

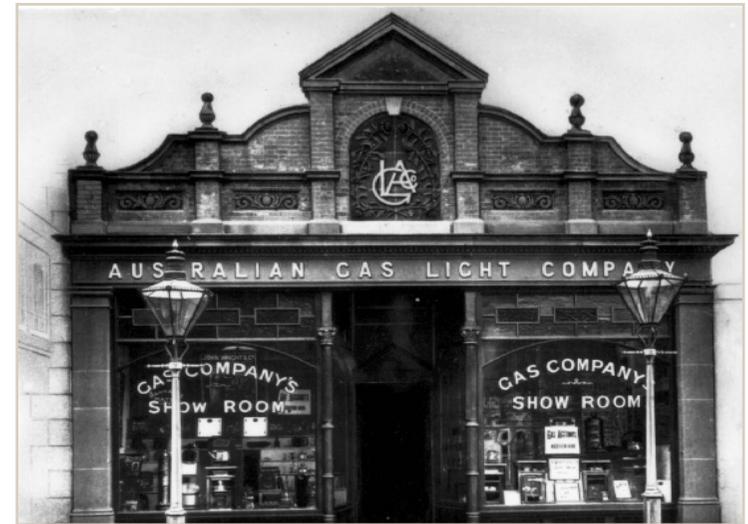
Queensland Health

- Cogeneration & Trigeneration
- Steam & Steam Systems

AGL Energy Services | AGL Confidential

About AGL

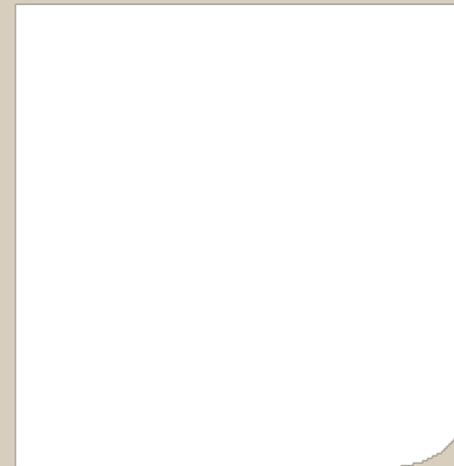
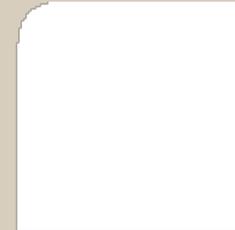
- The Australian Gas light company (AGL) was formed in Sydney in 1837. It supplied the first public lighting of a street lamp in Sydney in 1841 and was the second company to be listed on the then Sydney Stock Exchange;
- AGL is one of Australia's leading integrated renewable energy companies and is Australia's largest private owner, operator and developer of renewable generation assets.



About AGL Cont....

- AGL owns and / or operates more than 3,700MW of generation capacity across base, peaking and intermediate plants. More than 25% of this generation is renewable energy sourced from hydro, wind, landfill, biomass, bagasse and solar sources. The remainder of our portfolio is predominantly gas fired generation;
- AGL is committed to leading Australia in minimising the effects of climate change and investing in sustainable energy business, working on innovative environmentally friendly projects;
- Included in AGL's asset portfolio are 25 embedded customer generation assets, ranging from cogeneration plants, landfill gas electricity generation, biogas and biomass cogeneration and compressed natural gas refuelling depots.

AGL Energy Services Capabilities



AGL Energy Services Teams

Project Development

- > Project Feasibility Study
- > Negotiate Contracts Internally and Externally
- > Project Commitment
- > Detailed Design of Facility

AGL Boilers

- > Manufactures and Installs Steam and Hot Water Boilers
- > Customers include hospitals and other health care facilities such as Brisbane Hospital, large manufacturers and smaller regional customers
- > Dedicated technical and engineering experts

Project Implementation

- > Project Construction Delivery
- > Project Management ('Smartway')
- > Technical Specification
- > OH&S
- > Sub-contracting

Asset Management

- > Ongoing Asset Management
- > Operations and Maintenance
- > Customer support
- > Continuous Improvement

AGL Energy Services Teams continued

Advisory

- > Carbon inventory, Strategy development, Energy & carbon modelling, Regulations & policy, and Innovative energy contacting.

