Energy Neutral WWTPs for NZ – A Dream or Reality?

Based on

USA client technical tours – April & September 2016

WEF, WERF and WSAA reports on energy efficiency and Resource recovery

The Proposition

- “That NZ WWTPs are in a position to achieve “nett energy neutrality” through a combination of bioenergy generation and energy conservation initiatives”
- Opportunities:
  - Biogas generation enhancement and gas-turbine vs CHP engines
  - Co-digestion of sludges with high strength organic wastes (FOG)
  - EECA funding of energy saving technologies and GHG credit offsets
- Challenges
  - Tighter consent conditions on final liquid and solids streams
    - higher aeration and disinfection energy needs
    - solids conditioning and drying
  - Restrictions on capital expenditure

The WEF Visionary Statement

In 2011, the Water Environment Federation (WEF) produced a position statement which declared:

“WEF believes that wastewater treatment plants are NOT waste disposal facilities, but rather water resource recovery facilities that produce clean water, recover nutrients (such as phosphorus and nitrogen) and have the potential to reduce the nation’s dependence on fossil fuel through the production and use of renewable energy”.

Why is this topic important for NZ?

“Watercare plants on track to become energy neutral by 2025”

29 February 2016 – Raveen Jaduram (CEO)

Watercare has announced an ambitious target to see its two major wastewater treatment plants become electricity neutral by 2025.

By 2025, Watercare plans to run its Rosedale and Mangere wastewater treatment plants entirely on self-generated electricity, a target that will see Watercare reduce its electricity demand on the grid by about 37GWh every year.

USA WWTP Examples

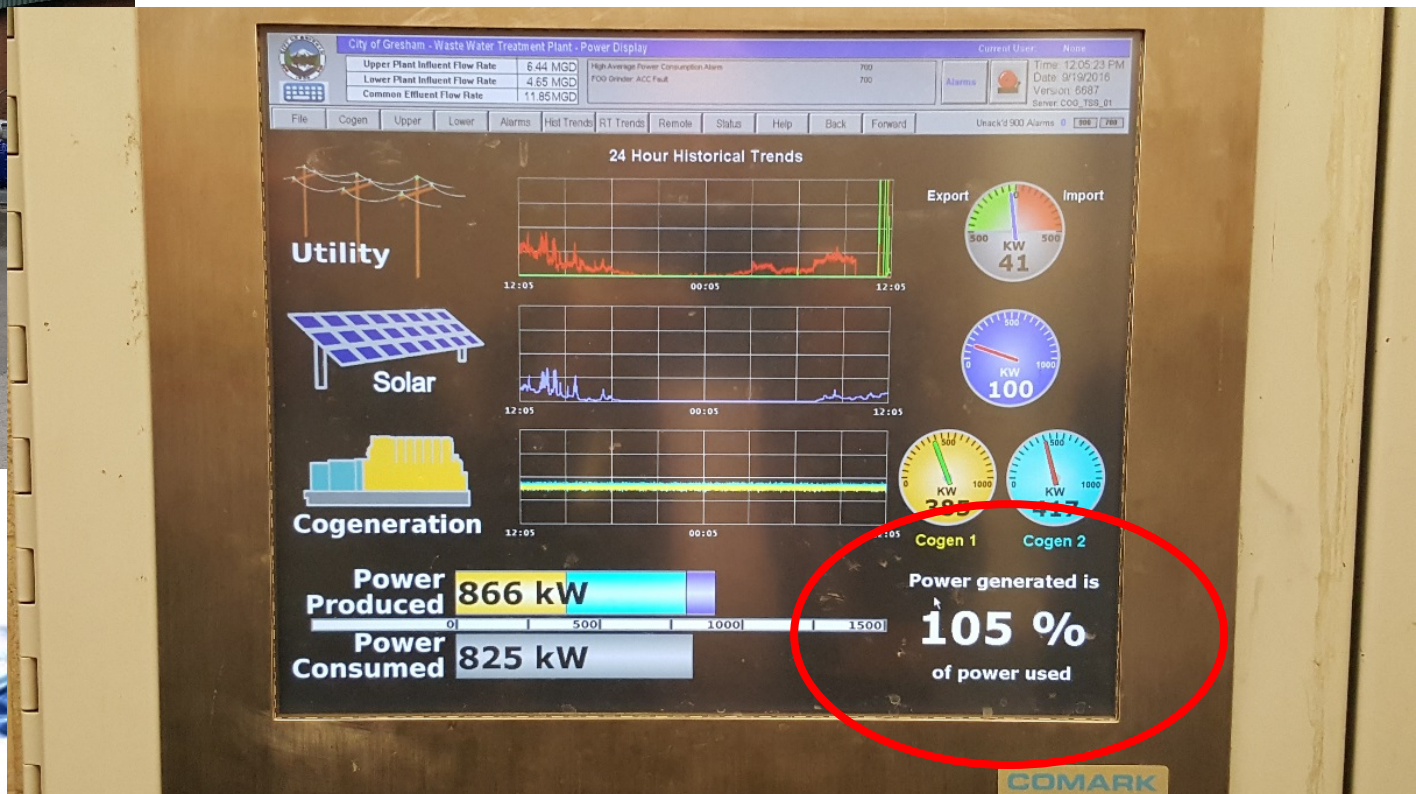
West Coast

- Gresham, Oregon
- Columbia Boulevard, Oregon
- South East WPCP, San Francisco, California
- East Bay MUD WWTP, Oakland, California
- Oceanside, San Francisco, California
- Santa Clara, San Jose, California
- Merced, California
- Sacramento, California

