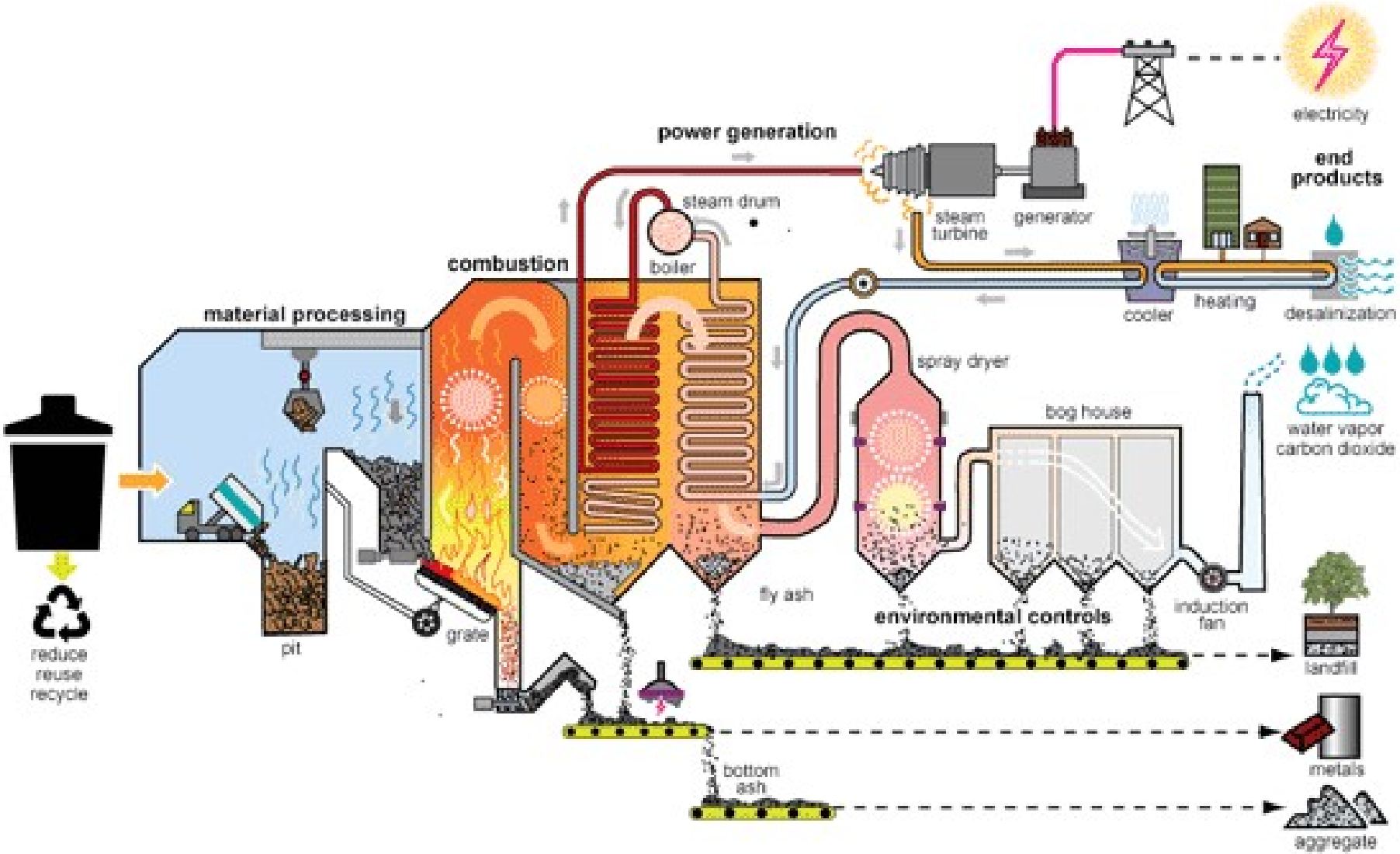
Waste to Energy (WtE)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material processing
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desalinization
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bag house
water vapor
carbon dioxide
reduce
reuse
recycle
pit
grate
fly ash
environmental controls
induction fan
landfill
metals
bottom ash
aggregate

Municipal Solid Waste (MSW) - Waste to Energy

Conventional wisdom is that any treatment exists in a regime of Reduce, Reuse, Recycle – that is incineration fits in at the end of RRR

But – once a refuse to energy plant is installed the incentive to remove the fuel elements of paper and plastic is reduced.

