

Challenges and Opportunities for Engine Ancillary Electrification

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Introduction – AVID Technology Ltd.

- Ⓢ Based in the NE of England
- Ⓢ Leader in design and manufacture of electrification solutions that improve efficiency, emissions and reliability of heavy duty and high performance vehicles
- Ⓢ Specialist in design and intelligent control of vehicle electrified ancillary systems known as micro and mild hybridisation

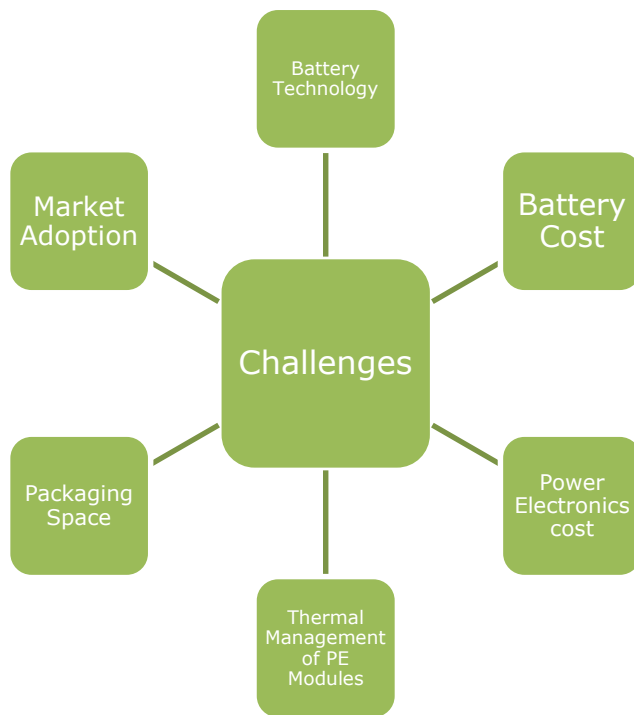


Introduction – AVID Technology Ltd.

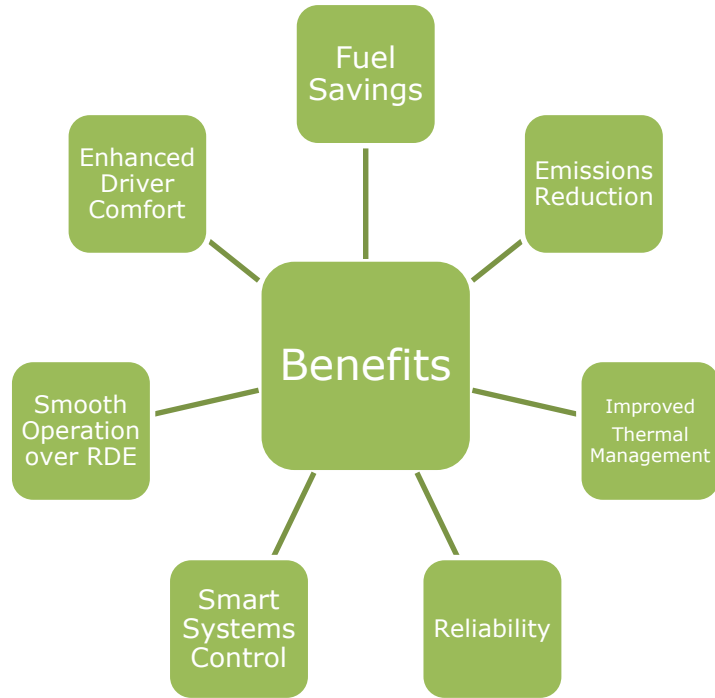
- 🔌 Pioneered the electrification of thermal management systems in transit bus applications
- 🔌 Customers include leading manufacturers of heavy duty and high performance electric, hybrid and ICE powertrains
- 🔌 Systems development, manufacture and integration of complex hybrid and electric vehicle powertrain



