co.uk/pdf/biomass-project-update- Dundee/03%20ES%20Volume%203%20-%20Appendices/Appendix%20C%20-%20Air%20Quality%20-%20FORTH%20ENERGY.pdf>)

Car equivalents:

Biomass NOx emissions in car equivalent = $705,600/0.37 = 1907027.03$ or **1,910,000 cars**

Biomass PM emissions in car equivalent = $34,560/0.68 = 50823.53$ or **51,000 cars**

Dundee has a population of 141,870 and in the UK there are 510 cars per 1000 people. So Dundee has around **72,000 cars**.

Conclusion:

Power Station NOx emissions in car equivalent = **1,910,000 cars**

Power Station Particulate Matter emissions in car equivalent = **51,000 cars**

Dundee has a population of 141,870 and in the UK there are an average of 510 cars per 1000 people. So Dundee has around **72,000 cars**.

The power station would be equivalent to almost 2 million extra cars in terms of NOx emissions, and equivalent to a 70% increase in traffic for PM emissions.

Please note that the power station emissions are from the top of the smoke stack and are dispersed throughout the area, whereas emissions from cars concentrate along busy roads at ground level.

Appendix C

Jobs and subsidies:

Forth Energy's Planning Statement, submitted in 2010, states that the power station, once built, would support 40 full-time jobs. It is now speaking about 70 such jobs in the media⁴, but it gives no reason for this sudden 'job inflation'.

Forth Energy expects to be eligible for subsidies, paid as Renewable Obligation certificates, and if it qualifies then those will be around £66 million a year (just for Dundee).⁵ This would be £1.65 million in subsidies for each of the 40 jobs promised in the planning application! Even with 70 jobs, that's nearly £1m per job per year, and £66 million a year could create many more jobs in other sectors.

In addition, reports of a major drive for tourism in Dundee, reported in the Courier on 18 April 2013, will be severely undermined if hoped-for cruise ships have to sit in the estuary alongside a massive incinerator pumping out carbon dioxide and other pollutants, and rail passengers approaching the refurbished station over the Tay

⁴ <http://www.thecourier.co.uk/news/local/dundee/controversial-dundee-harbour-biomass-plans-resurrected-1.81735>

⁵ This is based on the average price per ROC between April 2012 and March 2013, which was £41.42 and on the assumption that the power station would meet the very low requirement for being classed as 'combined heat and power' and thus attract 2 ROCs per MWh of electricity.

Bridge have views of the new incinerator just beyond the V&A museum. This could easily result in lost business costing Dundee more than 70 jobs.

Efficiency:

When Forth Energy put in its four initial planning applications in 2010, it gave efficiency figures for just one of them – Rosyth. That power station (the same design and size as that proposed in Dundee), it said, would be just 29% efficient without heat use.⁶ This means that more than two of every three trees cut down to fuel the power station will be entirely wasted as uncaptured heat.

Recently, Forth Energy has been presenting all of its proposed power station proposals as 'combined heat and power'. This is hardly surprising: The Scottish Government has decided that biomass power stations that size will only be subsidised if they meet that definition – and without subsidies, it would not be financially viable. However, the Scottish Government also decided to make it very easy for energy companies to have power stations classed as 'combined heat and power'. They would only have to use or supply a very small amount of heat to achieve 35% efficiency or even less (half the level required by the EU). They could, in theory, use some heat just to dry woodchips.

Back in 2010, Forth Energy published a "CHP Feasibility Study" (which it was obliged to do). This showed that, unsurprisingly, there are many houses and businesses near the site which are using heat – but that a district heating network would be needed to supply such heat from the power station.

However, installing a district heating network needs significant capital investment and Forth Energy has not offered to help pay for one. Nor has anybody else – and local authority budget cuts would make it impossible for Dundee City Council to carry the cost. There is no single big 'heat customer' nearby – if Forth Energy was to, for example, supply heat to a nearby swimming pool, that could at best improve the efficiency from 29 to 29.3% - i.e. it would make no real difference. Even if it could supply heat to the nearby Nynas oil refinery, this would at best amount to less than 7 MW of heat according to Forth Energy's own figures.

Sustainability and climate impacts:

Forth Energy says that it will, at least initially, import up to 90% of the wood. Its application would allow it to burn wood from anywhere in the world, although in the short term, most of it is likely to come from the southern US and Canada.

In the southern US, the last remaining, highly biodiverse and carbon-rich forests are currently being cut down for biomass as well as for pulp and paper. Once logged, they are being turned into monoculture tree plantations which support little or no biodiversity but deplete soil and water. Those could soon be plantations of genetically engineered eucalyptus, which will pose an even greater threat to natural forests and which use vast amounts of water – in a region suffering from ever worse droughts already.

⁶ <http://www.forthenergy.co.uk/pdf/biomass-project-update-rosyth/06%20S36%20Supplementary%20Information/01%20-%20CHP%20Feasibility%20Study-%20Rosyth.pdf>

In Canada, state governments are allowing logging companies to cut ever more wood, thus destroying the country's biodiverse forests and releasing their carbon at an ever faster rate. Companies claim that clearcutting then burning beetle-infested wood is sustainable, yet many studies show that this prevents forests from re-generating in future and releases far more carbon than leaving infested forests alone.

Forth Energy says that it will be buying wood certified as 'sustainable', but under the schemes it cites, even clearcutting oldgrowth forests, wiping out biodiversity, logging watersheds and other highly destructive practices have all been certified as 'sustainable'.

It has not yet signed any contracts for 'sustainable' timber supplies, and will have to secure these in a global marketplace where demand is growing fast. As demand is met in one place, this puts pressure on other places to supply timber, rather than growing food or remaining as natural forest. Poor communities are pushed off their traditional lands as governments sell it off to big companies. This is well documented with the rush to biofuels, stimulated by European regulations. Pressure to grow trees and crops for fuel for export has displaced and impoverished communities, resulted in destruction of tropical forests, and contributed to rising global food prices. Yet all indirect social, environmental, climate and economic impacts are ignored in the sustainability criteria proposed by Scottish Government.

Carbon Debt

Per unit of electricity, biomass power stations emit around 50% more carbon dioxide from their smokestacks than coal power stations. Those smokestack emissions are being ignored because it is argued that new trees will grow back and re-absorb all that carbon dioxide. Yet even if this was to happen – of which there is no guarantee – it takes minutes to burn a tree yet decades for a new one to mature. Many scientific studies show that the impacts on the climate are even worse than those from coal power stations for a period of several decades. Figures recently released by DECC confirm this⁷. Yet the Scottish and UK Governments accept that emissions must be brought down rapidly if we are to have any hope of avoiding the worst impacts of climate change – we cannot afford to increase them further for decades to come.

For more details about the impacts of biomass power stations on forests and climate, see http://www.biofuelwatch.org.uk/2012/biomass_myth_report/ and a list of scientific studies at <http://www.biofuelwatch.org.uk/resources-on-biomass/>.

⁷ See http://www.foe.co.uk/news/this_changes_everything_39485.html