East Coast

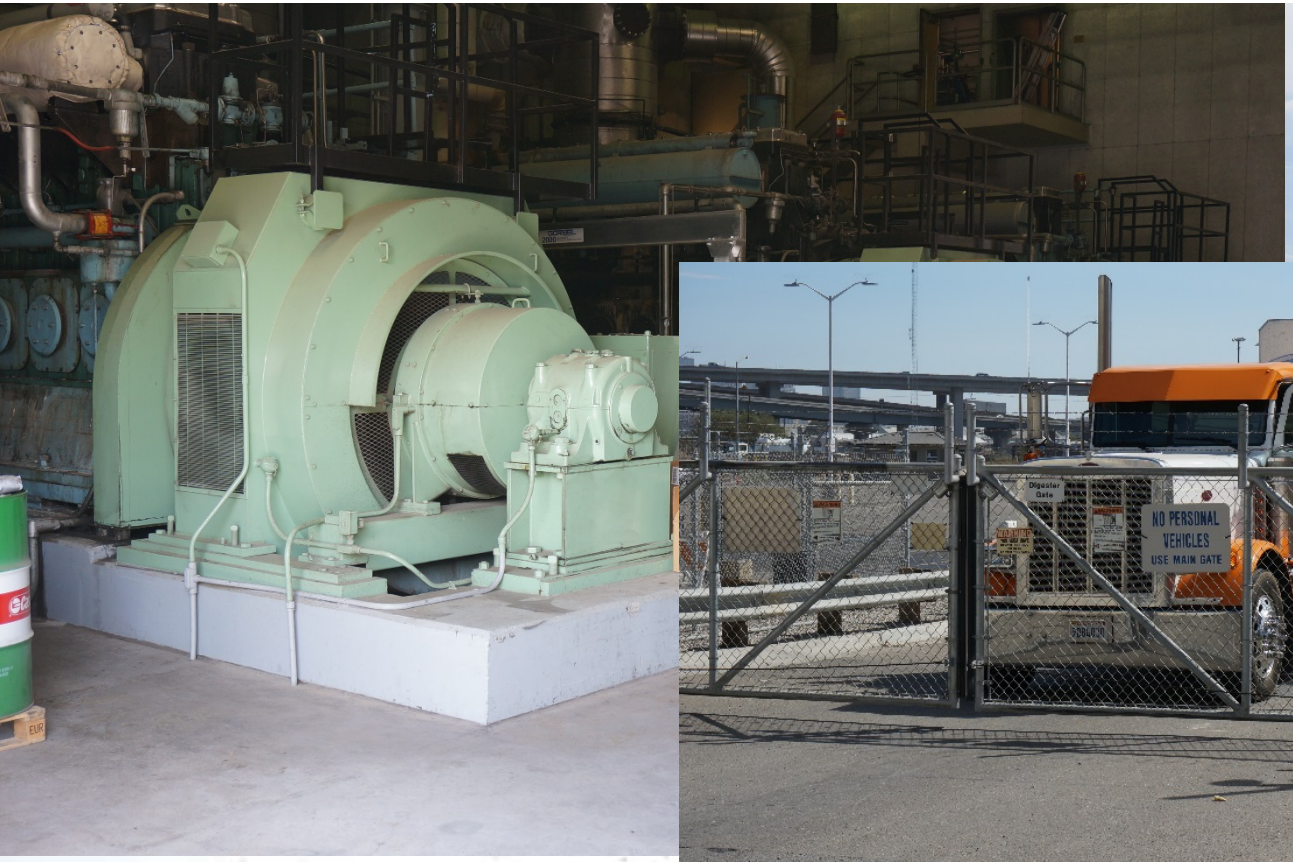
- Jones Island, Milwaukee, Wisconsin
- Blue Plains WWTP, Washington DC
- Alexandria RENEW, Virginia
- UOSA, Virginia
- Hampton Roads Sanitation District, Virginia

Gresham WRRF
Nett Energy Producer – Imported HS Wastes



Gresham WRTP
Solar Power (PV arrays)