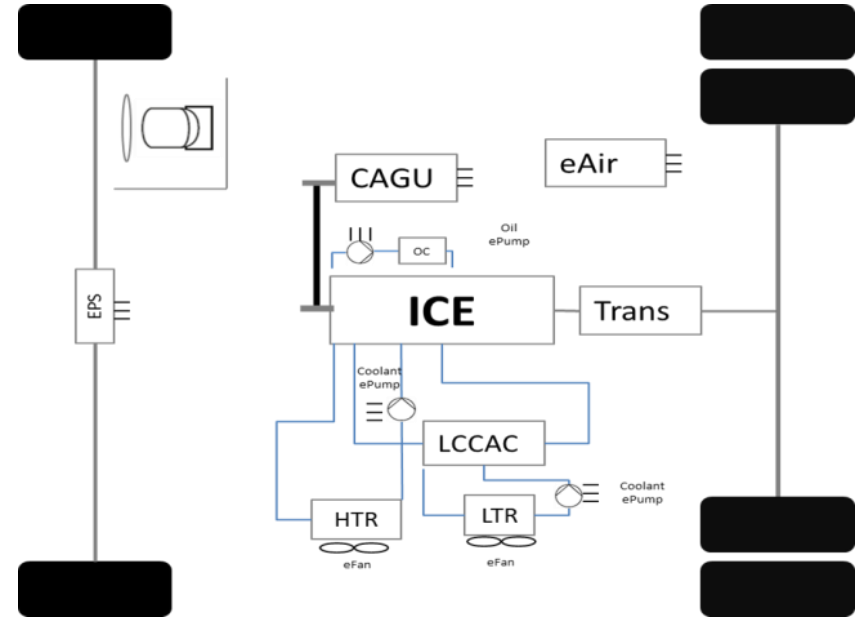
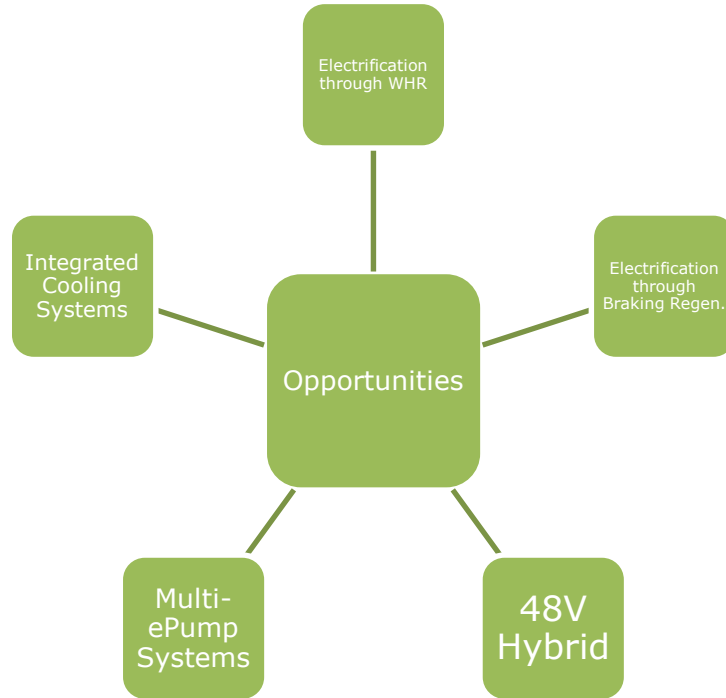
Engine Ancillary Electrification



