aeristech

driving clean technology

Aeristech's Motors and Generators for Turbomachine Applications and the FullElectric Turbocharger

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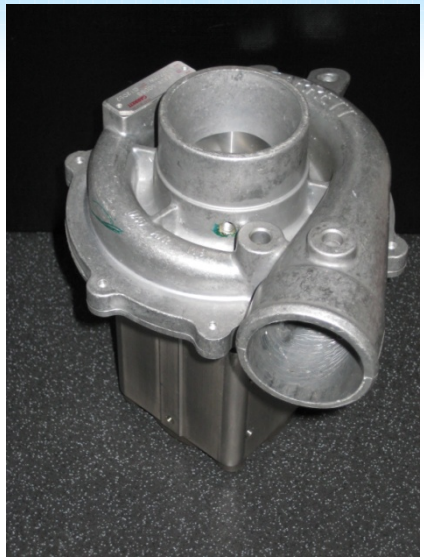
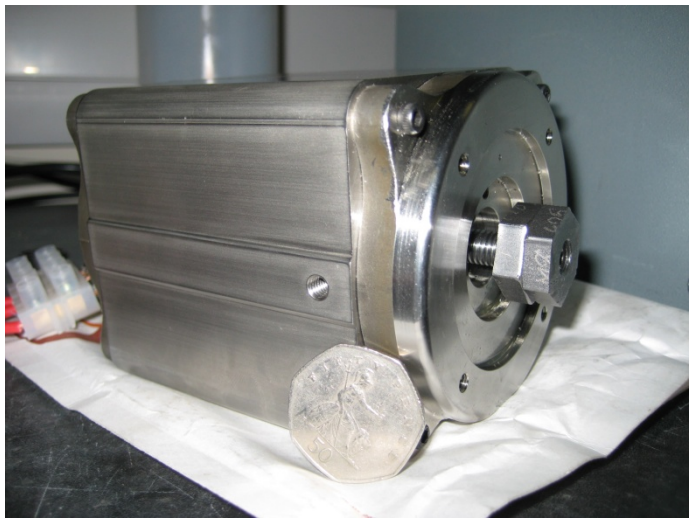
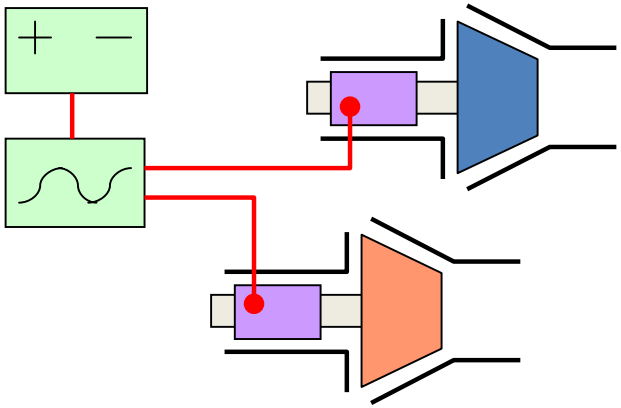
driving clean technology

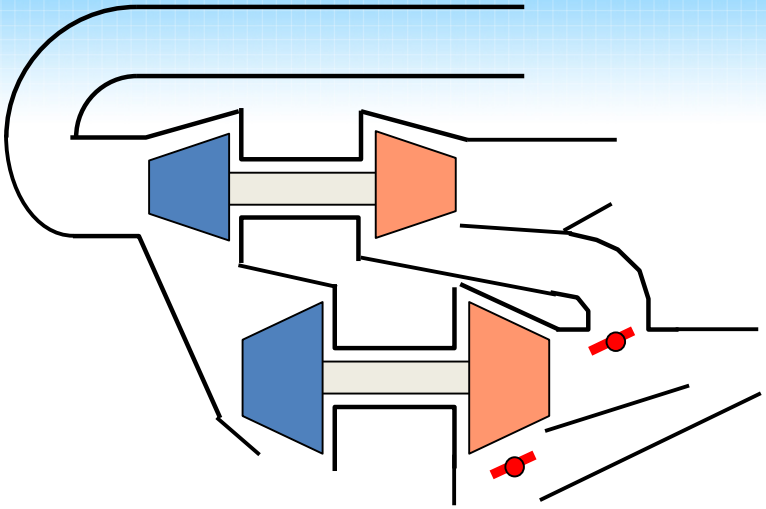
- High-Performance Electric Machines
  - Fastest Accelerating
  - Power Dense
  - millisecond control
  - Using standard materials



