

Energise your waste!



Energy Efficient Energy-from-Waste: Meeting the R1 Criterion

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1. Why a R1 Criterion?

- Waste Framework Directive determines whether an Energy-from-Waste (EfW) plant is a 'recovery operation' - R1 (Ann. II) or a 'disposal operation' - D10 (Ann. I)
- By assessing the efficiency in energy use
- R1 is a carrot (R1) and stick (D10) approach



1. What is the R1 Criteria?

- It is introduced to promote the efficient use of Energy-from-Waste
- This means recovering as much energy as possible out of what the plant receives with the waste and make it available for the most efficient uses



2. Calculation: details

$$R1 = (Ep - (Ef + Ei)) / (0.97 \times (Ew + Ef))$$

- Ep: annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (GJ/a)
- Ef: annual energy input to the system from fuels contributing to the production of steam (GJ/a)
- Ew: annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/a)
- Ei: annual energy imported excluding Ew and Ef (GJ/a)
- 0.97 is a factor accounting for energy losses due to bottom ash and radiation



2. Calculation: details

- The result is a decimal value (not a percentage); to qualify as R1 it must be:
 - ≥ 0.60 (plant permitted before 1.1.2009)
 - ≥ 0.65 (plant permitted after 31.12.2008)



2. Calculation: remarks

Important!

- The R1 Formula is a 'political', not a technical one
- The R1 Formula does not address the exported energy but the produced energy
- The R1 Formula does not address/calculate the energy efficiency of the plant in a typical way: it addresses the efficiency at which the produced energy is utilised



2. Calculation: remarks

Important!

- Energy-from-Waste plants have very efficient boilers, recovering over 80% of the Waste's Energy
- ESWET members are capable of supplying plants with the potential for very high R1 (even higher than 1.00)
- The internal configuration of an EfW plant is quite similar/optimised, not a large potential for improvement
- ...a plant using the produced energy as heat (completely / partially) will have a higher R1



3. Issues regarding the R1 Formula: Interpretation



- Interpretation and commonly used application of the R1 formula is an important issue
- The Commission has installed a special working group to come up with a 'Guidance'
 - What is in the different energy terms (E_p , E_f , E_i), what not
 - How to deal with the requirements of 'annual averages'
 - When and how does an EfW plant gain/lose R1 status
- Two meetings have been held; a report by an external expert has been delivered



3. Issues regarding the R1 Formula: Interpretation



- A first draft of this 'Guidance' has been distributed on 11.5.2010; main proposals:
 - Definition of what is in the different energy terms (E_p , E_f , E_i)
 - For new plants, R1 value to be calculated based on plant design data
 - For new plants, R1 value to be verified in the course of the plant performance test; R1 status to be defined on that basis
 - For every plant, R1 status is verified with plant data every year ('annual average')
 - For every plant, R1 status to be tested after 'major' plant modification or after a maximum of 10 years



3. Issues regarding the R1 Formula: Interpretation



- Final draft to be elaborated til 9.2010
- Another meeting on 16.9.2010 where the final draft will be discussed
- Guidance to be finalised by end of 2010



3. Issues regarding the R1 Formula: Climate



- Utilisation of heat instead of electricity greatly increases the R1 value
- The possibility to use heat is greatly dependant on the climate; thus the geographical region
- Much higher number of 'heating degree hours (HDH) in northern countries => more demand for heat
 - 5823 HDH in Finland
 - 2903 HDH in Netherlands



R1 



3. Issues regarding the R1 Formula: Climate



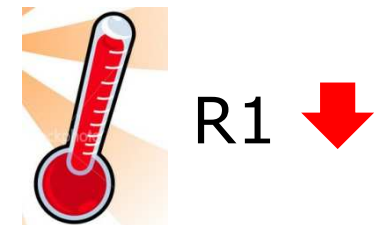
- EfW plants provide base heat load in many northern countries
- This does not only raise the R1 value, but also influences the economics favourably (lower gate fee)



3. Issues regarding the R1 Formula: Climate



- Most EfW plants use air-cooled condensers as the cold source when producing electricity
- Cold weather increases the efficiency of air-cooled condensers and of the water-steam cycle
- A drop in air temperature from 20°C to 5°C means increased electricity production by 7%



3. Issues regarding the R1 Formula: Location



Rural Area R1  R1  Urban/Industrial Area

- A plant in a remote rural area will likely not have heat clients
- Industrial plants are steady heat consumers
- Plant near waste production source:
 - Less transport (=> energy savings, GHG reductions)
 - Efficient District Heating. Large-scale District Cooling under development
- But: NIMBY and NIMTO (Not In My Term of Office) prevents more efficient use of waste as a resource



3. Issues regarding the R1 Formula: Size



- EfW Plants are sized according to a specific waste arising
- Big plants are normally more efficient than small ones (turbine bleeds, pipes sizes, other efficiencies of scale) and built in densely-populated areas
- Small plants make sense in isolated/low population density areas (rural, mountainous, islands)
- Size should be taken into account in the R1

R1 



4. What does this mean for your business?



- Reaching the R1 status means

Legally/Short-term:

- Easier transboundary shipment of Waste: greater potential of fuel supply and more financial flexibility for operator

Public Image/Long-term:

- Greater Public acceptance as a waste management plant: Recovery is step 4 of the Waste Hierarchy, just below Recycling and above Disposal. This means that R1 plants lower the disposal rates (less Landfilling).
- Greater Public acceptance as an energy-producing plant: Especially if the plant is a CHP or Heat plant (i.e. District Heating), the produced energy is seen as more valuable, reliable and as a vital energy source for the city/area



5. Summary / Conclusions

- The possibility for an EfW plant to be considered a 'recovery' operation is positive
- That this is coupled with a requirement for a certain level of usage of the energy produced makes sense
- This will help to locate EfW plants where this can be achieved, e.g. where there is a demand for heat
- R1 is mainly influenced by the possibility to utilise heat, not by plant design / configuration
- ESWET strongly supports the work of the Commission on the 'Guidance' document
- ESWET supports the introduction of correction factors for climate and size
- Giving a level-playing field in the EU



Thank you for your attention!



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