EBMUD Energy, Oakland
Net Energy Producer/Co-digestion



Alexrenew, Alexandia
Demon Ammonification/Odour Control

Blue Plains, DC Water
Largest THP (Cambi) plant in USA

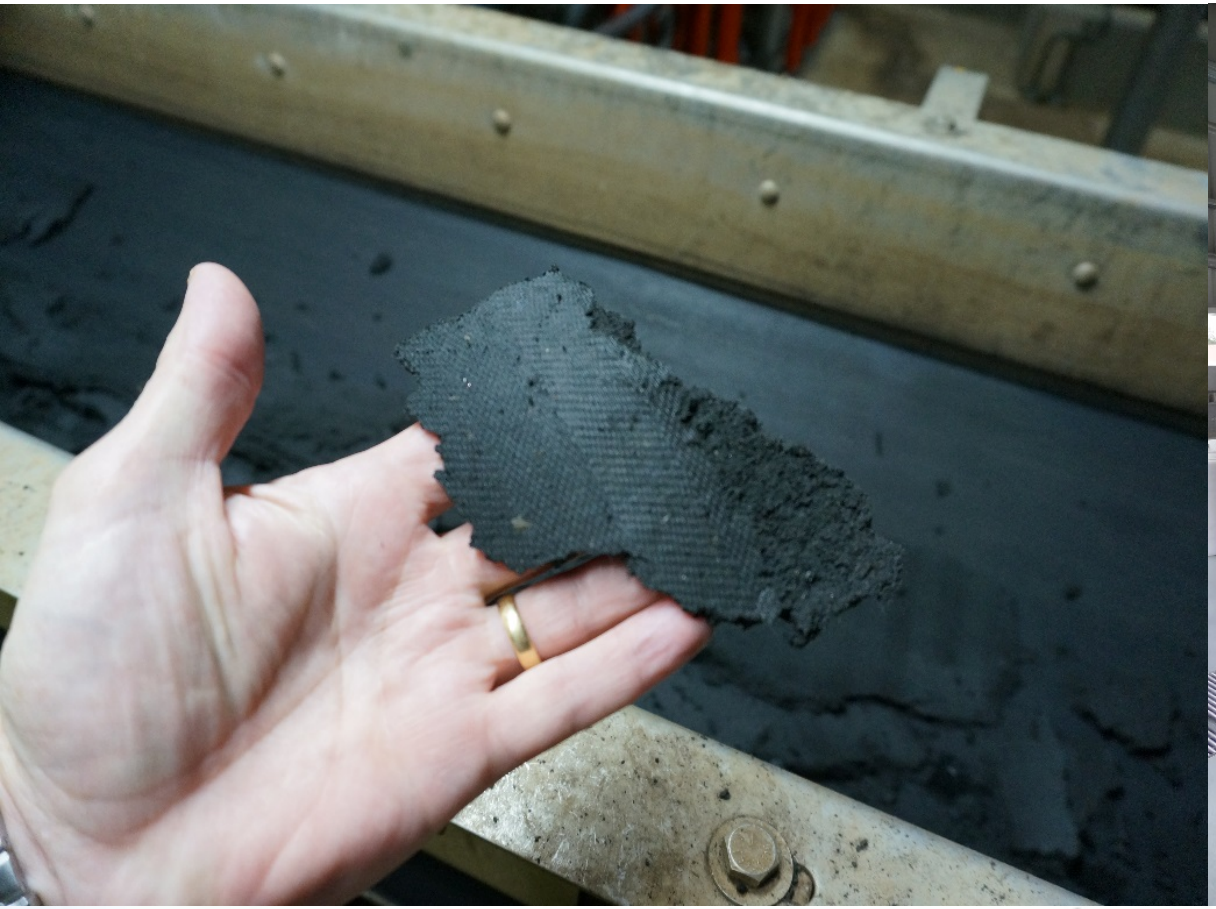
Merced Utility, CA
Solar Dried Class A Biosolids – Annual Crop Planting

Sludge Drying Technologies
Fossil Fuel vs Renewable Fuel Sources

Modifying/Updating Traditional Practices

Anaerobic Digestion (meso+thermo+new mixing systems)

More (Energy) Efficient Dewatering
THP/Digestion, Dewatering, Lower Disposal Costs