- Example 26kW motor:
  - 120,000 rpm
  - 0.45 secs to full power







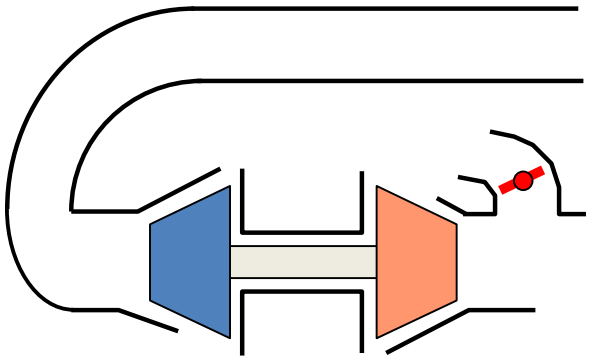
Multi-Stage Turbocharger

fullElectric™

Less pipe-work than a standard turbo

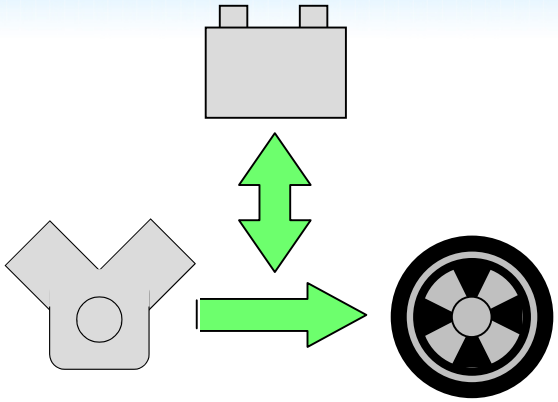
Better control than multi-stage

Price point between the two

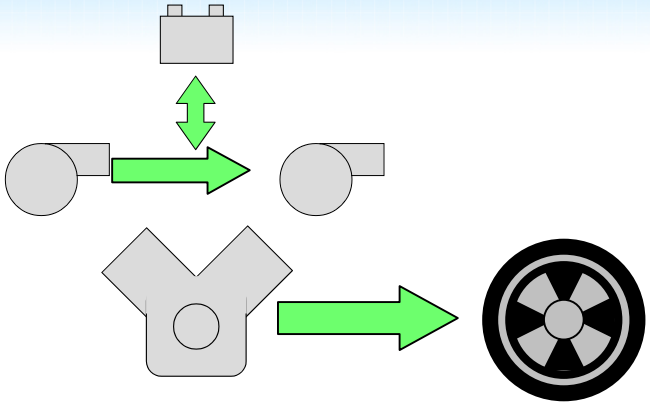


