



**NYCLHVCC Meeting**  
**Monday, April 11, 2011**

**TRANSIT CONNECT  
BATTERY ELECTRIC VEHICLE**

**E450 BALANCE HYBRID  
ELECTRIC VEHICLE**

**LEAP HYBRID REFRIGERATION  
SYSTEM**

# Who is Azure Dynamics?

- > **Azure Dynamics is the industry leader in hybrid electric and electric powertrain solutions in the Class 3 & 4 vehicle segment.**



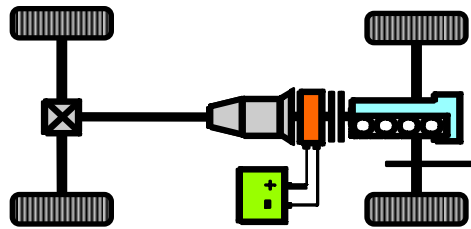
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# What We Build

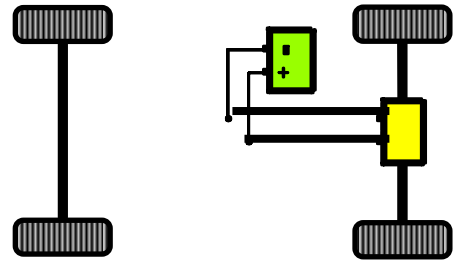
## PARALLEL HYBRID

Mechanical connection between engine & electric drive motor



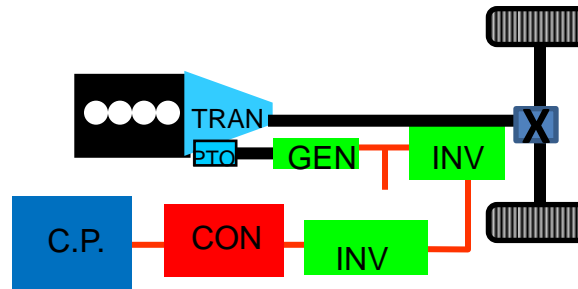
## ELECTRIC

Battery stored energy drives vehicle – zero tailpipe emissions



## LEAP FREEZE HYBRID

Mild hybrid – cold plate technology, eliminates pony engine



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# *Transit Connect Electric*

## *What is it?*

**Ford's first dedicated small commercial van**

- > **Versatile**
- > **Spacious**
- > **Hard-working**
- > **Proven**
- > **Electric**



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# Battery Electric -- Why Buy?

- > **Car-like driving dynamics, cargo capacity, accessibility, low purchase and operation costs.**
- > **For commercial users traveling predictable, short-range routes with frequent stop-and-go driving in urban/suburban environments, a BEV makes sense.**
- > **For customers seeking sustainable mobility solutions, the Transit Connect Electric provides a zero emissions option.**



# Transit Connect Electric -- Specifications

## BATTERY ELECTRIC PROPULSION SYSTEM UPFITTED BY AZD

- > 28 kWh lithium ion battery supplied by Johnson Controls-Saft
- > Driving range up to 80 miles (UDDS cycle)
- > Charge time 6-8 hrs w/240V/30A
- > Top speed 75mph
- > Able to ascend a 20% grade
- > Ambient operating temp -30F to 120F

## WEIGHTS/PAYLOAD

- > GVW 5005 lbs
- > Payload 1000 lbs
- > Interior cargo volume 135 cu ft

## SAFETY

- > FMVSS certified
- > Collapsible steering column
- > Tire pressure monitoring system
- > Driver and front passenger airbags and front seat side impact airbags

## ATTRIBUTES

- > 114.6 in wheelbase with high roof
- > XLT trim package
- > Van or wagon available
- > 2nd row sliding doors, both sides
- > Exterior rear panel for advertising

*Some power reduction may occur above 110F. Lower ambient temperatures require preconditioning. Specifications are preliminary and subject to change at introduction.*

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# Johnson Controls-Saft



- > **Transit Connect Electric uses the same proven battery technology on the road today in Ford's Escape plug-in hybrid.**
- > **AZD is now using Johnson Controls-Saft lithium-ion batteries for its E450 Balance HEV. The shared supplier business relationship provides additional synergy between Ford and AZD for Transit Connect EV.**