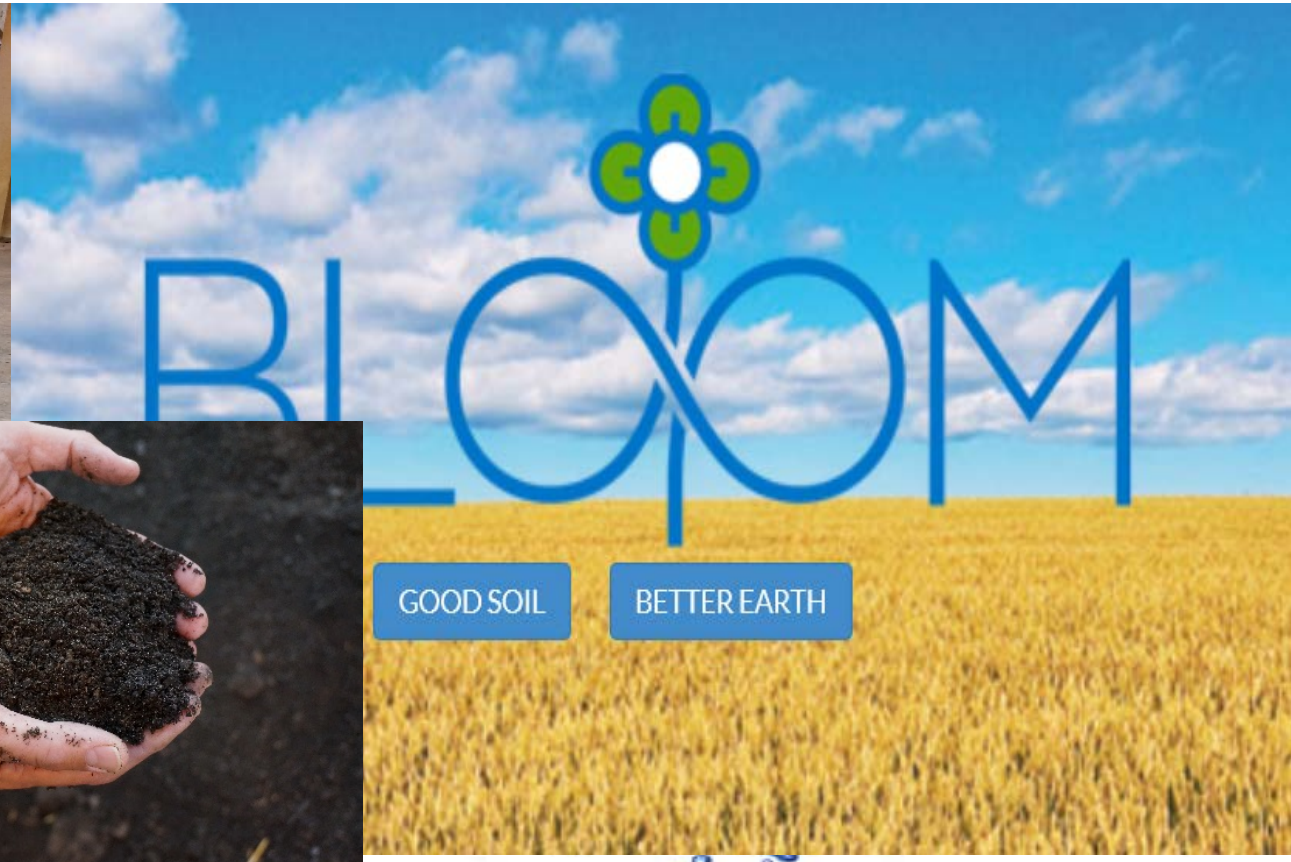


HRSD WRRFs

Ostara Process (turning Struvite nuisance into fertiliser)

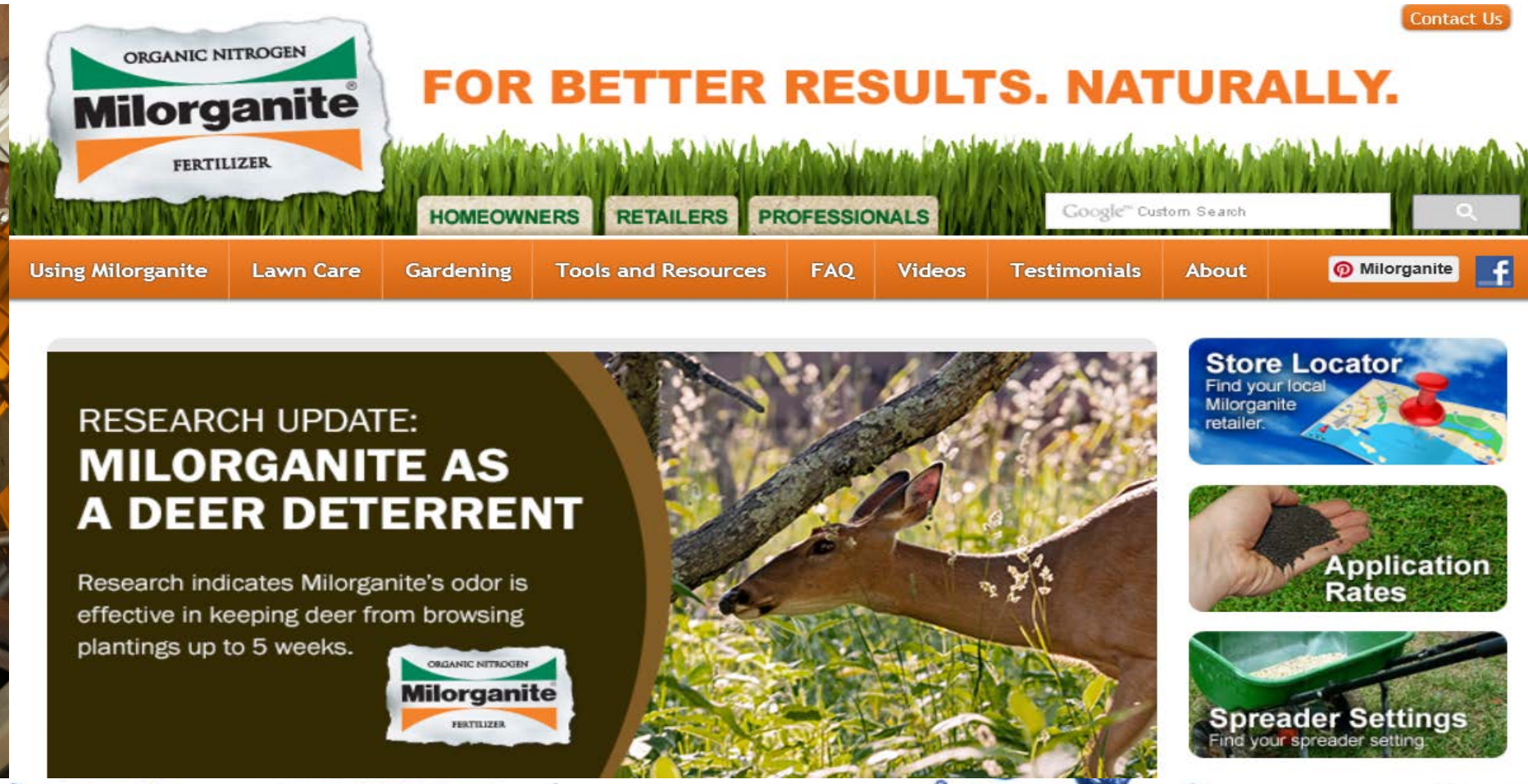
Customer Demand for “Natural Products”