Projects

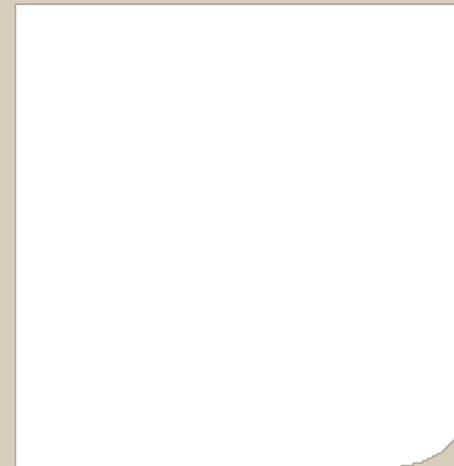
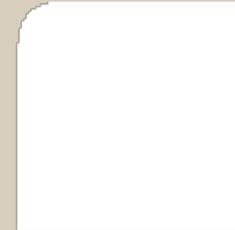
- > Energy efficiency, Lighting, HVAC, Boilers, and Process optimisation.

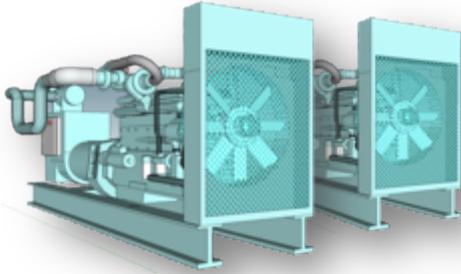
Technical

- > Over 25 years of technical service to customers including Programmed Maintenance and Plant Installation.