# Transit Connect Electric Program Timing

- > **Feb 2010** Introduced at Chicago Auto Show
- > **May 2010** Priority production "Slot List"
- > **Sep 2010** Drivable demos
- > **Dec 2010** First units to Lead Customers  
DHL, NYPA, AT&T, SoCalEdison, Canada  
Post, Johnson Controls, XCEL
- > **Apr 2011** Start of full production
- > **Being sold by Azure with Ford's  
support via selected Ford dealers**



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# *EV Components and Maintenance*

- > Other EV components (i.e. DC-DC converter, power steering system) are common to other Ford vehicles**
- > Motor and controller are sealed, maintenance-free and designed to last the life of the vehicle**
- > No oil changes or other engine maintenance**
- > Fluid levels, tire pressure are the only check items**
- > Reduced brake maintenance**

# *Warranty and Battery Replacement*

- > 5 years/60,000 mile EV powertrain warranty**
- > 3 years/36,000 miles rest of vehicle (same as other Ford vehicles)**
- > At 60 miles/day, 5 days/week, it will be 5 years**
- > Battery projected life 7-10 years**
- > Battery pricing much lower in future (like buying a computer today vs. years from now)**

# *EV Charging*

- > **EVSE (Electric Vehicle Supply Equipment) available from multiple vendors, SAE J1772**
- > **Level 1 -- 110V any outlet ~18 hrs full charge**
- > **Level 2 -- 240V/30A EVSE ~6 hrs full charge**

# "Fuel" Cost for Transit Connect Electric

- > **Gasoline at \$3.50/gal and Transit Connect gasoline vehicle at 22 mpg >>**  
**\$0.159 per mile**
- > **Electricity at \$0.10/kWh and Transit Connect Electric at 350 watt-hrs/mile >>**  
**\$0.035 per mile**

# Pricing

- > **\$57,400 plus destination charge**
- > **\$7,500 US Federal tax credit applies >>  
\$49,900**
- > **Cargo van now, 5-seat wagon for MY2012**
- > **Glass or solid panels in rear/side available**
- > **255 opening rear doors and rear view camera additional**

# *Balance™ Hybrid Electric Stripped & Cutaway Chassis*



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# Ford E450 Balance™ Hybrid

- > **Parallel hybrid technology**
- > **Anti-idle compliant**
- > **Only hybrid in its class with engine-off capability as standard**
- > **Only gasoline-powered hybrid in its class**
- > **E85 compatible**
- > **7 yr/200,000 mile Altoona-tested**



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# Ford E450 Balance™ Hybrid

## Base Specification

- > Ford E450 Chassis
- > 14,050 lbs GVWR
- > Cutaway or stripped chassis
- > 158" and 176" wheelbase
- > 5.4 Liter V8 gasoline engine
- > 5 spd automatic transmission