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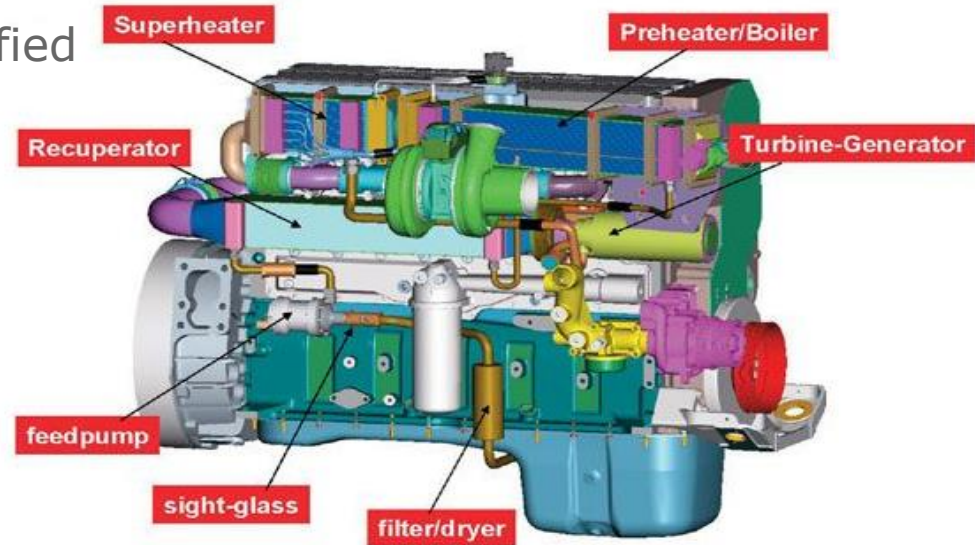


Engine Ancillary Electrification A Systems Approach



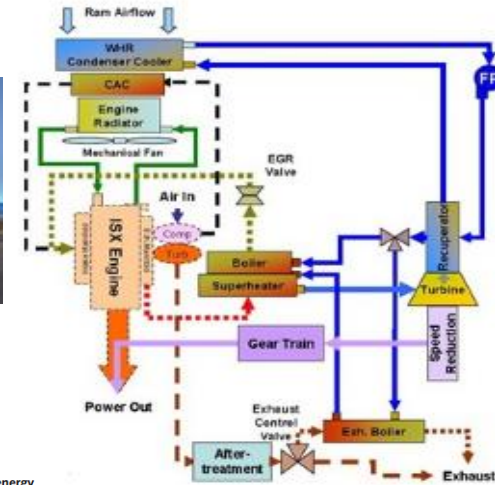
Electrification through Waste Heat Recovery

- ⏻ The WHR mover can be linked to crank or generate electricity
- ⏻ Use waste heat to power electrified ancillaries
 - ⏻ ICE cooling eFans
 - ⏻ Coolant ePump
 - ⏻ WHR fluid ePump
 - ⏻ WHR condenser cooling eFans
 - ⏻ Steering
 - ⏻ Air compressor

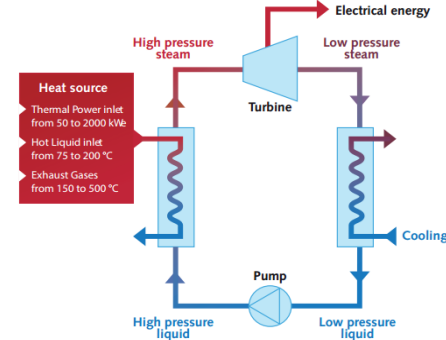


Electrification through Waste Heat Recovery

- ⚡ Cummins SuperTruck
 - ⚡ Organic Rankine Cycle
 - ⚡ Power available to crank
 - ⚡ 50% efficiency target

