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Hybridization with Axial Flux Motors

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Hybrid Systems: More Than a Stop Gap

The market is trending towards hybridization and range extension.

Axial flux motors and EDUs are the foundation for this movement.

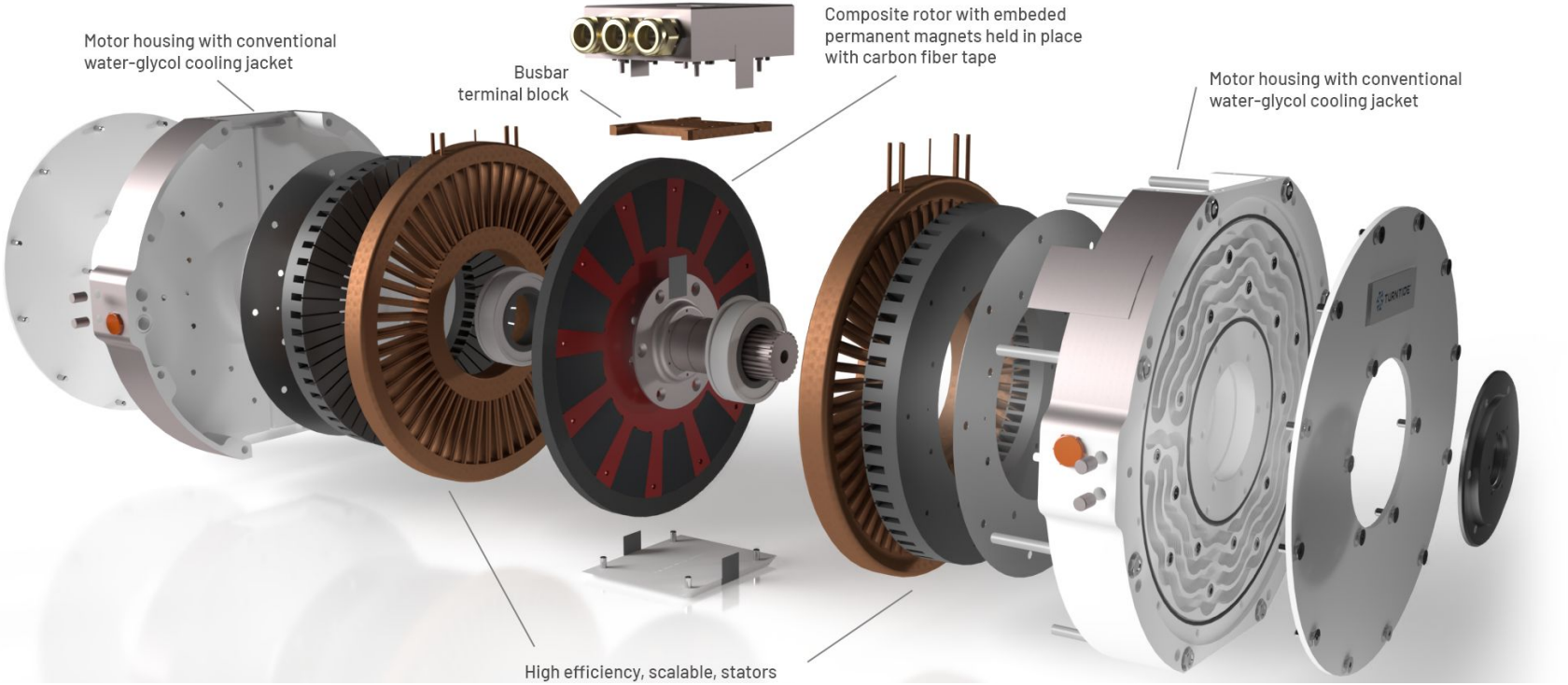
Advantages of AF Motors

Capabilities

Applications

Use Case

What Is an Axial Flux Motor?