Soil mix additive – “Bloom” – rural farms + urban gardens



Wastewater Resource Recovery

National branding – “Milorganite” – product placement



Comparisons - USA with Australia/NZ

Number of differentiating factors

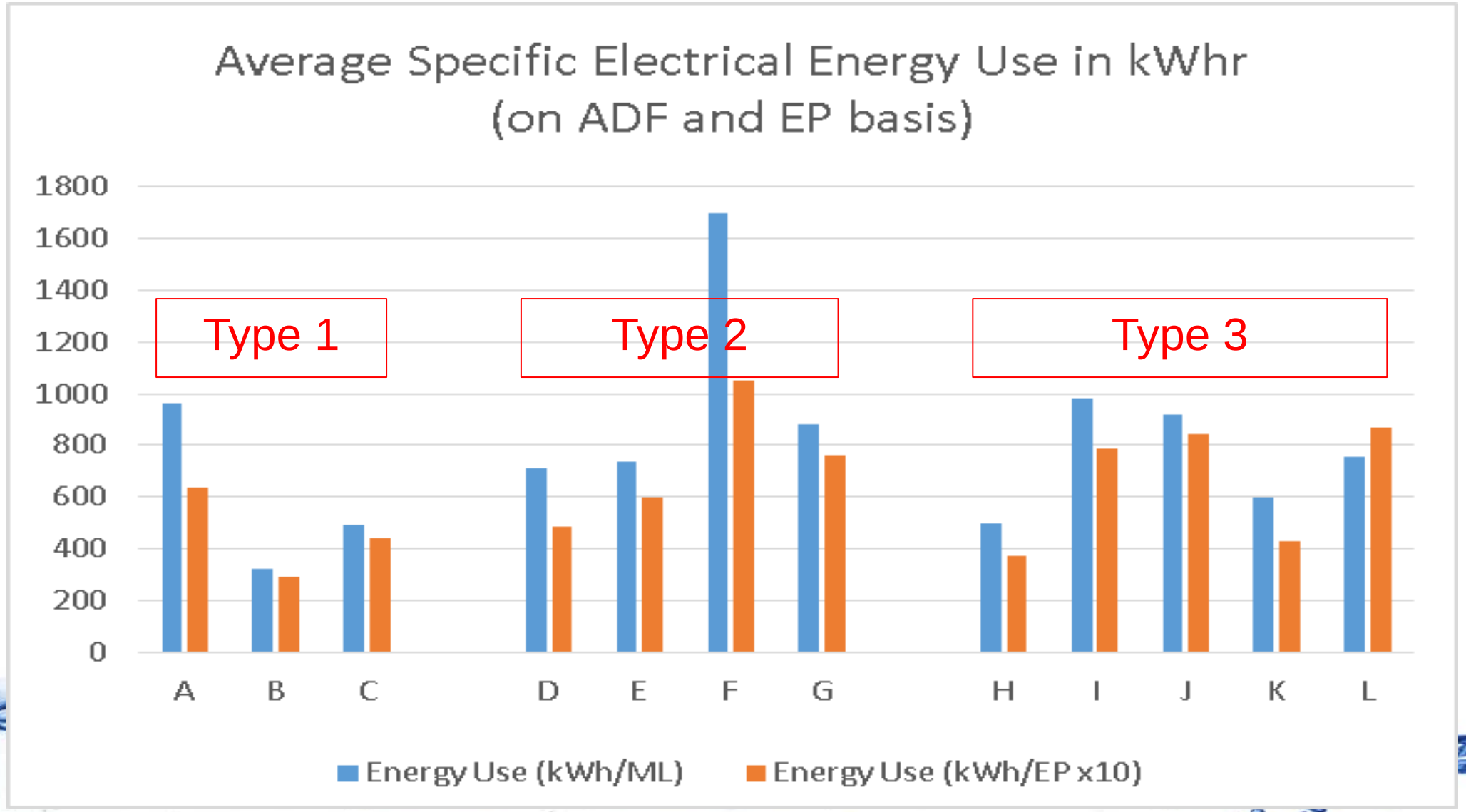
- Higher nutrient standards on effluent
- UV disinfection (vs chlorine)
- Lack of economy of scale
- Lower/less stringent landfill costs and limits
  - Easier to dump biosolids
  - Less reason to divert high strength wastes from landfill to WWTPs
- Immature “green credits” market
- No primary treatment in recent WWTPs – less opportunity for digestion/biogas