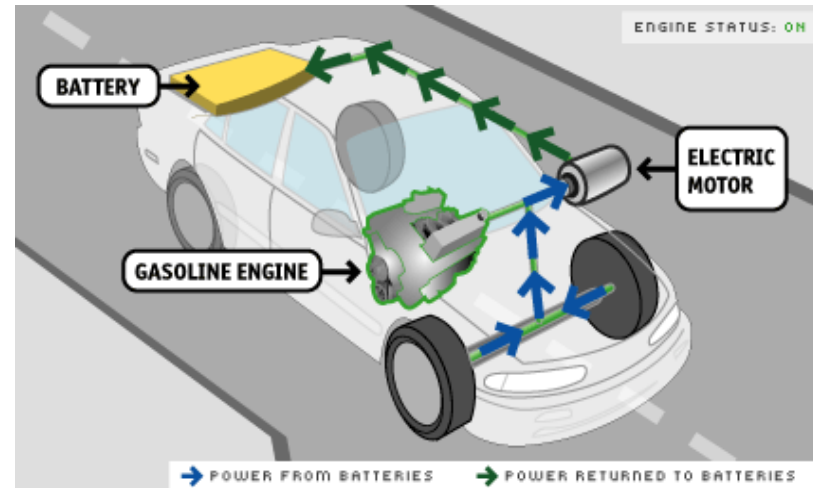


- ⚡ Efficient Ship
 - ⚡ Organic Rankine Cycle
 - ⚡ Turbo-generator charging batteries
 - ⚡ 10% fuel saving target



Electrification through Brake Regen.

- Smart control of alternator up to full crank assist where the eMachine can be a generator or assist motor.
- Energy recovered is “free” as the engine is not fuelling during regen.
- Energy recovered during braking can be used to power electrical ancillaries
 - ICE Cooling eFans
 - Coolant ePump
 - Steering
 - Air compressor
 - HVAC
- AVID systems offer up to 7% fuel economy in Real Driving Environment (RDE)



Comparison Ancillary Electrification

	2.0 TD Passenger Car		Commercial Vehicle 6.7L Transit Bus	
System	12V	48V	24V	48V
Coolant Pump	80A	20A	80A	40A
Power Steering	60A	15A	180A	90A
Cooling Fan	60A	15	25A x 6	12.5A x 6
Air Compressor	N/A	N/A	360A	180A
15kW Crank Assist Generator	1,250A	312A	620A	312A
Main Engine Oil Pump	160A	40A	300A	150A

Systems electrification is effective because of the large amount of power used by parasitic systems in Real Driving Environment



Benefits of 48V Electrification

- ⏻ Helps RDE performance of vehicle as components are decoupled from engine
- ⏻ Supports Start Stop Engine Operation as functions can operate when engine is off, e.g. coolant or oil circulation
- ⏻ Enabler for engine down sizing
- ⏻ Improved thermal management for after treatment systems through improved “cooling” system and direct heating
- ⏻ Improved safety = reduced cost and complexity compared to higher voltage hybrid systems
- ⏻ Enabler for future technologies e.g electronic valve actuation, eBoosting, WHR