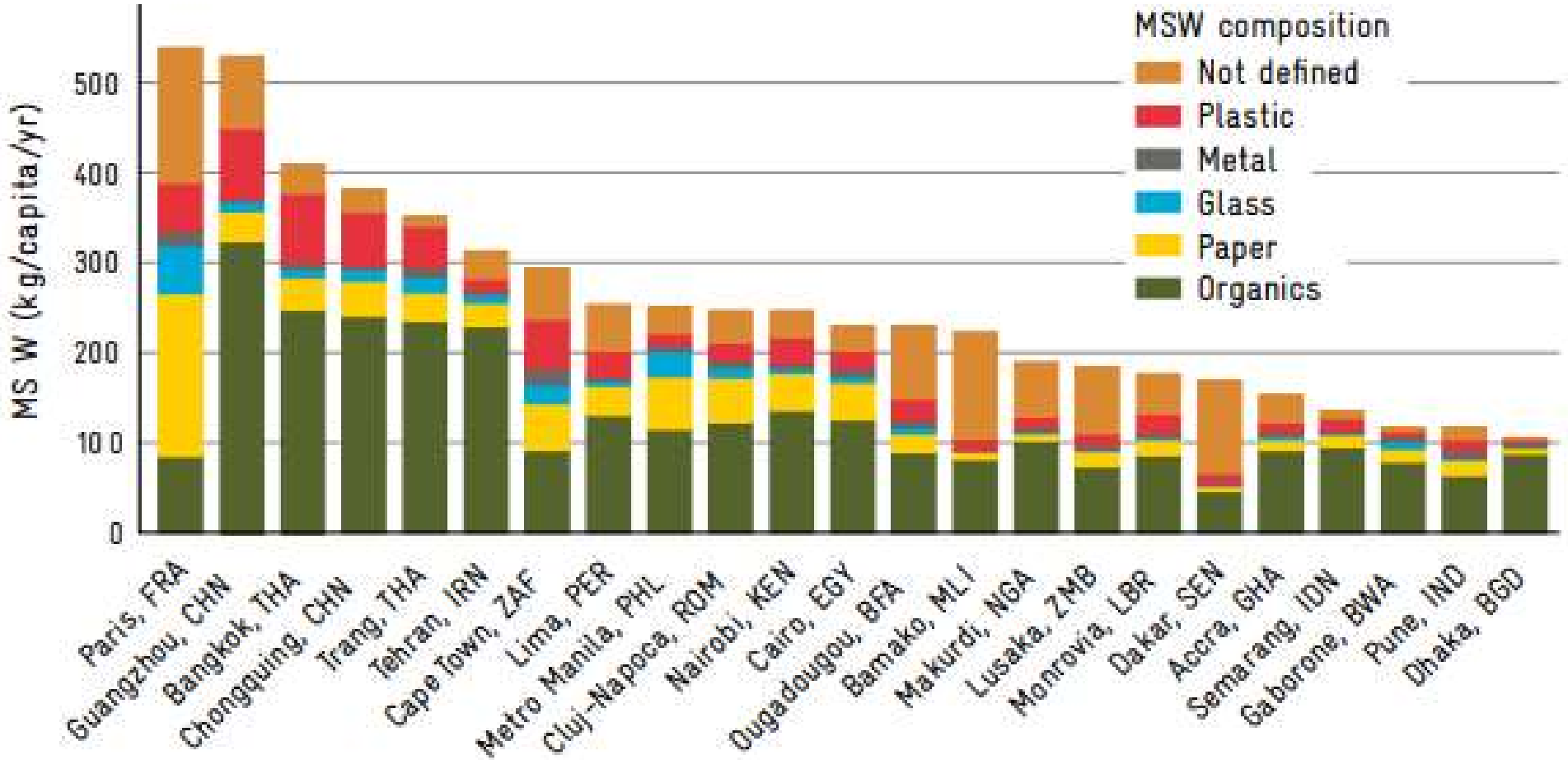
MSW has a relatively low energy content – average Western World ~17 MJ/kg Coal: 8.0-24.0 MJ/kg – i.e. equivalent to poorer coal. Much worse if wet or low in paper / plastic.

Some improve the material for fuel.

- Air classification to extract paper and plastic – that burned the rest otherwise dealt with.
- Pulverise and classify and compress the suitable fractions into fuel pellets. These can be used in substitution or in addition to coal in small to large boilers. Bit prone to self ignition.