WWTP Type and Size Class (SC) Definition

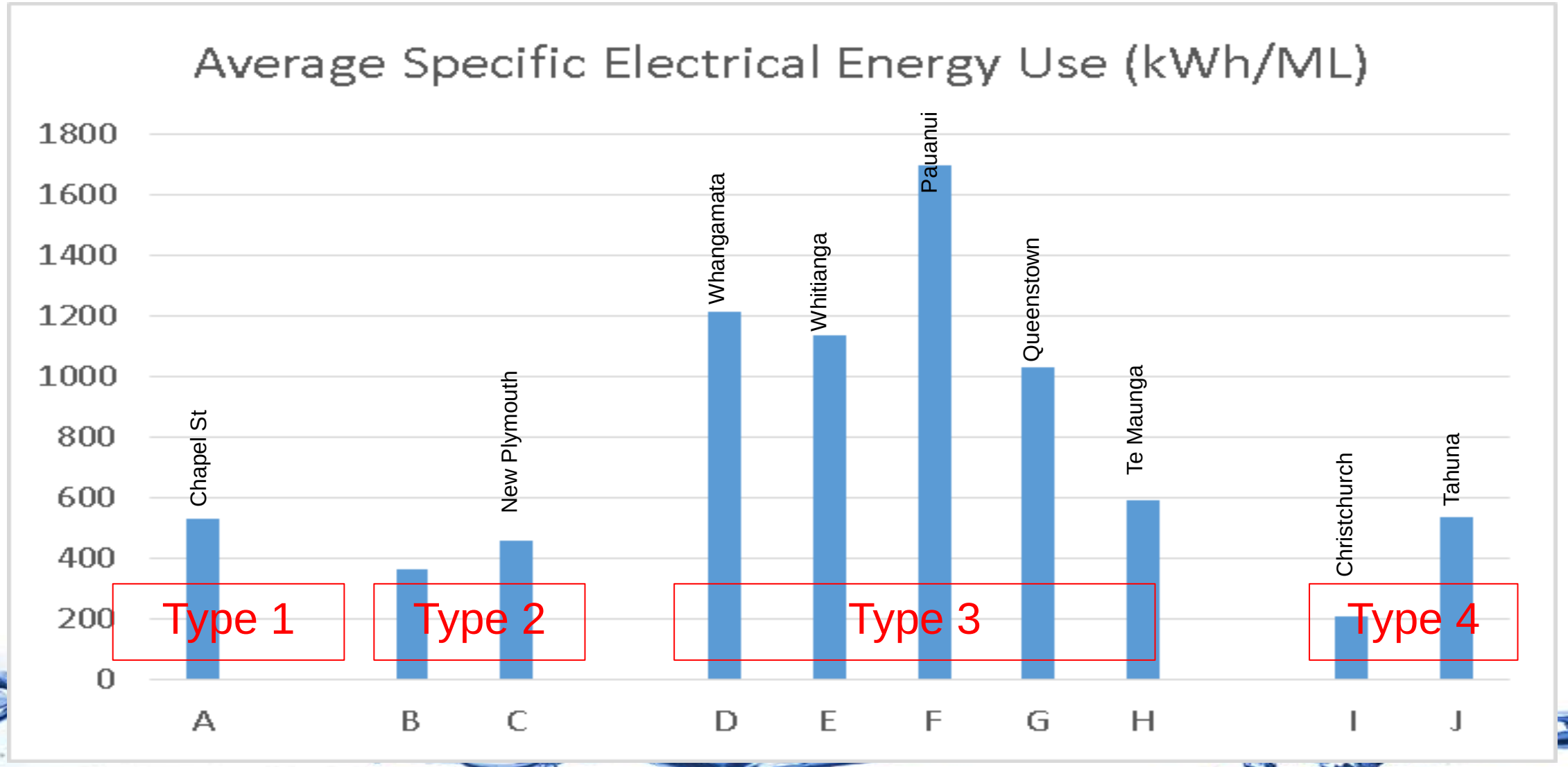
Type	Description
Type 1	Activated sludge treatment with separate sludge stabilisation including those with primary sedimentation, anaerobic digestion (or alternative – refer Note 1) and with onsite co-generation using biogas
Type 2	Activated sludge treatment with separate sludge stabilisation including those with primary sedimentation, anaerobic digestion (or alternative – refer Note 1) BUT without onsite co-generation using biogas
Type 3	Extended aeration activated sludge including aerobic digestion. No biogas production and no onsite cogeneration (refer Note 2)
Type 4	Trickling filters or trickling filter-activated sludge combinations. Plants may include primary sedimentation and anaerobic digestion sometimes with onsite cogeneration using biogas
Type 5	Aerated or unaerated lagoons. No biogas production and no onsite cogeneration
Note 1	Alternative sludge stabilisation includes: incineration, covered anaerobic lagoons, alkaline/lime treatment. Plants with aerobic digestion for sludge stabilisation are classified as Type 3
Note 2	Membrane bioreactor plants are included in Type 3 if no primary treatment is present with separate sludge stabilisation (as in Types 1 and 2)