Axial Flux Motor Advantages

Compact horizontal design

- For most applications, we can create hybrid solutions with current platform space

Superior torque-power to weight ratio

- Lighter than radial motors
- Two to four times more power at 50% less weight
- Less rotational mass = longer life

Axial Flux Motor Advantages

Wide range of power solutions

- Diameter change to produce power and torque
- Multiple sizes from 55 kW to 1 mW of power

Nimble design

- Can be fitted to SAE 1 to 3 motor flanges
- Most common shafts designs
- Industry standard input and output customization (female bore motor design)
- Any transmissions or any transfer case can be used

Axial Flux Motor Applications

Parallel hybrid

- ICE & electric traction/power: together or independent
- Maximizes efficiency at higher speeds
- Eliminates energy loss for mechanical to electricity during higher speed/longer

Series hybrid

- ICE generates power for electric motor
- Very efficient for City/Last Mile/Local driving and low speeds
- Efficient during frequent starts and stops

Standalone power generation

- While parked the system can be used as a genset
- Grid power push
- Vehicle power/re-charging platform

Hybridization Results

- 15% to 20% decrease in on-the-road diesel consumption
- Increased towing performance in town
- Decreased emissions in city/locations
- Decreased noise in neighborhoods and city centers
- Reduced maintenance costs
- Decreased battery costs

Real-World Innovation: Geofenced Power Switching

Dynamic Drive Unit Optimization

- Switch from ICE to EV with no user input
- Automated based on geofencing
- Last- and middle-mile applications

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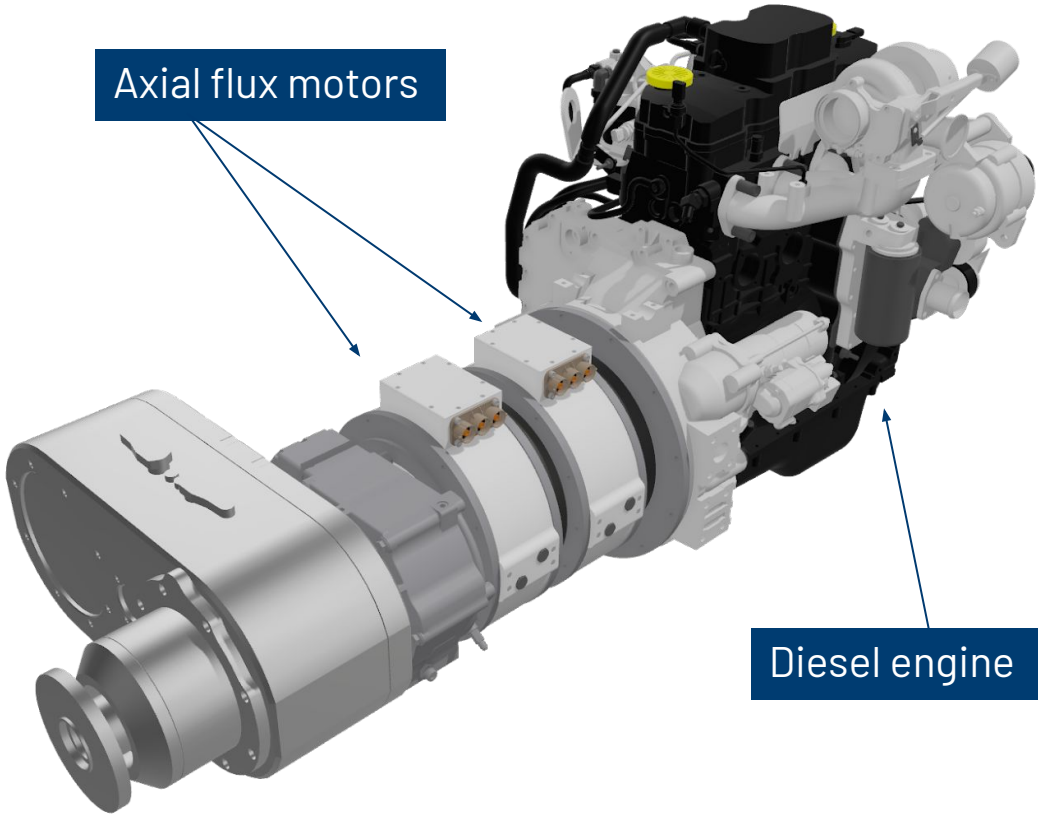
Real-World Innovation: Multi-Flow Diesel-Hybrid System