Standard Turbocharger

Hybridisation & Downsizing



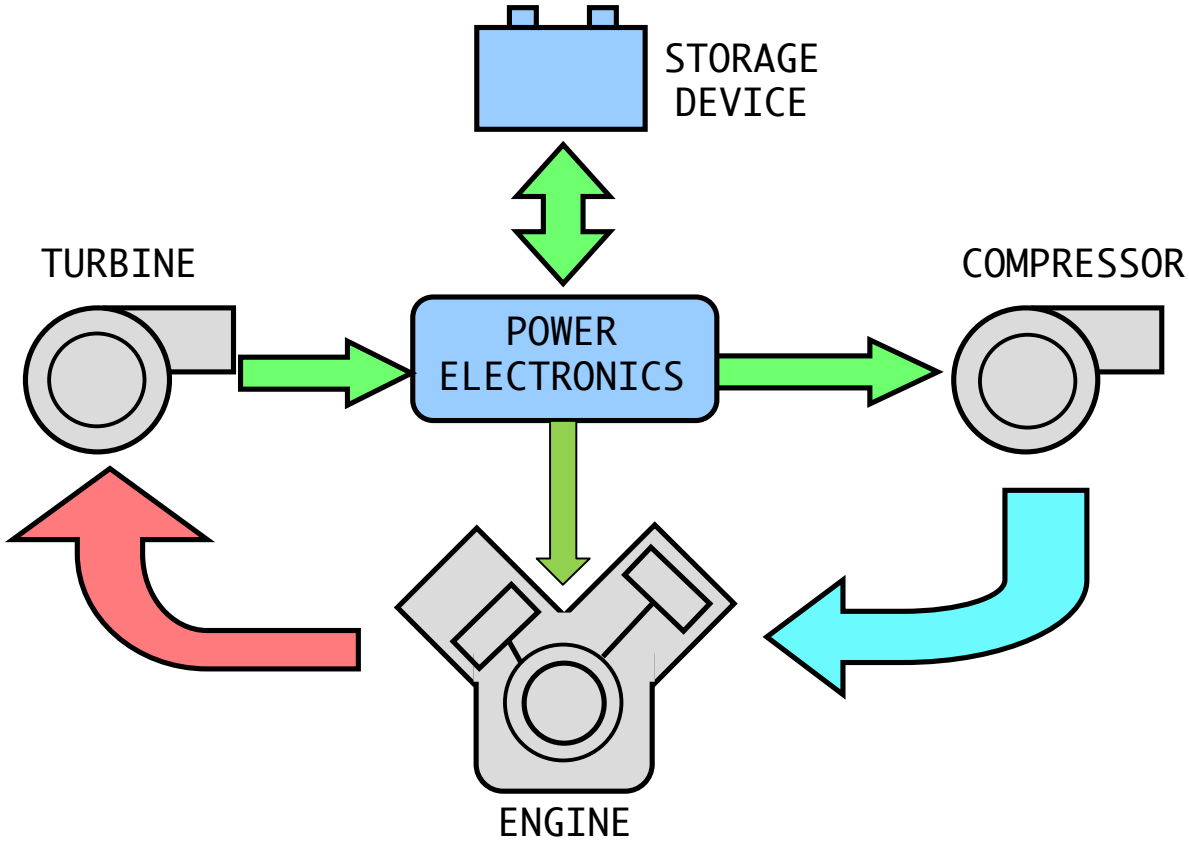
Hybrid vehicle



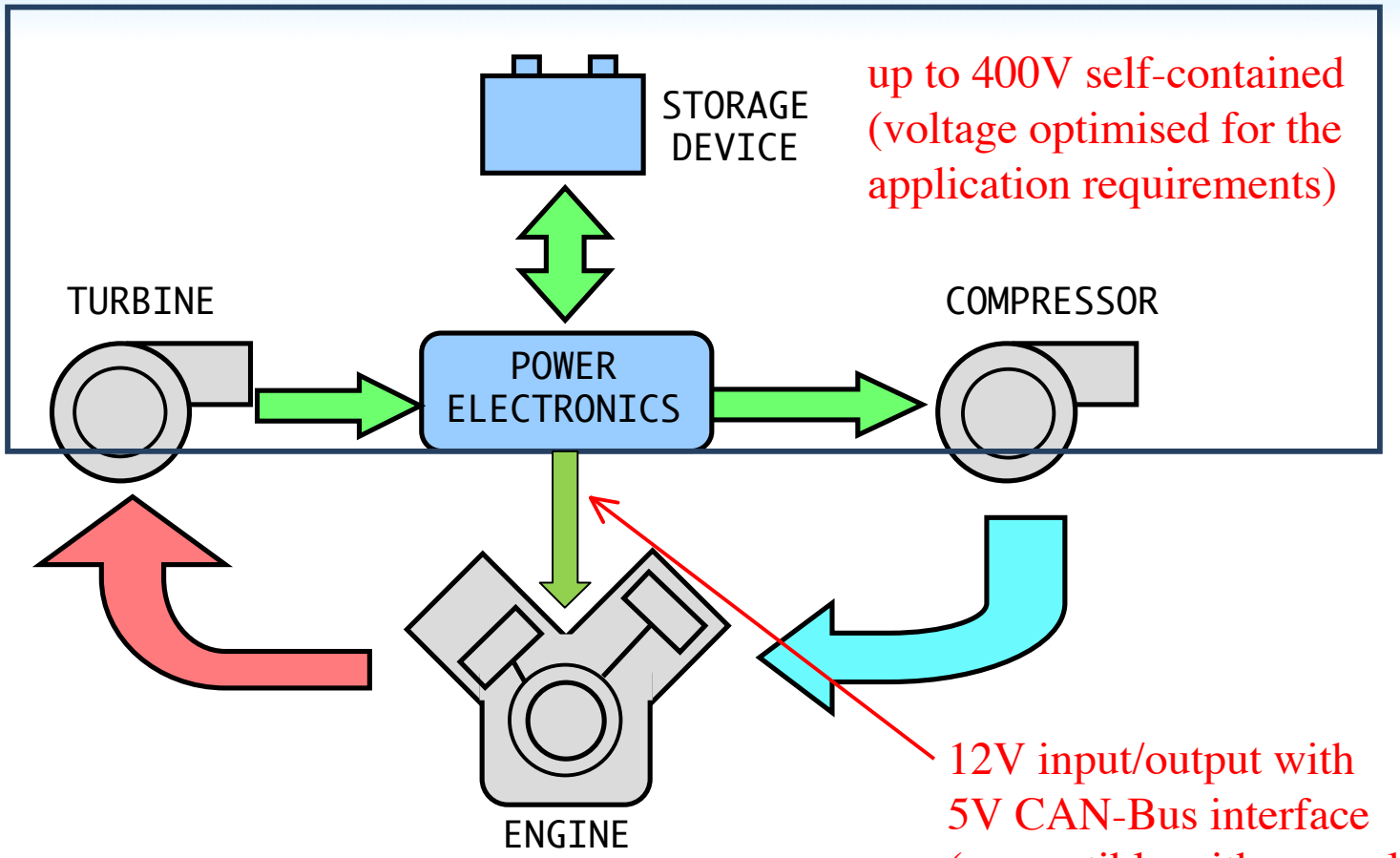
Hybrid Turbocharger

- Like-for-like, the fullElectric turbocharger gives more downsizing with a smaller storage reservoir compared to a hybrid powertrain on a standard driving cycle.