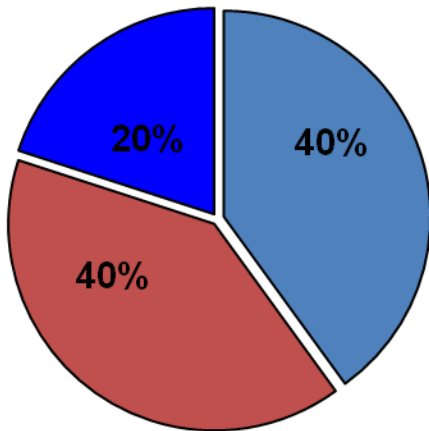


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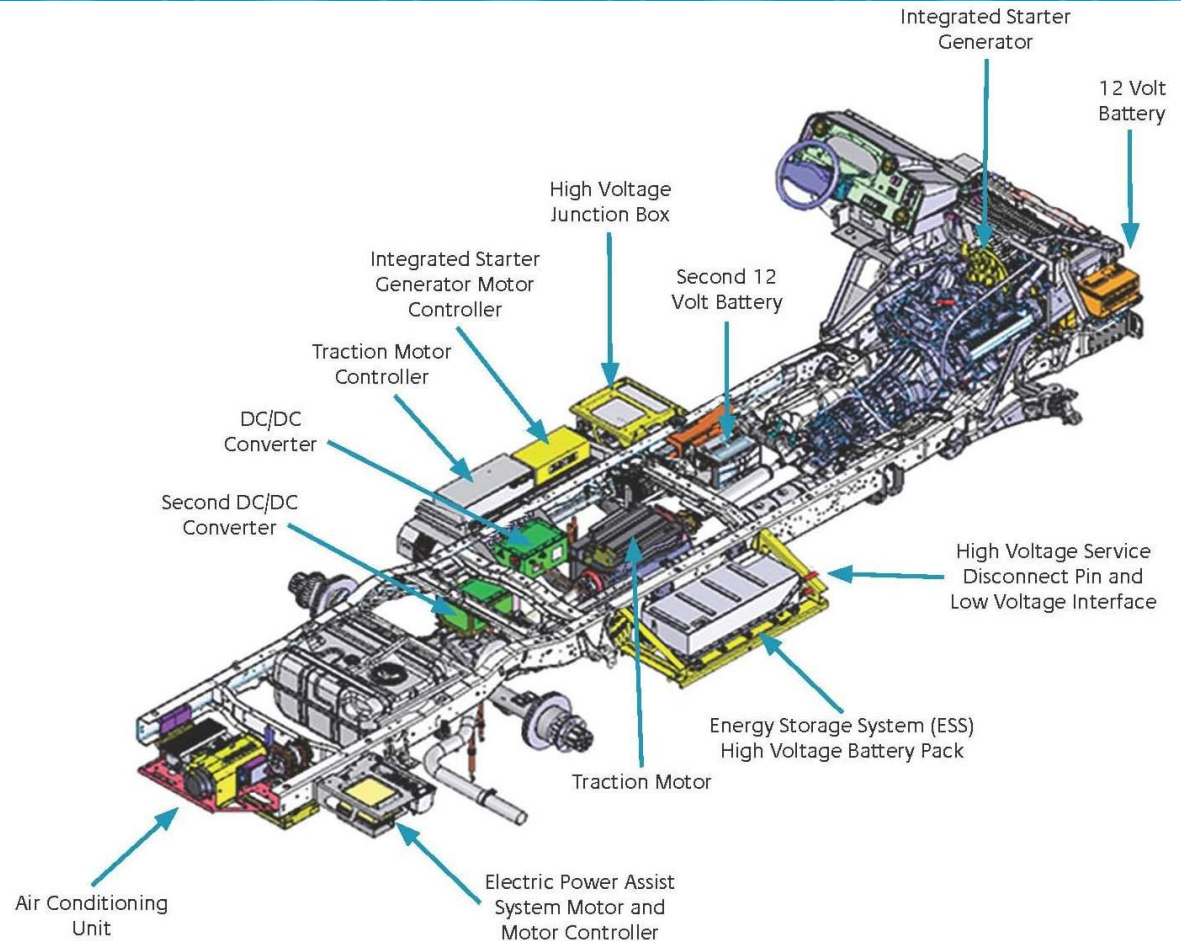
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# Balance™ Hybrid System Layout

## ENERGY SAVINGS PIE



- Engine Off
- Regenerative Braking
- Electric Auxiliaries



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# Azure's Growing Customer Base

- > **Commercial truck (over 600 operating/on order)**
  - > **FedEx, DHL, Purolator, AT&T, Cintas, ConEd**
- > **Shuttlebus (over 200 operating/on order)**
  - > **On state contracts in IL, MI, KY, WI, MN**
  - > **Transit agencies in Seattle WA, Dallas/Fort Worth TX, central CO, Daytona Beach FL, southwestern OH, western NC**
  - > **NY City area towns and hospitals**

# Balance™ Hybrid Fuel Economy and Emissions

- > Fuel economy and emissions testing obtained through use of Ford dynamometer at Ford's engineering center
- > Sample load cycle designed to simulate a NYC urban drive cycle

			Emissions			
			HC (g/mile)	CO (g/mile)	NOx (g/mile)	CO2 (g/mile)
NYCC	Baseline	Fuel Economy	0.25	3.30	0.77	1703
	Hybrid		0.16	2.79	0.28	1238
	Percentage Improvement	34.1%	33.5%	15.3%	63.4%	27.3%

# Hybrid System Summary

- > **E85 capable**
- > **Anti-idle compliant**
- > **Auxiliary systems supported with engine off (12V loads, air con, heat, power steering, power brakes)**
- > **25% less engine runtime = 25% less maintenance**
- > **30-40% MPG improvement**
- > **75% brake wear reduction – regenerative braking**
- > **3X improvement in starter motor life**
- > **3X improvement in 12V battery life**