Diesel power
- 550 hp
- 1,250 ft/lbs

Series hybrid
- 318 hp
- 820 hp (peak)
- 2,006 ft/lbs
- 4,682 ft/lbs

Parallel hybrid
- 159 hp
- 410 hp (peak)
- 1,003 ft/lbs
- 2,341 ft/lbs
- 120 kW of power generation

Generator mode
- 220 kW



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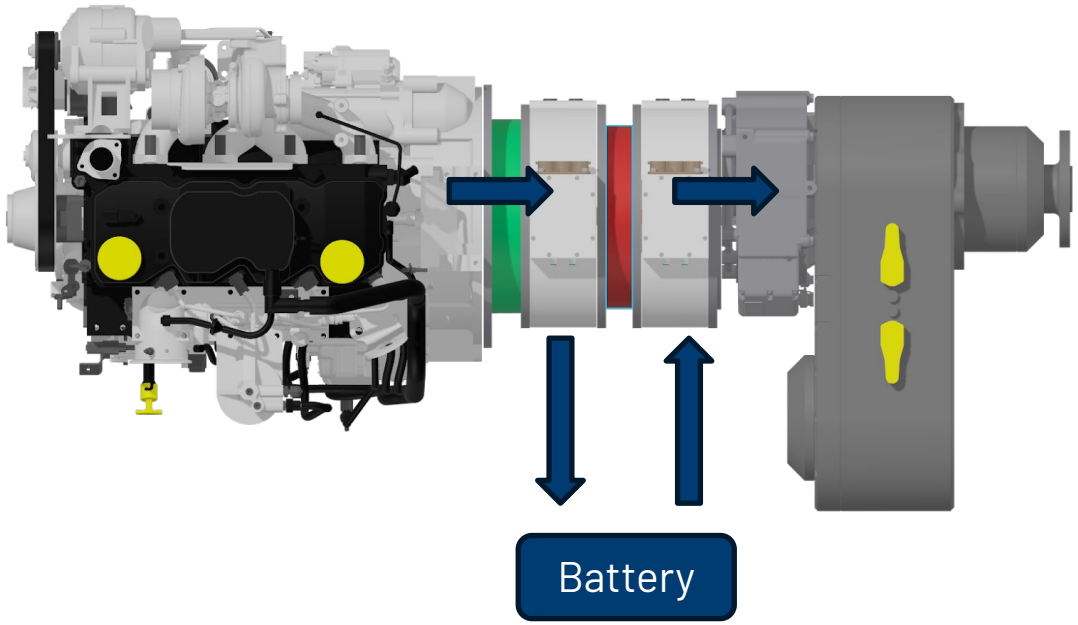
Real-World Innovation: Multi-Flow Diesel-Hybrid System

Series Hybrid

- The ICE powers a generator, which produces electricity.
- That electricity either powers the electric motor directly or charges the battery.

Parallel Hybrid

- Both the ICE and the electric motor are connected to the drivetrain and can independently or jointly power the wheels.
- The battery stores energy for the electric motor



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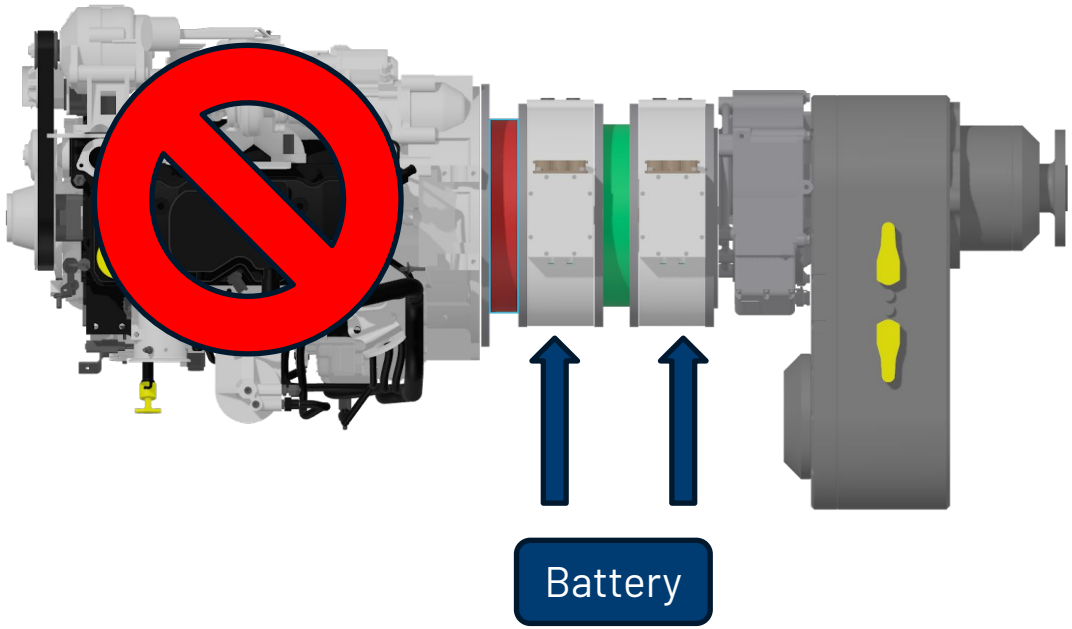
Real-World Innovation: Multi-Flow Diesel-Hybrid System

