Best use of waste biomass in a low carbon economy

David Turley, April 2024

In March, Defra's Minister of State for Food Farming and Fisheries, issued a Direction to the Environmental Agency to temporarily pause environmental permitting decisions on new waste incineration facilities. It was stated this was to allow Defra officials to "further consider the role of waste incineration in the management of wastes in England". This was instigated in response to Ministerial concerns as to whether incineration of waste was compatible with the Governments net zero strategy and a wish to encourage greater waste prevention.

Now that coal has been virtually eliminated from the UK electricity generation mix, this focuses greater attention on the impacts of burning residual waste streams which now generate the highest carbon footprints for power generation, due to the fossil derived contaminants in the feedstock. Around 50% of the residual waste stream comprises fossil sources of carbon. Incineration of mixed residual waste streams has to date been the major route of disposal. Around 12-13 million tonnes of residual waste are left after recycling in England and Wales, with increasing costs associated with disposing of this into landfill due to rising landfill tax rates.

Coincidently, in parallel to this announcement, the UK's Department for Transport has announced that following Parliamentary Approval of the Energy Bill, it expects to extend support under the Renewable Transport Fuel Obligation (RTFO) to recycled carbon fuels (RCFs) from 1 May this year. These are fuels derived from the fossil portion of residual waste or from capture and use of gaseous CO2 waste streams. The importance of this is that it now provides an additional incentive for around half of the output from any advanced renewable fuel production process that uses mixed residual waste as a feedstock.

Fuel derived from the biogenic part of the residual waste stream already receives support in the form of development fuel renewable transport fuel certificates where 'drop in' fuels are produced (i.e. that are capable of blending in high volumes with fossil fuels). Such advanced fuels have struggled to make financial headway to date and the additional support that will be available to the fossil fraction could help to push developments forward that will deliver outputs not only suited to the road transport sector but also to the aviation sector. The latter is important as the UK will also place a mandate on UK aviation fuel suppliers from January 2025 that will force them to source part of their fuel supply from sustainable aviation fuels such as those produced from gasification of residual waste.

There are many low carbon alternatives to generate electricity that could replace that lost or forgone by not putting any further energy from waste (EfW) capacity onto the grid, or at least any capacity without carbon capture and storage. In contrast, transport and particularly haulage and aviation will rely heavily on liquid fuels with few alternatives for the foreseeable future. These forms of transport therefore need low carbon liquid fuels to encourage rapid and cost-effective uptake. It would seem sensible to prioritise the diversion of the finite residual waste resource to where it can be utilised in difficult to decarbonise sectors of the economy where there are few alternative options available.

EfW makes only a small contribution to current UK annual electricity demand (ca 1.45%) and its diversion to other potential uses, could deliver better GHG outcomes for the UK economy.

Conventional EfW and incineration technologies have been developed at large scale to treat a sizable residual waste problem linked to local authority waste collection, or to address a high heat sector demand (i.e. for cement production). In contrast advanced thermal gasification technologies are capable

of delivering at a range of scales through use of modular design and parallel processing trains. Such smaller flexible gasification units have the advantage in being able to service more discrete local industrial heat and power demands.

Advanced gasification technologies with syngas clean up capabilities can also deliver a range of useful energetic outputs including heat, power and liquid fuels. With the addition of carbon capture, they can also produce hydrogen. The higher energy conversion efficiencies associated with gasification technologies compared to conventional EFW combustion systems (at around 26%) means that they can deliver greater energy output per tonne of feedstock and therefore can reduce the GHG impacts of energy generation.

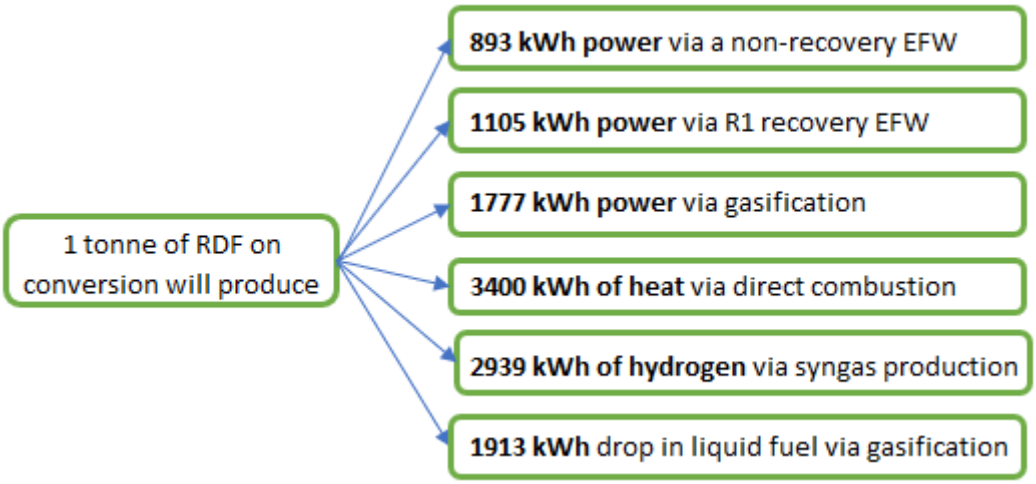

Figure 1. Examples of the energy outputs that can be achieved for different conversion processes (conventional EfW and gasification) from 1 tonne of residual refuse derived fuel (RDF) feedstock.

In contrast to large EfW facilities, gasification of RDF can deliver power with a GHG value per kWh 47% lower than a typical EfW plant and 34% lower than that from a typical R1 (energy recovery) plant. However, compared to other means of renewable power generation these remain relatively high.

NNFCC research with partners in the renewable fuel sector shows that gasification of RDF can deliver renewable fuels that delivers a 70% or greater GHG saving over production and use of current petrochemical-derived road transport fuels, which is in line with many other alternative biofuels.

So, not only does prioritising use of limited residual waste streams make sense in helping to decarbonise 'difficult' sectors of the economy with few alternatives, but it also makes sense from a GHG saving perspective as we look to deliver greater reductions in GHG emissions from the economy.

NNFCC has developed significant experience in delivering regulatory and exploratory GHG analysis of new and emerging as well as existing fuel chains serving sectors across the economy from biomethane generation to renewable fuel, green hydrogen, recycled carbon fuel and low carbon ammonia production.

For more information, please contact us.

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