SC1	SC2	SC3	SC4	SC5
<1000 EP	1001-5000 EP	5001–10000 EP	10001–100,000 EP	>100,000 EP

Australian Large WWTPs (SC5) Energy Benchmarking Results



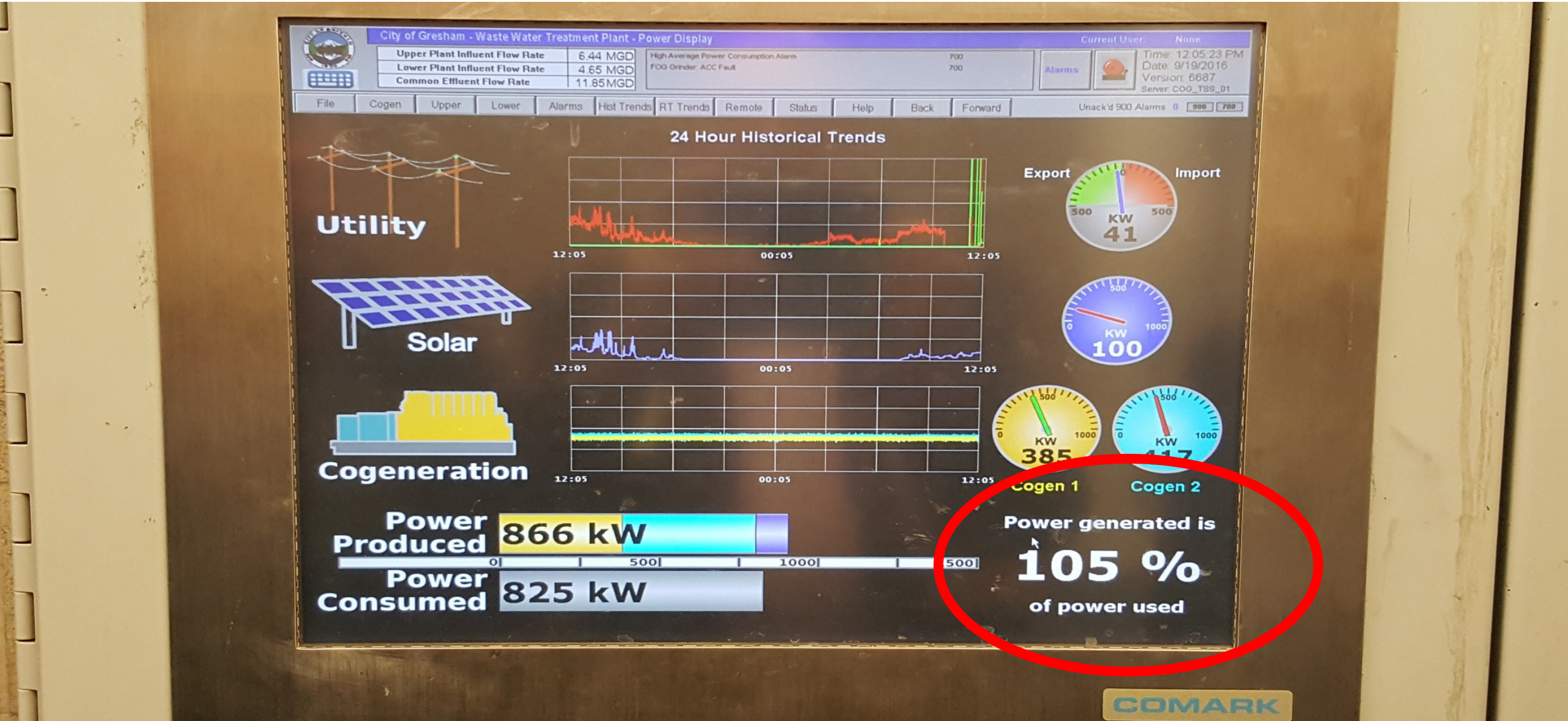
NZ WWTPs
Specific Energy Use (kWh/ML)