AGL Project Development Embedded Generation

- Cogeneration
- Trigeneration



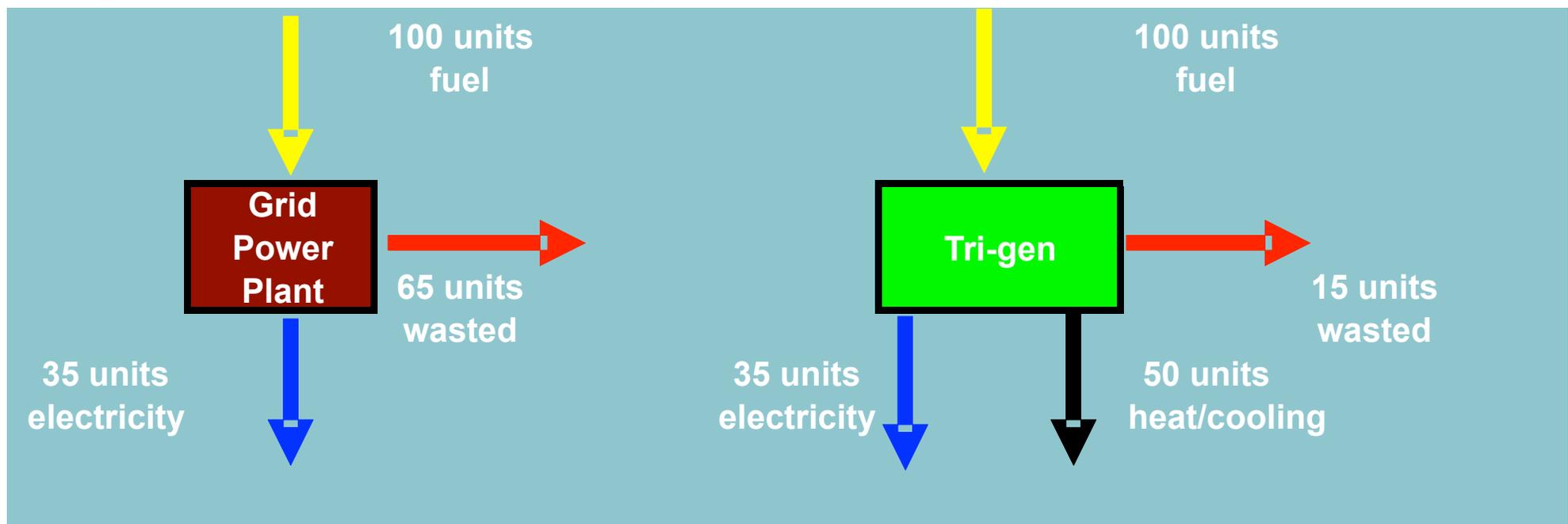


What is Embedded Generation

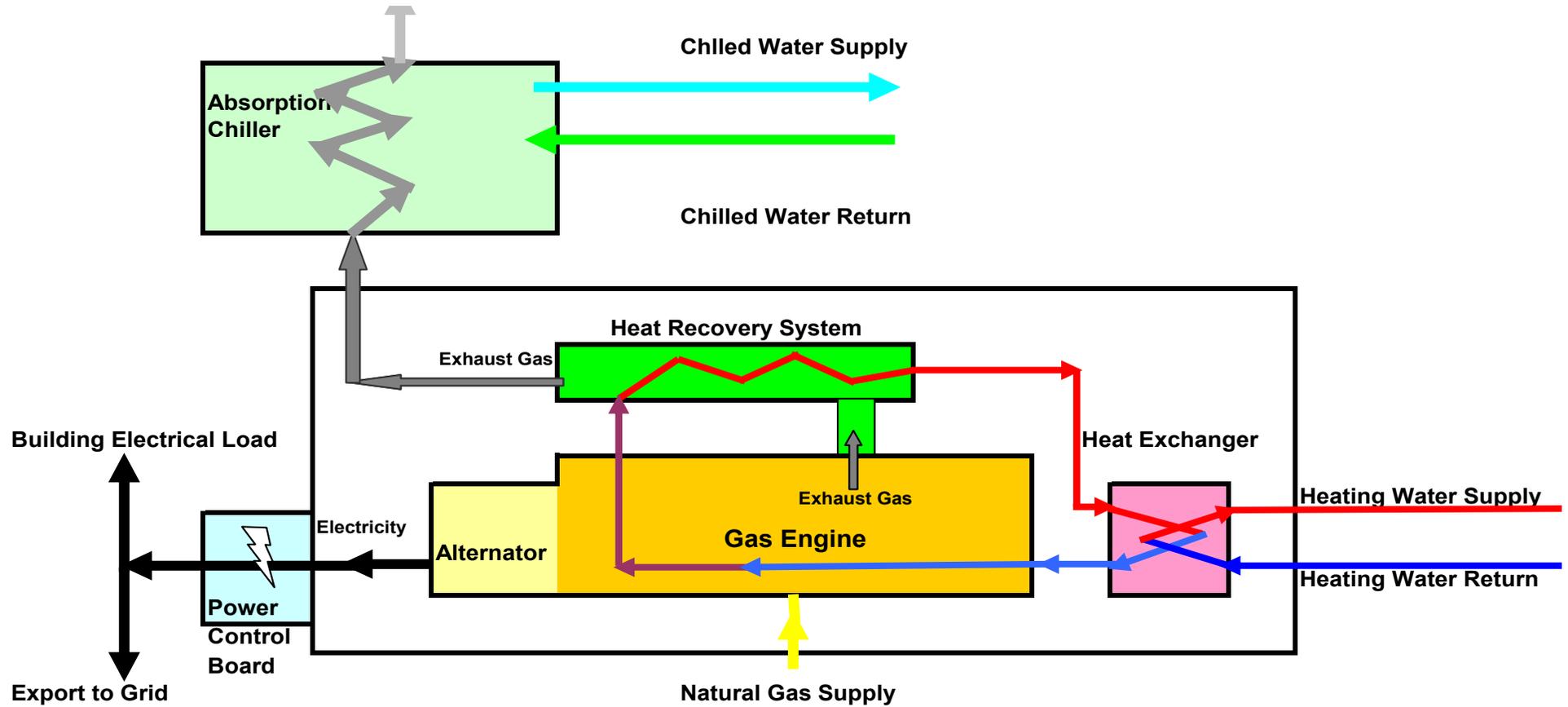
- Embedded Generation is the “on site” production of electrical and thermal energy to suit the customer’s energy requirements.
 - The technology utilised by AGL is well proven, supplementing traditional grid sourced electricity and allowing customers to expand without adding strain onto the electricity distribution network.
- Embedded Generation systems have overall fuel to energy conversion efficiency rates of up to 85%.
 - High efficiency systems help to meet consumer energy costs similar to those offered in the wider market.
 - Typical electrical efficiency 35%, thermal efficiency 50%

