



*The lowest cost, zero emission power solution.*



***VOLT's ATEN (Accretive Thermal Efficiency Node) Technology or System is a waste heat recovery, zero emission electricity generation technology. An installed ATEN system recovers open cycle gas turbine and reciprocating engine driven power station exhaust heat or industrial waste heat to generate zero emission, baseload electricity.***

ATEN generated electricity can significantly reduce 'energy intensive' industry scope 1 emissions and operating costs via the displacement of grid sourced electricity or fossil fuel usage associated with electricity generation. ATEN's simple, high efficiency design and modular sub-system configuration provides a low capex, uniquely efficient and scalable solution to exploit 'low and high grade' industrial waste heat otherwise vented to atmosphere.

VOLT's priority target markets for the ATEN System include power generation, oil & gas and industrial processing sectors.

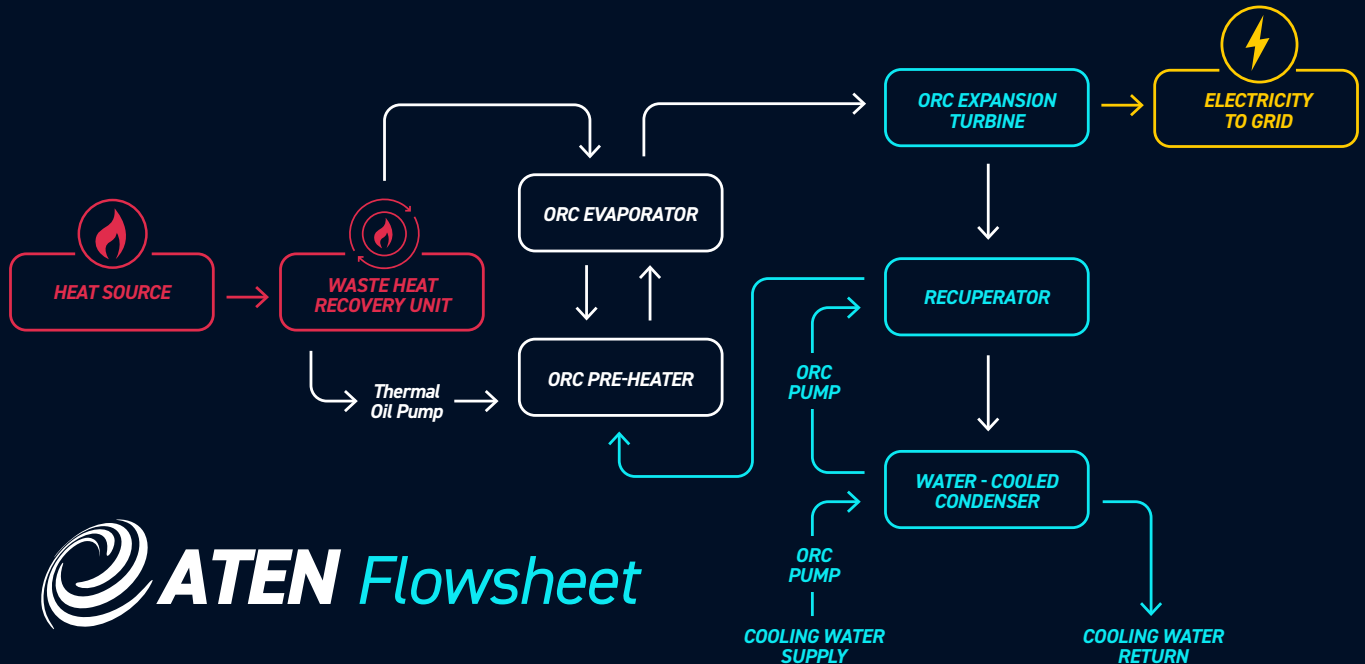
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# THE ATEN SYSTEM

The ATEN System design integrates two primary sub-systems comprising:

- A waste heat recovery and thermal oil sub-system (Waste Heat Recovery Package); and
- An organic rankine cycle and power generation sub-system including modular air-cooled or water-cooled condenser (ORC Package)



## ATEN Flowsheet

### Waste Heat Recovery Package

The primary function of the Waste Heat Recovery Package is to maximise the recovery of exhaust or industrial heat otherwise vented to atmosphere and to transport this heat to the ORC Package.

### ORC Package

The ORC Package is a closed loop thermodynamic process that initiates temperature, pressure and phase change to an organic working fluid converting thermal energy into mechanical work. The mechanical work (in the form of rotary motion) drives a

generator to produce zero-emission, baseload electricity.

The ATEN System delivers the reduced-cost benefits of standardised and simple design, proven technology, accelerated construction execution timeline, autonomous operation and zero water requirements, whilst maintaining broad compatibility with many industrial waste heat resource circumstances.

The ATEN System's commercial competitive advantage over alternative waste heat to power recovery solutions lies in its broad compatibility, high efficiency, autonomous operation, low CAPEX & OPEX and certified Australian Innovation Patent.