Full-Electric Mode

- Full battery operations
- 40 kWh to 200 kWh battery
- **Geolocation capable** with automatic power switching
- Equal power specs to current diesel platforms from 1.8 L to X15 models



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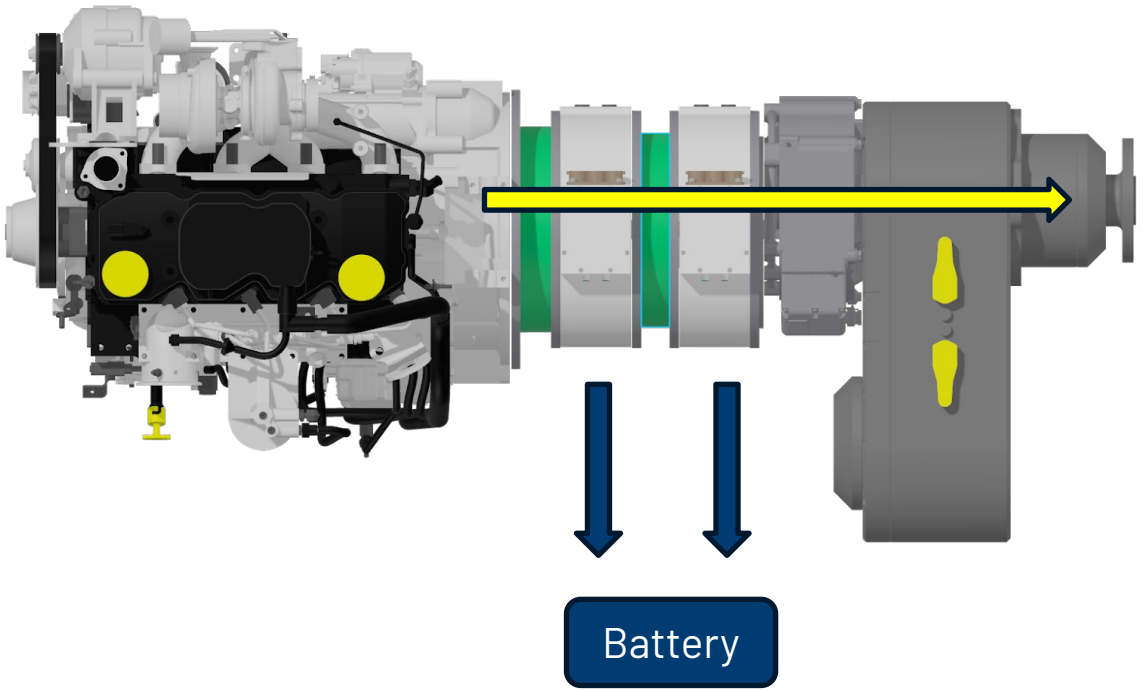
Real-World Innovation: Multi-Flow Diesel-Hybrid System

Full-Diesel Mode

- Full diesel torque and power
- Pulling and towing
- Power production and battery charging
- Ideal for hill climbing, extreme towing capacity, longer distance highway driving
- EV-boost capable



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Thank you!

For questions or other information requests or to discuss the multi-flow system, stop by **Booth 19** to talk with our team or contact me via email:

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