Cogeneration/Trigeneration

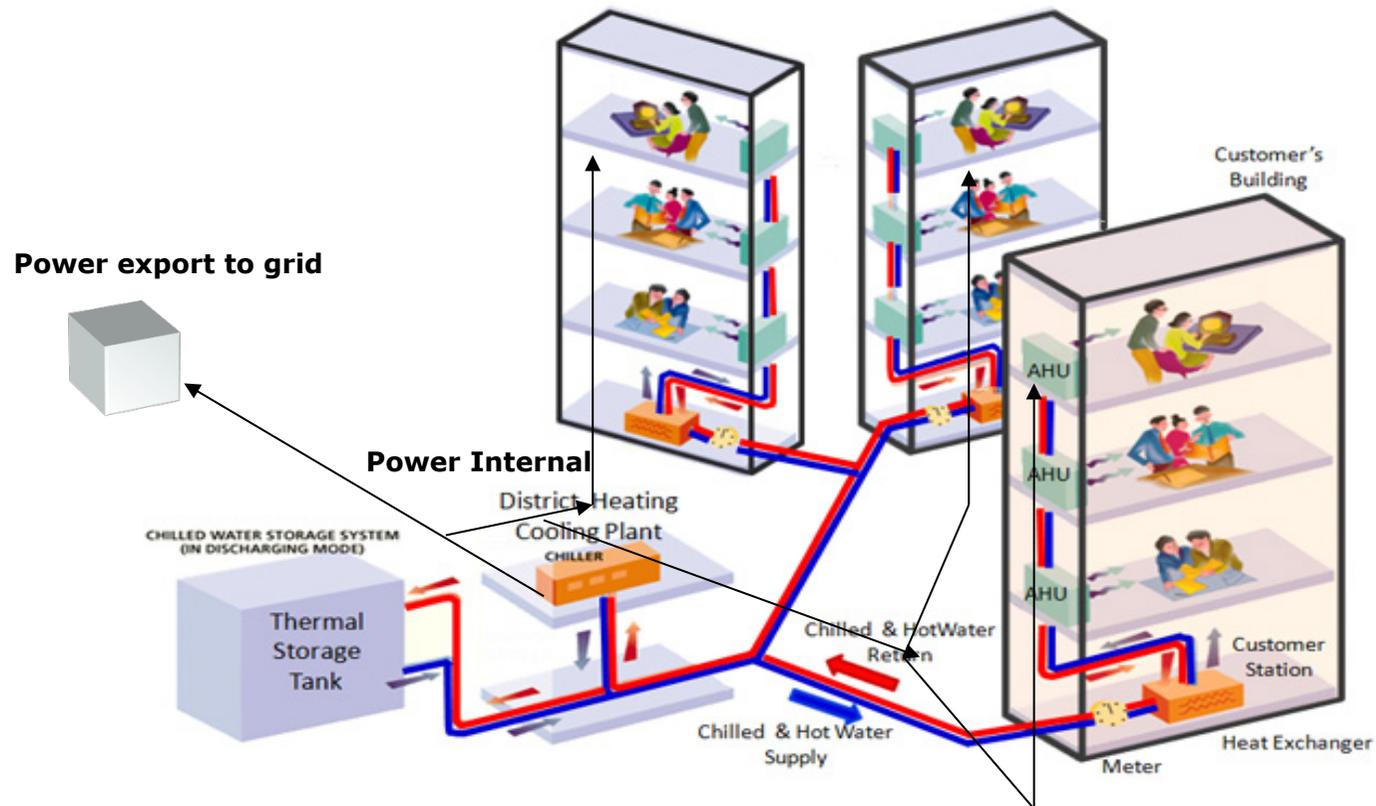
- Cogeneration – The use of waste heat from an embedded generation system for hot water; can also be the partial use of steam from a boiler to run a generator for electricity;
- Trigeneration – The use of waste heat from an embedded generation system (electricity production) for hot or chilled water;



Simple Tri-generation Schematic



Simple Tri-generation Schematic for District Cooling and Heating System



Design Components of Tri-generation

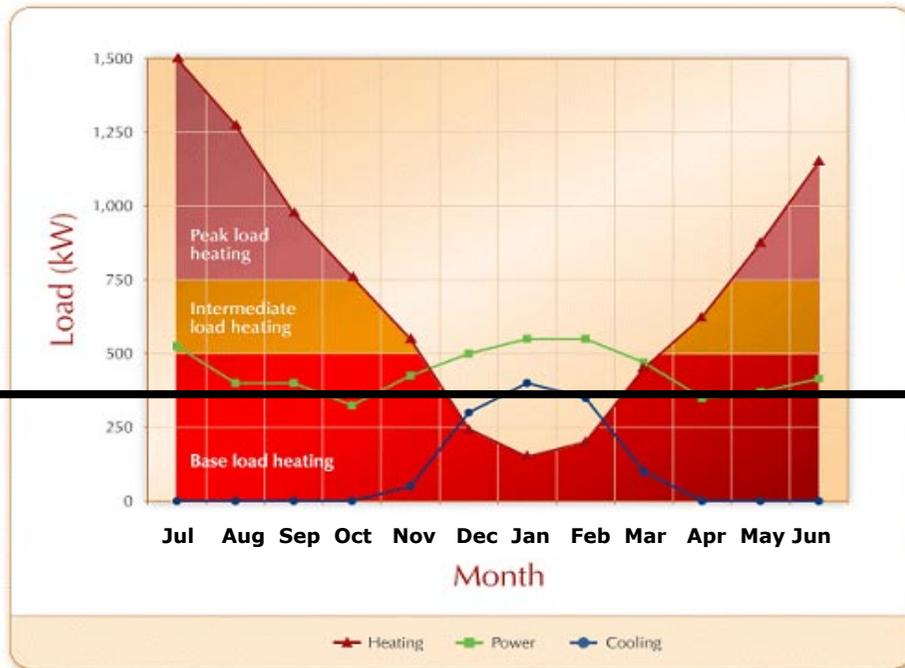
- Gas supply, heating/cooling water and electrical design work.
- Foundations, anti-vibration, soundproofed enclosure.
- Separate switchboard.
- Interfacing and BMS modification with existing conventional heating and cooling systems in other buildings, and grid supply.