System Operation



System Operation

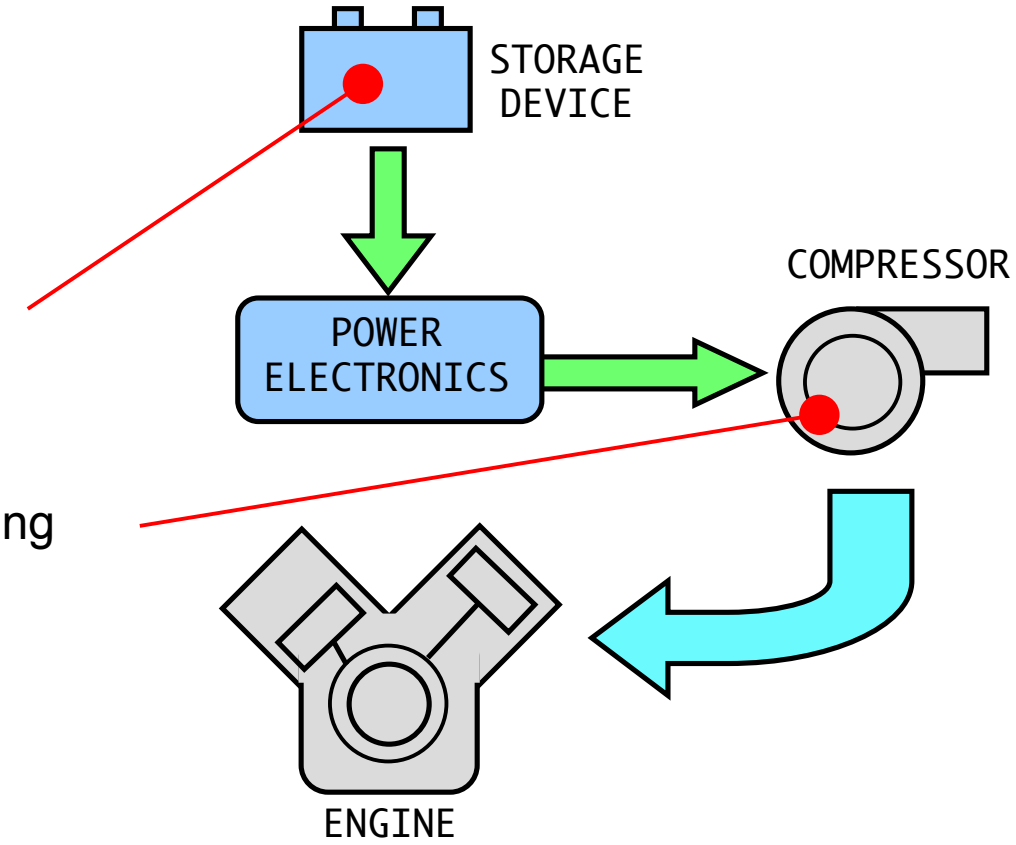


System Operation

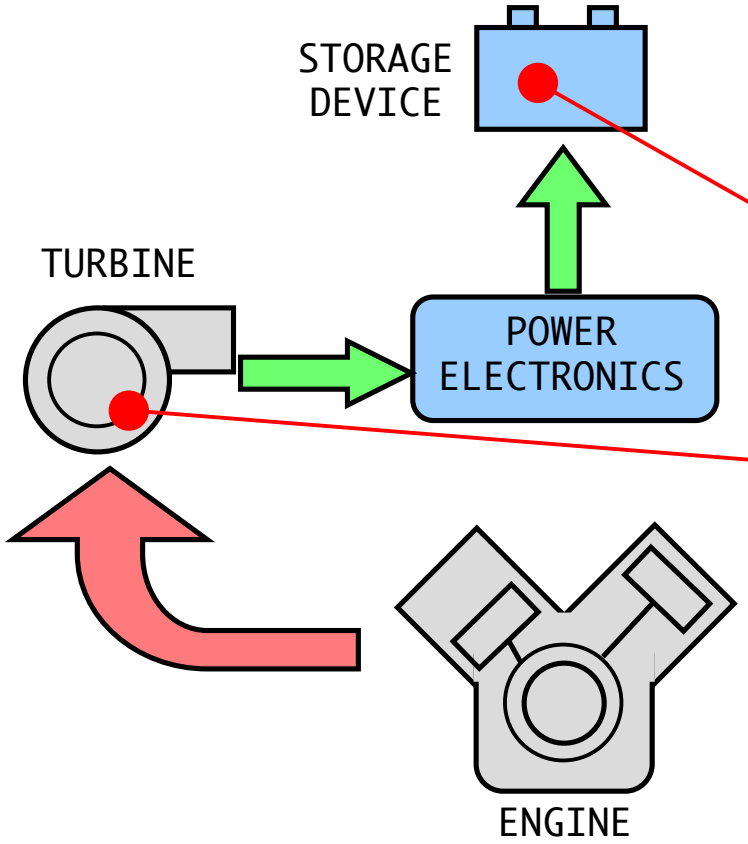
Condition 1: Supercharging

•Stored energy powers the compressor