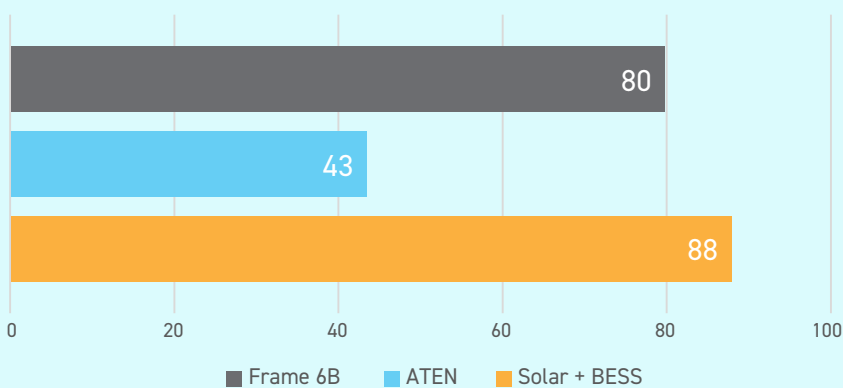


# THE ATEN ADVANTAGE

*ATEN has the key advantages and capability of generating baseload, zero emission power for a ~60% lower CAPEX and ~50% lower lifecycle cost compared to Solar & Wind intermittent generation.*

## THE ATEN COST CONTEXT

Levelised Cost of Energy (LCOE\*) technology comparison (equiv. annual electricity generation)



**OCGT Marginal Cost Generation – Frame 6B** (gas cost @ A\$6/GJ and OPEX/Maint. @A\$10/MWh)

**ATEN – Waste Heat to Zero Emission Power** based on an Frame 6B OCGT waste heat resource and prelim. feasibility study (including OEM verified OPEX and CAPEX +30% Remote Site CAPEX uplift and 95% duty performance)

**Solar + BESS Hybrid – Renewable Energy** (including 1hr BESS @ Solar Capacity installed. Costs from IRENA 2021 (including CAPEX +30% Remote Site uplift, BESS @ A\$700,000/MWh and OPEX @ A\$10/MWh)

\*LCOE based on ARENA calculation methodology using 8% discount rate, A\$35/REC, A\$30/ACCU where relevant

### **The ATEN Technology key capabilities and performance characteristics also include:**

- **Baseload, Zero Emission Power** – incremental zero emission baseload power compatible with Solar / Wind hybrid systems
- **Proven Technology** – Proven OEM sub-systems
- **Grid Stability** – Delivering capacity and higher zero emission penetration stability
- **Creates ACCUs** – Carbon Credits (CFI) Act 2011 Offset Project / ACCU eligibility (non-Grid)
- **Zero Water** – Reduced environmental approval requirements and OPEX
- **Autonomous Operation** – No operational personnel required and reduced OPEX
- **Compact / Small Footprint** – Retro-fit to existing assets on a brownfields site footprint

*High efficiency gas fuelled dispatchable generation is required to deliver ‘mission critical’ power reliability at remote, large load bespoke resource and industrial operations and minimise scope 1 emissions. ATEN can enhance gas fuelled generation efficiency by up to ~25% complementing any solar and wind hybrid installations to deliver significant cost savings and maximise overall system zero emission power penetration.*

# THE ATEN OPPORTUNITY

**“Energy efficiency and renewables can account for 80% of cumulative CO<sub>2</sub> emission reduction to achieve Paris Agreement Targets” – International Energy Agency, 2019**

80%+ of global energy production is generated by carbon-based fossil fuel combustion.

Consequently, global industry vents huge quantities of 'low' and 'high' grade waste heat to atmosphere, presenting an outstanding opportunity for the commercial roll-out of the ATEN waste heat to power system.

Global government policy to displace fossil fuel energy use with zero emission electricity generation, energy efficiency and hydrogen production technologies, continues to reduce global fossil fuel energy use.

However, the absolute growth in global fossil fuel demand – the result of population growth, economic modernisation and human pursuit of improved living standards – has outpaced the displacement of fossil fuel energy by renewable technologies.

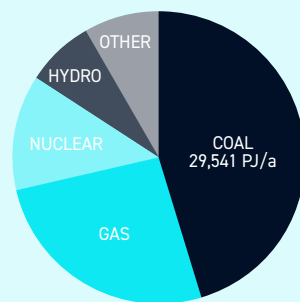
At present, renewable energy and battery technologies are unable to deliver the scale, frequency management, electrical inertia, total project affordability and baseload reliability that modern large-scale industry needs to function sustainably and prosperously.

Whilst populist opinion demands immediate cessation of fossil fuel use, for the foreseeable future, existing high efficiency, low emission natural gas fossil fuel energy supply technologies are required to deliver the 'mission critical' reliability to support the renewables transition and the extensive energy supply requirements of the global industrial complex.

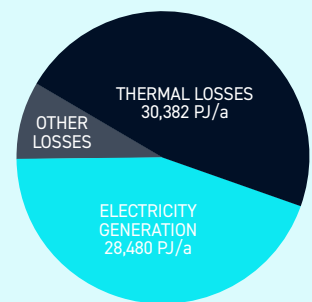
Energy efficiency technologies like ATEN minimise the Scope 1 emissions produced by reliable, low-cost natural gas energy solutions.

**APPROXIMATELY 48%  
OF GLOBAL ELECTRICITY  
GENERATION ENERGY  
IS LOST AS HEAT**

Source: International Energy Agency Electricity Information Statistics, worldwide, not including combined heat and power plant



**ENERGY INPUT**



**ENERGY OUTPUT**

# THE ATEN APPLICATIONS

**Numerous industrial scale operations worldwide generate a significant waste heat resource, currently vented to the atmosphere, including:**

- Pipeline compressor stations
- Onshore LNG and domestic gas supply facilities
- Extractive industry & urban grid power generation
- Industrial aluminium & steel smelters
- Silicon smelters critical to solar panel manufacture
- Downstream lithium processing and existing chemical industry facilities

VOLT maintains a focused ATEN commercialisation strategy delivering Scope 1 emission reduction solutions that deliver to these Primary Targets

## THE SCOPE 1 REDUCTION CIRCUMSTANCE

These existing Primary Target industries vent a significant and under exploited waste heat resource into our planetary atmosphere.

Each of these Primary Targets can significantly reduce Scope 1 emissions by using the ATEN System generating incremental zero emission electricity to displace electricity generated from fossil fuel technologies.

For more information visit  
[voltpower.com.au/aten](http://voltpower.com.au/aten)