Auckland domestic refuse stream is separated – hence lower paper / plastic. Since wheelie bins introduced not as wet.
General stream has a higher than usual content of demolition material – e.g. CCA treated wood (chromium, copper, arsenic) and low energy plasterboard.

GL1



NZ 734 kg/cap/yr – and increasing
Auckland domestic kerbside to landfill 150 kg/cap/yr
Auckland total est. 800 and 1,050 kg/cap/yr

Slide 5

GL1 Garry Law, 22/10/2019

Municipal Solid Waste (MSW) Waste to Energy

Issues 1:

Grate design: Some components of MSW very prone to fusing onto the grate elements – so coal designs do not suffice (e.g. fluidised beds) – need purpose built grates that self clean.

Dioxins: Thorough combustion with sustained high temperature is the method to control. Having sustained high temperature dictates the size of the fire zone and thus cost. There can be problems on start-up and with any unusually wet fuel.

PVC (Polyvinyl chloride) combustion produces HCL which will condense in water droplets on the boiler tubes at the cool (exit) end if the temperature is too low. Short tube life. Avoiding this lowers efficiency c.f. say coal fuel.

The acid gas component of the flue gas has to be dealt with before the bag-house - there are some different technologies but essentially it is lime reaction to do this. E.g. “Spray driers” Deals with some heavy metals as well.

The bottom ash as produced is not always suitable for stand alone landfills (leachable content) - you might get a municipal landfill to take it to mix in - but it is better stabilised with cement before landfilling.

Municipal Solid Waste (MSW) Waste to Energy

Issues 2:

The fly ash has to be dealt with bag-houses or electrostatic separation - and then the collected ash dealt with - which can be useful for some industrial processes but it is low value and not worth transporting far. To landfill it needs some stabilisation.

Mercury is not readily controlled by any technology - it can go out the stack and settle in the vicinity.

If you want to control NOx then you need to inject ammonia to neutralise - all adds to cost.

Low thermal efficiency - 10% typical

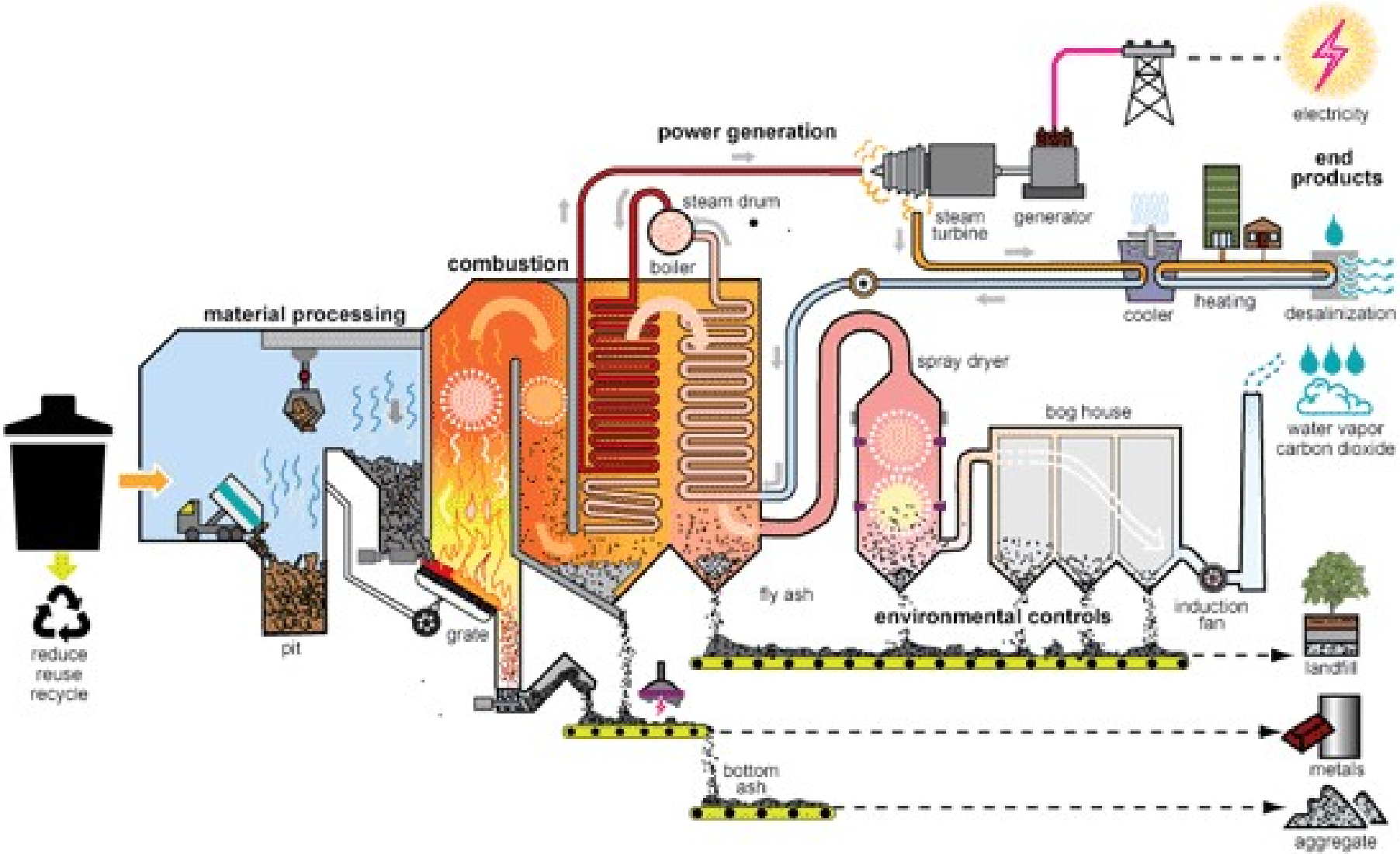
Consenting:

Very difficult!

Field day for NIMBYs. Scare stories on Dioxins, Heavy metals, Acid gas, failure of RRR commitment etc, etc.

Any publicly owned body promoting it will come under considerable political pressure.

Analysis had shown that worldwide, consented plants are predominantly sited in poorer localities that have lesser community resources to oppose plants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Logistics / Operating Intent:

The collection system needs to be designed to minimise water - wet rubbish does not burn happily.

Explosive things in the refuse can be an issue.

You can't economically size the plant to the peak refuse flow week of the year for all its design life. Thus with a smaller size you will need to have a means of disposing of the excess - usually landfill - so you do not escape them. Maintenance shut downs - especially with single boiler operations - likewise you need an alternative.

If you have a low storage then you have a burn as it arrives system - your power generation will be very feed time dependent and you will not sell the power for much, as it may not be a peak price time. Nor is a thermal plant efficient that operates periodically.

Alternatively a large storage pit will mean you are better able to run continuously and to sell the power when it is needed - but it is never ideal.

Waste to energy tends to get dominated by the need to dispose of waste rather than maximising / optimising energy recovery.

Myth 1: “WtE is an easy going solution to get rid of all the waste problems in a city”

Myth 2: “A WtE plant can finance its costs exclusively through the sale of recovered energy”

Myth 3: “With a WtE plant in operation, a big fraction of the energy demand of a city can be covered

Myth 4: “You can make gold from garbage; even unsorted waste can be sold with profit to be used for further energy and material recovery”

Myth 5: “Qualified and experienced international companies are queuing up to invest and operate large WtE plants in developing and emerging countries at their own risk.”

Alternatives

With incineration - District Heating – with main or waste heat from incineration. Other than in very cold climates demand is much more seasonal than the refuse supply so have to dump heat in summer.

Co-processing e.g. Co-firing MSW with other fossil fuel in cement kilns.

“Dirty MRF” Materials Recovery Facility that takes all waste and extracts proportions for recycling. Hard to make MRFs so they add value. Dirty paper and plastic of low value. Composting organic fractions from this is not straight forward but with enclosed fermentation and compost product classification is possible.

Composting wide spectrum organic components separately collected – but mass collection is expensive and compost supply can exceed compost demand – particularly seasonally.

Get serious about RRR – Concentrate where it matters - in Auckland ***NOT DOMESTIC*** and e.g. not export the third R (Recycle) product offshore to others where it is vulnerable to disruption.

Pyrolysis – Not yet done with MSW at scale – Gas product not a good fit to the current gas markets, Char not valued by mass solid waste customers and wood char undercut in BBQ market by imports.

Landfill – Flexible and if well engineered has low impact, can produce some energy from landfill gas – but uses land. New sites are remote – transport cost.

End