•Response is improved, reducing turbo lag and eliminating boost threshold



System Operation



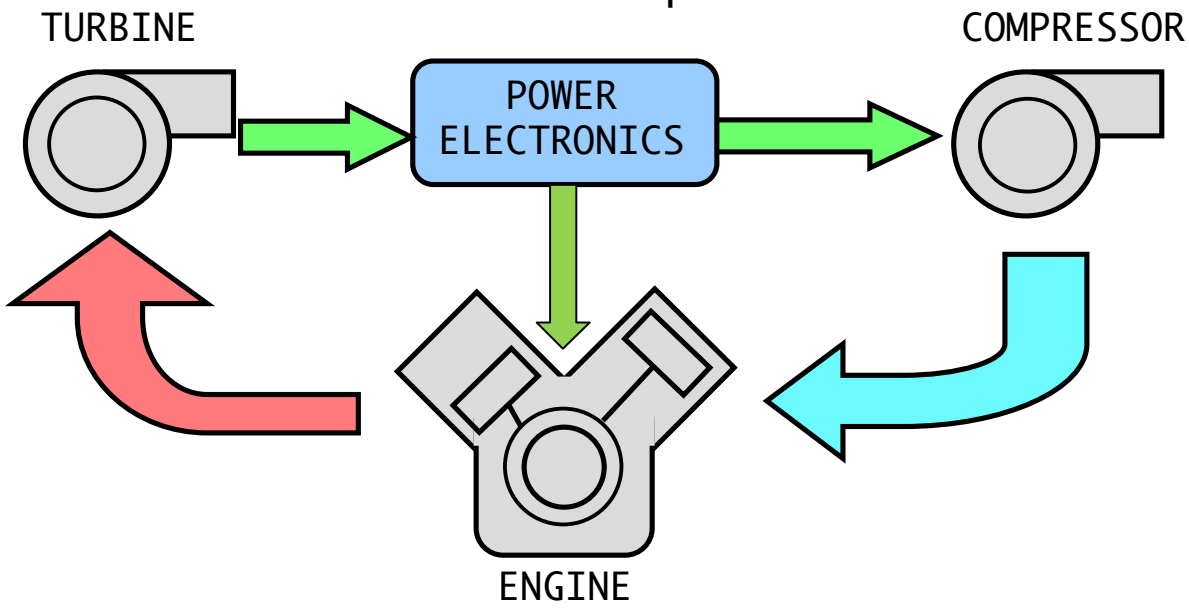
Condition 2:
Charging

- Exhaust energy is captured and stored
- Turbine torque is managed by the power electronics unit