Sizing Options

Tri-gen normally is designed to provide:

- For a certain heating/cooling demand and when the electricity is in excess of demand, export to the grid.
- For a certain electrical demand and recovered heat to reduce energy needed for heating or cooling. Excess heat not required locally will be dumped and “wasted”.
- For a certain heating/cooling demand and electricity to partly offset normal conventional heating/cooling and grid supply.

Electrical and Heat/Cooling Load Sizing



To maximise the energy efficiency performance of Tri-generation, all the power and heat generated should be used for the base power and heating/cooling loads. This will allow the Tri-generation plant to run 24/7 and exclude the cost of having excess power to be exported or excess heat to be dumped

Issues on exporting excess electricity

- The ease or difficulty of the network connection will depend on the location and the capacity of the local network.
- If the network is near capacity (constrained) it may not be able to safely accommodate the exported power without transformer upgrades and fault level equipment upgrades.
- The energy purchase agreement may be unattractive.

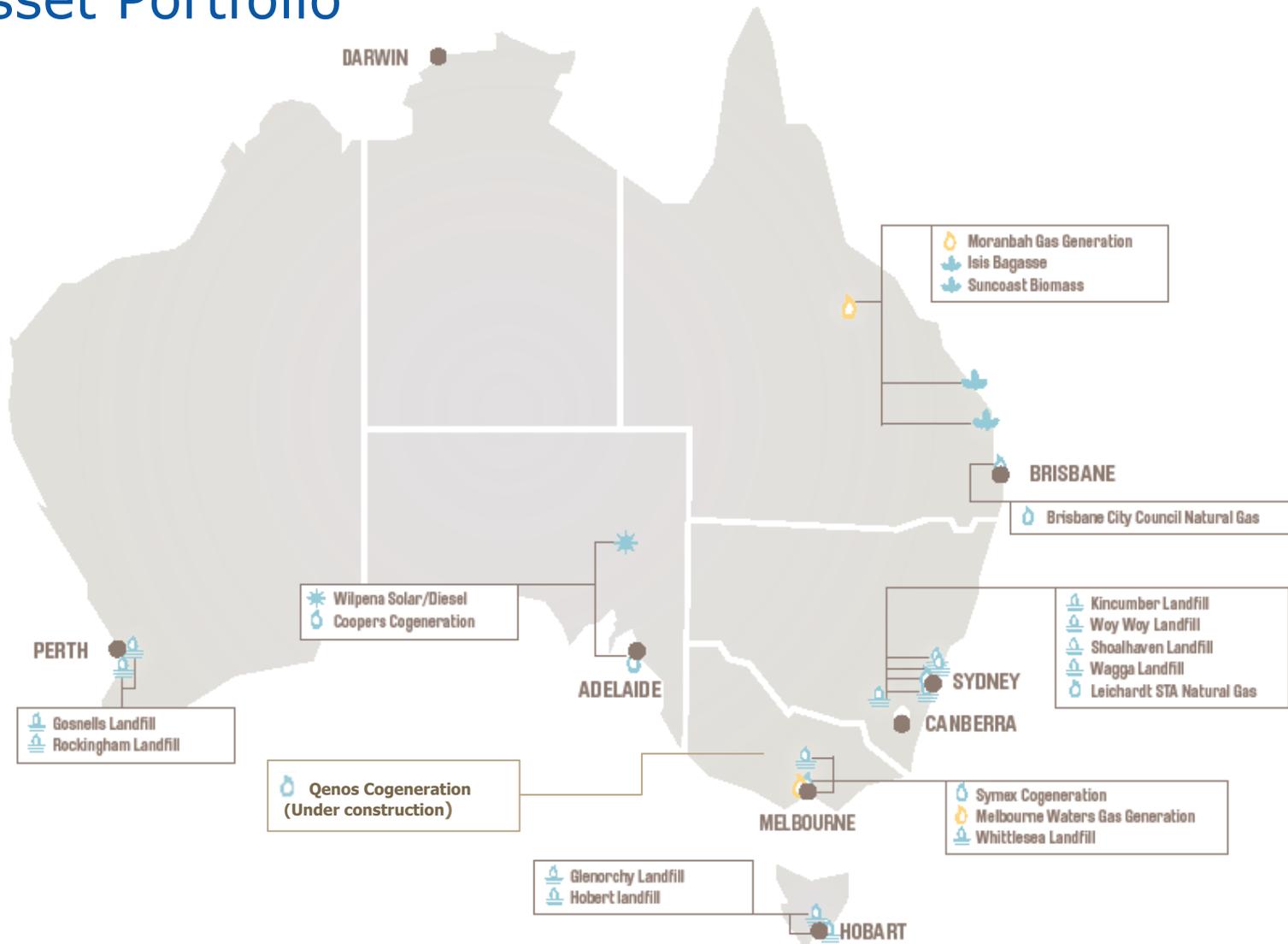
What are the Benefits of Embedded Generation?