Energy Reality for NZ?
Some Observations

- Very site specific – depends on existing processes
- Need primary sludge, anaerobic digestion and biogas co-gen
  - Improve mixing, change process (staged digestion), add THP
  - Import suitable high-strength wastes
  - Offset residual power costs through sale of recovered resources
- Other plants
  - Reduce energy consumption through best practice (more efficient aeration systems - blowers and diffusers, better aeration control)
    - Install PV arrays/storage batteries in free areas or as covers over tanks
    - Pond systems could be a simpler target for “energy neutrality”
  - Look at overall costs across WWTP
- Aim to be **“OPEX neutral”** in the longer term as **“green factory”**

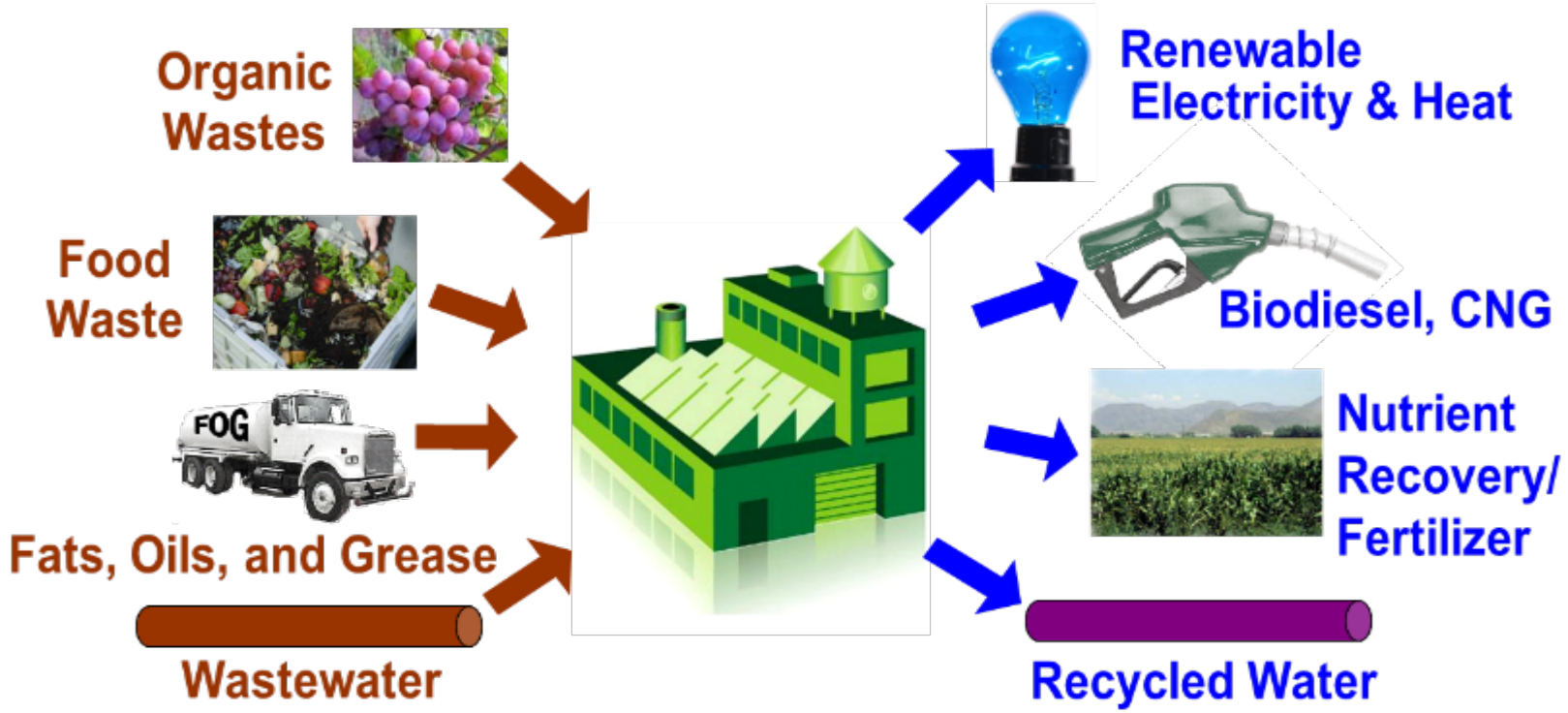
Be inspired by others
and transform our (current) world!



Questions

Utility of the Future

Water Resource Recovery Facility



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