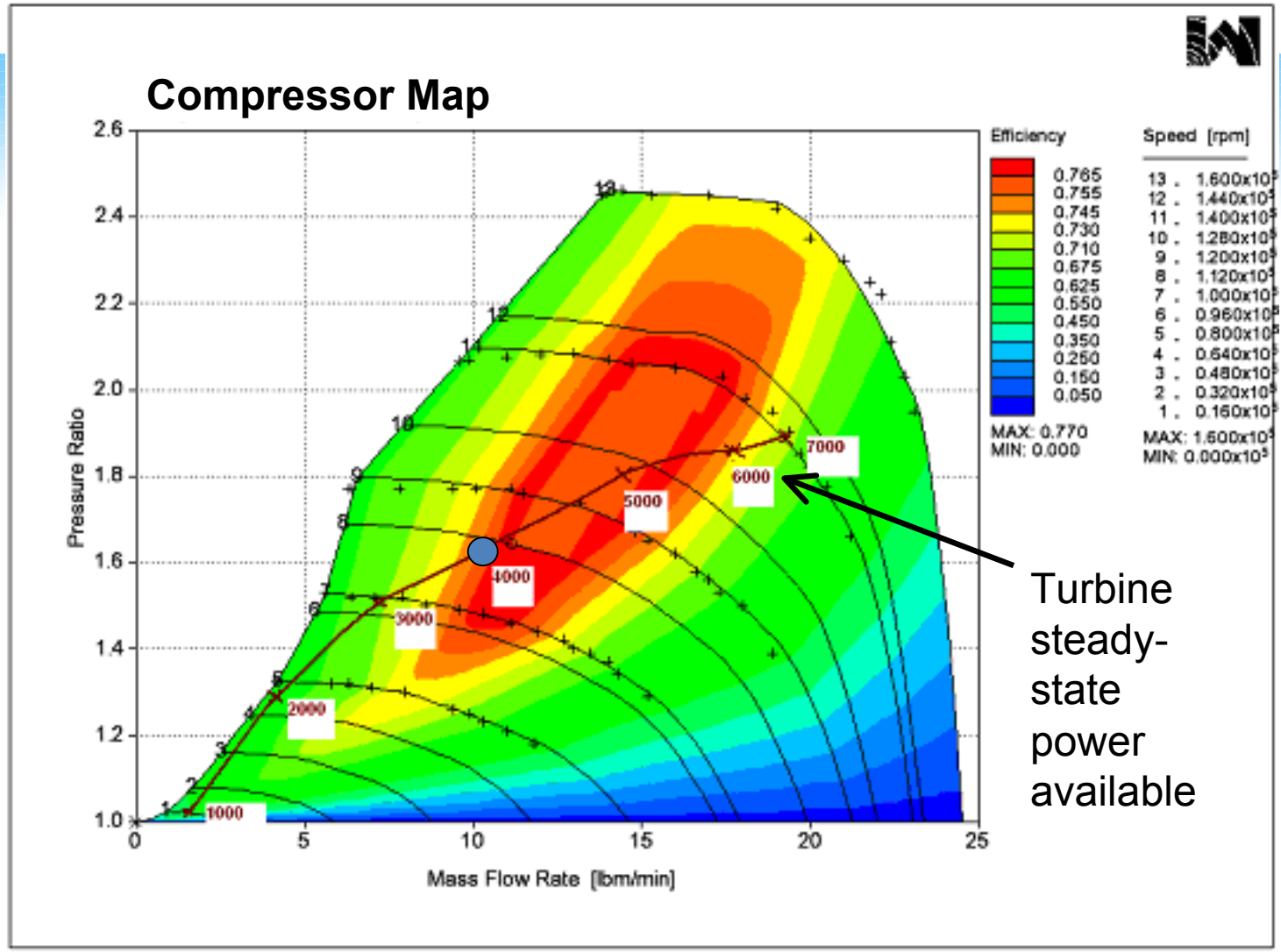
System Operation

Condition 3: Steady-State Turbocharging

- A high-efficiency electrical system transfers power from turbine to compressor
- Turbomachine speeds are independent