- Cost benefit by avoiding electricity distribution (network) charges and thus potentially cheaper electricity & steam/hot water and or cooling;
- Improved security of supply in the event of blackouts by supplying part or all of a site's electricity requirements (modular approach also aides in this security of supply);
- Flattens electricity and natural gas demand profiles which can reduce your peak demand charges from network providers (by providing a proportion of total demand);
- Allows Queensland Health to focus on core business;
- Defer or negate capital works programme and the ability to secure the latest and greatest in technology;
- Offsets ongoing Opex costs to existing plant;
- Risk transfer on total plant deliverables to agreed outputs;
- The ability to secure a view of long term energy pricing, in such a volatile market; and
- Reduced exposure to carbon pricing and lower emissions purely due to the fact that natural gas has half the CO₂ emission intensity than grid sourced electricity.

Partnering with AGL for Embedded Generation

- Energy Performance Contract – Qld Health put up the capital, AGL design & install, Qld Health operate and maintain, AGL guarantee outcomes; or
- Minimal Capital - AGL can Build, Own, and Operate (BOO) the majority of the facility working closely with Queensland Health to ensure the correct safety, environmental and financial outcomes are achieved, AGL to manage the construction risk;
- Long Term Price - AGL regularly manages long term energy price risk through its wholesale trading portfolio in both gas and electricity markets and will offer fixed term supply arrangements to the project to assist Qld Health in managing their long term energy position;
- Reduce Carbon Footprint - Plant design will ensure that Qld Health's carbon footprint is reduced;
- Proven Experience - AGL has numerous embedded generation projects spread around Australia. Our experience delivering these plants over many years allows us to efficiently manage project risk;
- Proven expertise – AGL employees are professional, capable and knowledgeable throughout the modelling, design, implementation and operation stages of each project;
- Commitment - AGL will work with Qld Health to grow their asset-based generation portfolio (modular design) and manage it over the long term.

AGL Asset Portfolio



AGL Partners



Coopers Brewery Trigeneneration (SA)

4.4MW Solar Centaur Gas Turbine
25,000 MWh/A Electricity Generated
100,000t/A Steam Produced with partial diversion to an absorption chiller for Chilled Water



Symex Holdings Ltd Embedded Generation (VIC)

4.4MW Solar Centaur Gas Turbine
35,000 MWh/A Electricity Generated
90,000t/A Steam Produced

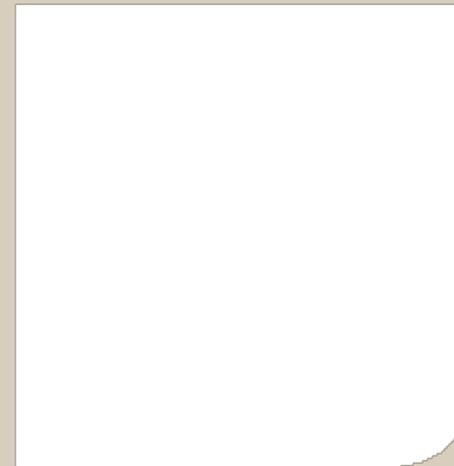
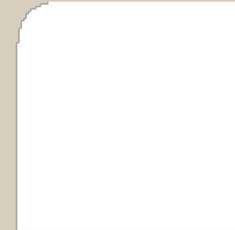


Qenos (Vic) – Under Construction

1 x 21MW Gas Engine Turbine
1 x 88tonne Heat Recovery Steam Generator (HRSG)
Electricity and Steam sold onsite

AGL Project Development Embedded Generation

- Model and Staging



AGL's Embedded Generation BOO Project Model

- AGL seeks to contract with over a 15-year Build, Own & Operate (BOO) Energy Services Agreement (ESA);
- AGL secures (internally) a long term gas price for the term of the project to give a fixed long term view of their energy expenditure. The preferred model is to fix a price year one and index that price annually to CPI;
- Energy tariffs are structured to Queensland Health so that they are competitive with “business as usual tariffs”
- AGL invests the required capital - No capital required from Queensland Health;
- AGL performs feasibility study, design, construction and manages plant installation;
- AGL is responsible for operations and maintenance of the embedded generation facility and balance of plant.