eFan Micro Hybrid Installations

🔌 Double decker bus

- 🔌 6 x 24V eFans
- 🔌 9% fuel saving
- 🔌 2 year PBP



🔌 Dump Truck

- 🔌 22 x 24V eFans
- 🔌 Alternator upgrade
- 🔌 55 kW saving
- 🔌 11% fuel saving



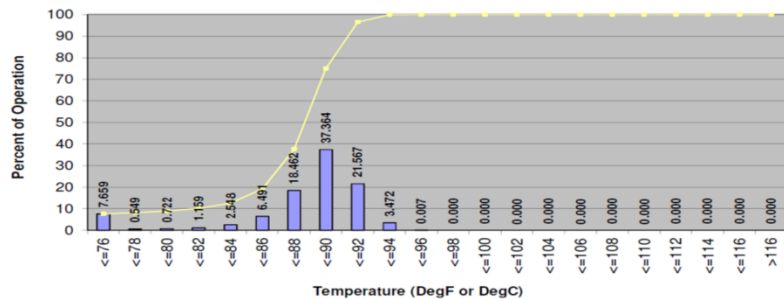
🔌 Excavator

- 🔌 16 x 24V eFans
- 🔌 38 kW saving
- 🔌 12% fuel saving



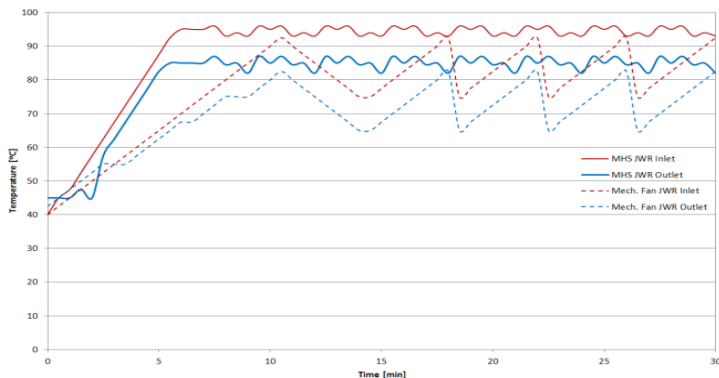
eFan Micro Hybrid RDE Performance

Radiator Coolant Temperature Measured by Micro Hybrid ECU



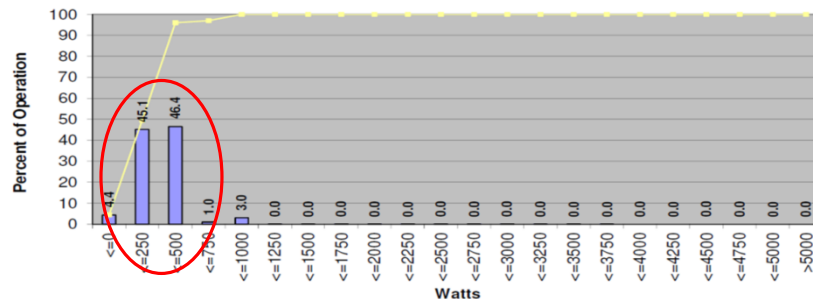
Coolant temp. levels of 86°C – 92°C in RDE

JWR Temperature Variation Comparison



Coolant temperature variation in conventional and eFan cooling kit

Micro Hybrid System Power Consumption - Histogram Plot



500W peak power draw out of 3kW installed power



Electrification of Main Engine Coolant Pumps

- ⚡ BMW pioneered electric coolant pumps for several years
- ⚡ With higher voltage levels ePumps can now meet higher flow – head requirements
- ⚡ ePumps can be controlled in conjunction with eFan system to improve thermal management and ensure power economy



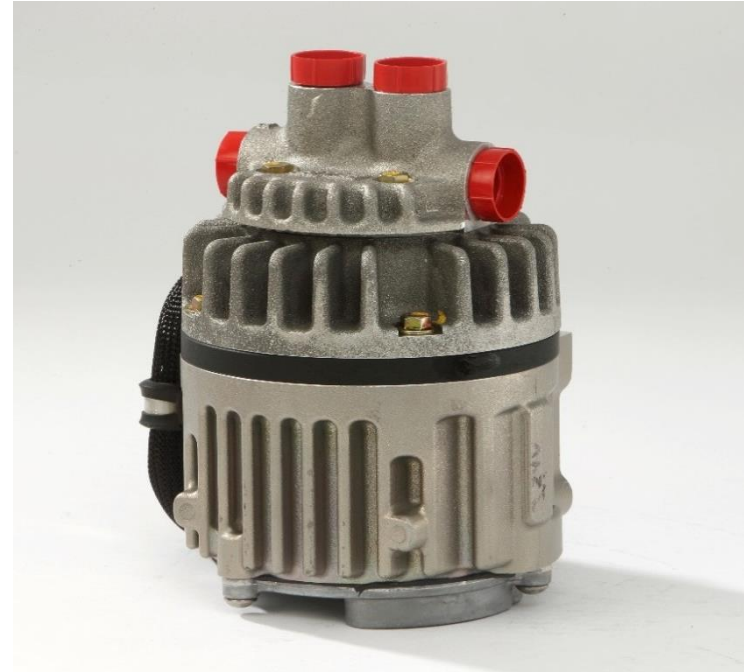
Electrification of Air Compressor

- Ⓢ Case study on 180hp Euro VI transit bus
- Ⓢ Compressor downsized by 75%
- Ⓢ Average RDE power consumption reduced by 80%
- Ⓢ Considerable reduction in operation noise levels



Electrification of Oil Pump

- ⏻ Fuel economy improvement of 2%
- ⏻ Increased reliability
- ⏻ Able to meet cold cranking requirements at higher voltage levels
- ⏻ Maintain oil pressure in gearbox during stop-start



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