Compressor Map

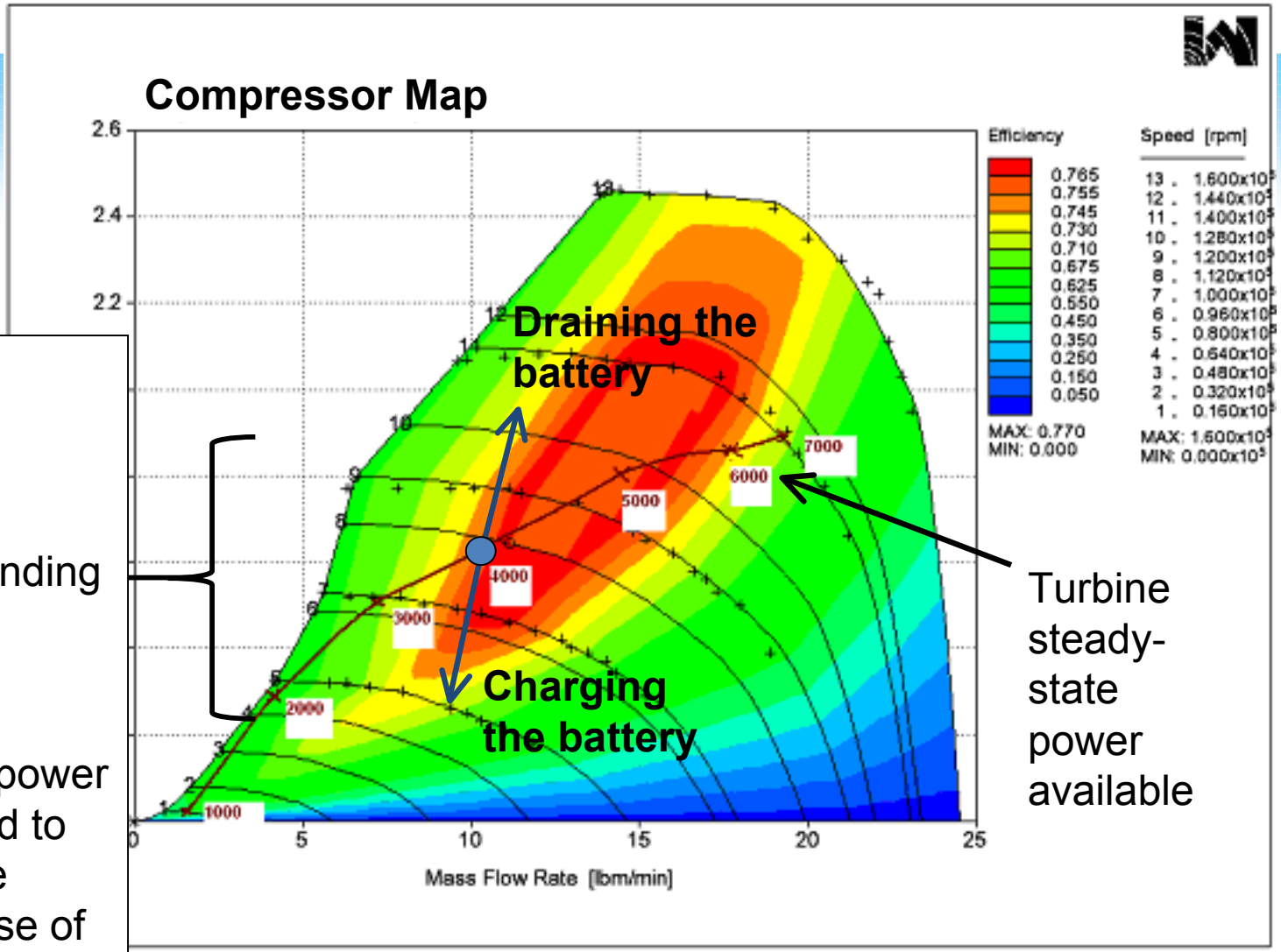


Turbine steady-state power available

Compresser performance at various Engine Speed (RPM)

Aeristech produces the required compressor output, responding to CAN-Bus signals

Compressor power does not need to match turbine power because of energy storage

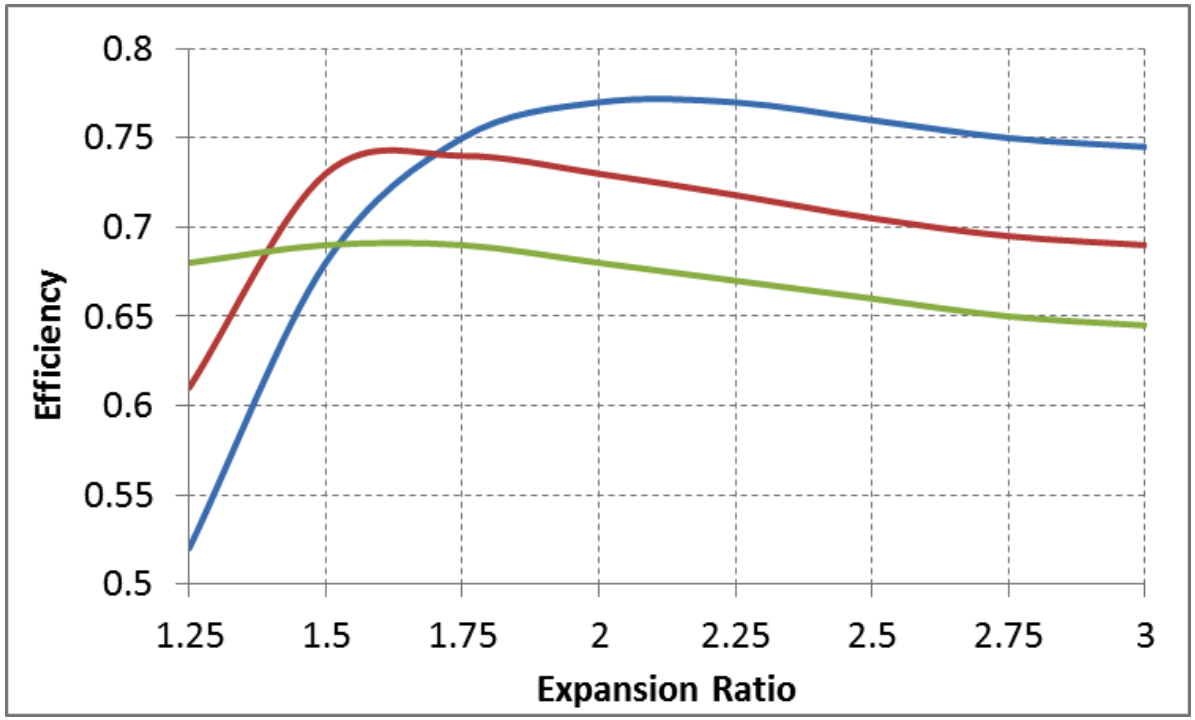


Turbine steady-state power available

Compresser performance at various Engine Speed (RPM)