AGL's Embedded Generation Staging

Gate One: 4 weeks (or EOI)

- Upon agreement with a client, AGL's Energy Services Project Development team will conduct an Embedded Generation Desk Top Study (project analysis) of the proposed generation facility.

Gate Two – 3 months (or RFQ)

- Client's commitment to proceed to a feasibility study under an MOU & Feasibility Agreement and an exclusive business partnership for the development of an embedded generation facility at the site is agreed.

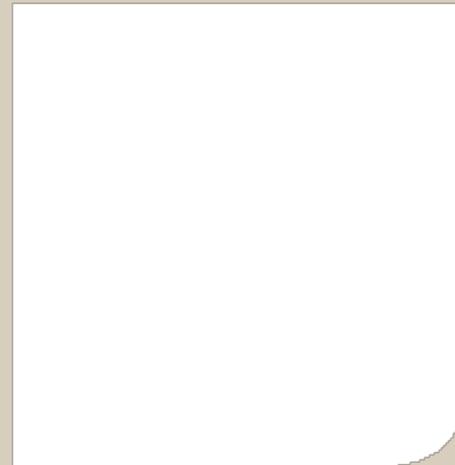
Gate 3: 6 months (or DFS)

- Client's commitment to proceed to a detailed design under an MOU and a Detailed Design Agreement; creating an exclusive business partnership for the development of an embedded generation facility at the site.

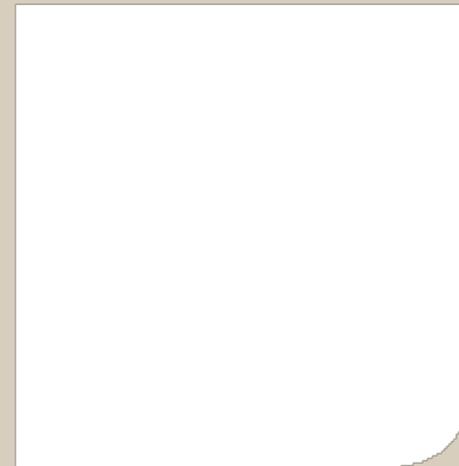
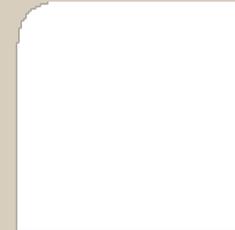
Implementation and Commissioning: 12-15 months

- AGL purchases all plant then installs and commissions; Note - subject to size, generation plant may take up to 12 months to supply.

Discussion...