# *Balance Pricing*

- > **\$38,850 for truck chassis hybridization**
- > **Typical finished truck cost = \$75-\$80K, depending on body configuration**

# *Balance PHEV*

- > **EPRI program**
- > **35 Balance PHEVs to be built**
- > **50-60% MPG improvement projected**
- > **4Q2011**

# LEEP™ Freeze Overview



**LEEP = Low Emission Electric Power**

**Compared to propulsion hybrids, LEEP offers:**

- > Smaller, lighter, less complex components**
- > Conventional auxiliary systems**
- > Much lower initial cost**

**> Azure supplies power to Kidron refrigeration system from:**

- > Traction engine OR**
- > Electrical power grid**

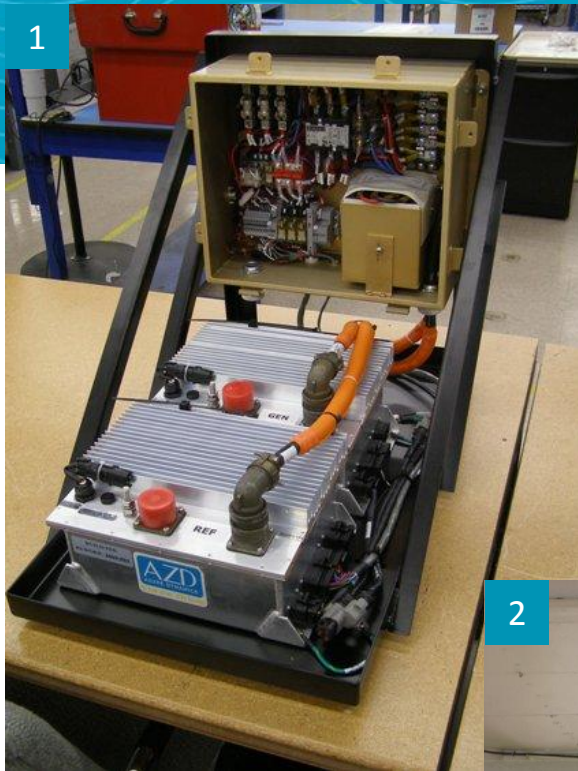
**...to operate refrigeration system & store thermal energy in cold plates.**

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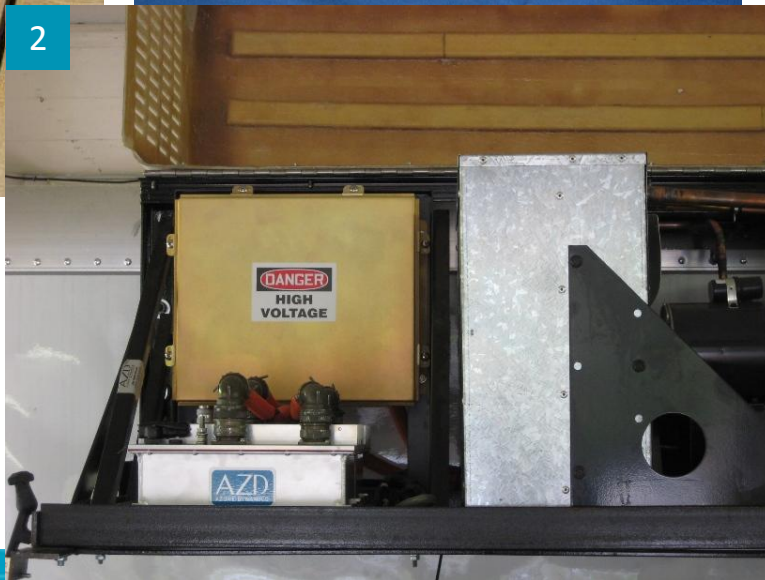
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# System Implementation

1



2



3



4



5



1. DMOCs, HVDP & frame
2. As installed above cab
3. Generator
4. As installed on frame
5. Completed truck

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# LEEP™ Freeze Advantages

## Versus conventional refrigeration:

- > **Elimination of pony engine:**
  - > Significant noise reduction
  - > Emissions reduction
  - > Fuel consumption reduction
  - > Maintenance cost reduction
  - > Increased reliability
  - > Increased system life
- > **Plug-in capability provides economical overnight cooling**
- > **10-24 hour thermal holdover w/o engine or grid**
- > **Bottom line – economic payback as fast as 12 months**

*Thank you!*

## **Questions?**

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