Turbine Optimisation

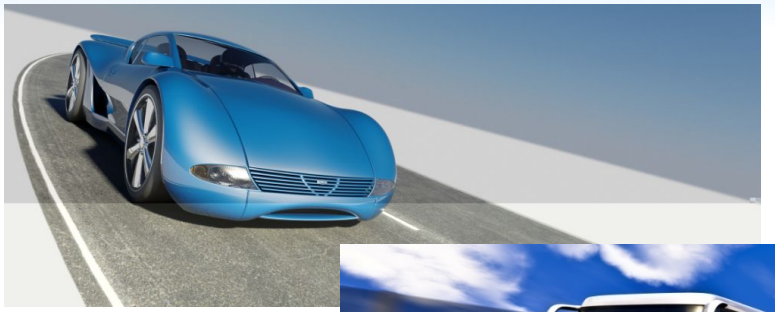
Aeristech's generator allows control of turbine shaft torque



Increase turbine size and decrease speed with less concern for inertia

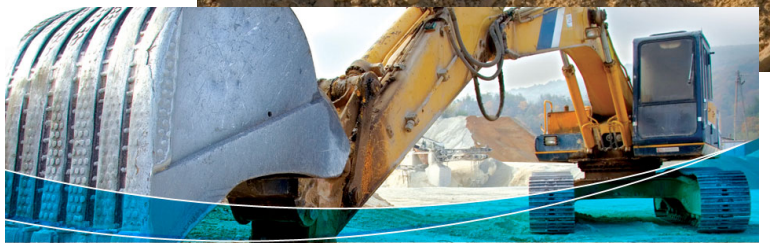
	Turbo match to engine	Turbo efficiency	Turbo lag
Effect on engine performance	**Problem**: Engine performance is reduced when operating far from the match point.	**OK**: Power from increased airflow outweighs back pressure increase.	**Problem**: Turbo lag is felt by the driver as reduced performance.
Effect on engine efficiency	**Problem**: The wategate must be used when operating above the match point.	**Moderate**: Turbo efficiency influences engine efficiency through back pressure.	**OK**: Fuelling and combustion is typically OK.
Improvement with Aeristech's FullElectricTT	**Good**: Aeristech allows a more flexible match because turbo and compressor run independently.	**Good**: Turbine efficiency is optimised over a wider range of operating points.	**Good**: Turbo lag is eliminated using Aeristech's high-power, rapid-response motor.

- Engine Applications (1) :
  - Cars, HGVs, Coaches
  - Turbo charging
  - Hybrid and ICE



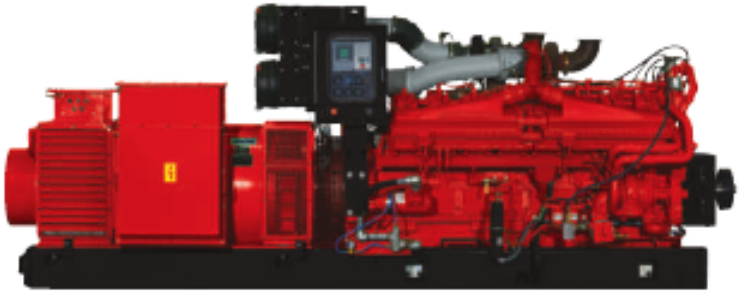
- Benefits:
  - Eliminates turbo lag
  - Lowers total costs
  - Reduces emissions
  - Increases fuel economy

- Engine Applications (2) :
  - Off Highway
  - Heavy duty cycle use
    - e.g.: back hoe power surge
  - Turbo charging
  - ICE



- Benefits:
  - Offsets filtration costs
  - Lowers operating cost
  - Lowers emissions

- Engine Applications (3) :
  - Power Generation
  - Turbo charging
  - Steady state & Variable load



- Benefits:
  - Increases fuel efficiency
  - Increases power rating
  - Reduces emissions
  - Fast response to variable load

Conclusions

- Intelligent, intrusive pressure charging enables engine downsizing and preserves/improves engine torque response
- Electrical turbocharging improves aerodynamic efficiency and eliminates turbo lag
- Aeristech provides the high-speed, high-efficiency, motors and generators required for turbocharging
- Aeristech's motors are the fastest accelerating

driving clean technology

Thank you for your attention

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