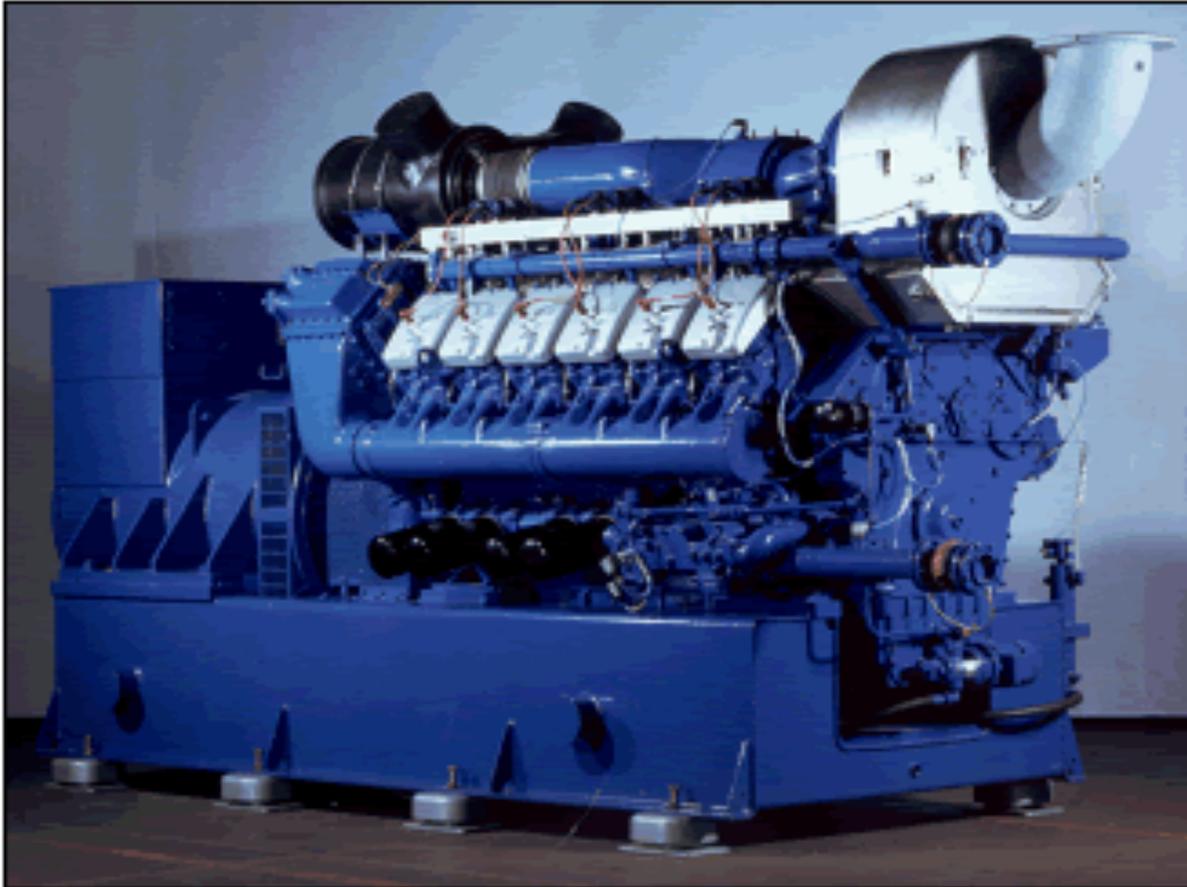


AGL Boilers



Typical Gas Reciprocating Engine Prime Mover with Power Alternator

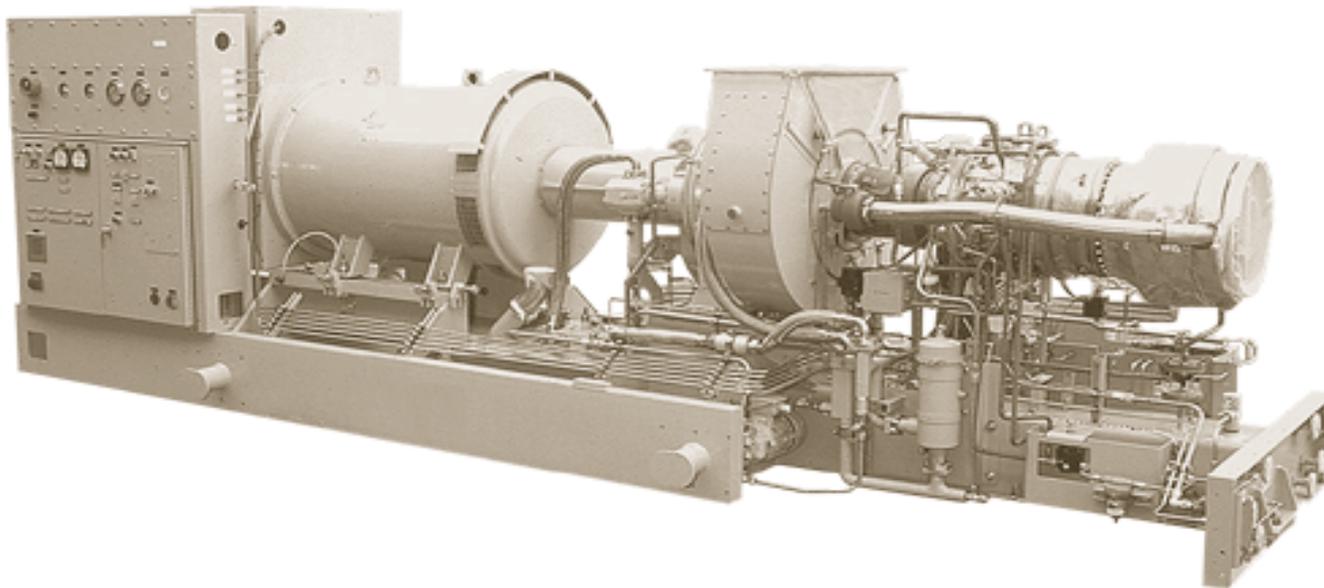
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180kW to 4000kW

Gas reciprocating engine, connected to an electrical generator, with the engine operating at a rotational speed of 1500 or 3000 rpm.

Typical Gas Turbine Engine Prime Mover Genset



1,200 kW gas turbine engine
genset



100kW Micro-turbine engine
genset

Operates at very high speeds (such as 60,000- 90,000 rpm).

Typical Absorption Chiller



- Functions: Cooling/heating/hot water
- Cooling Capacity: 200 ~11,630kW