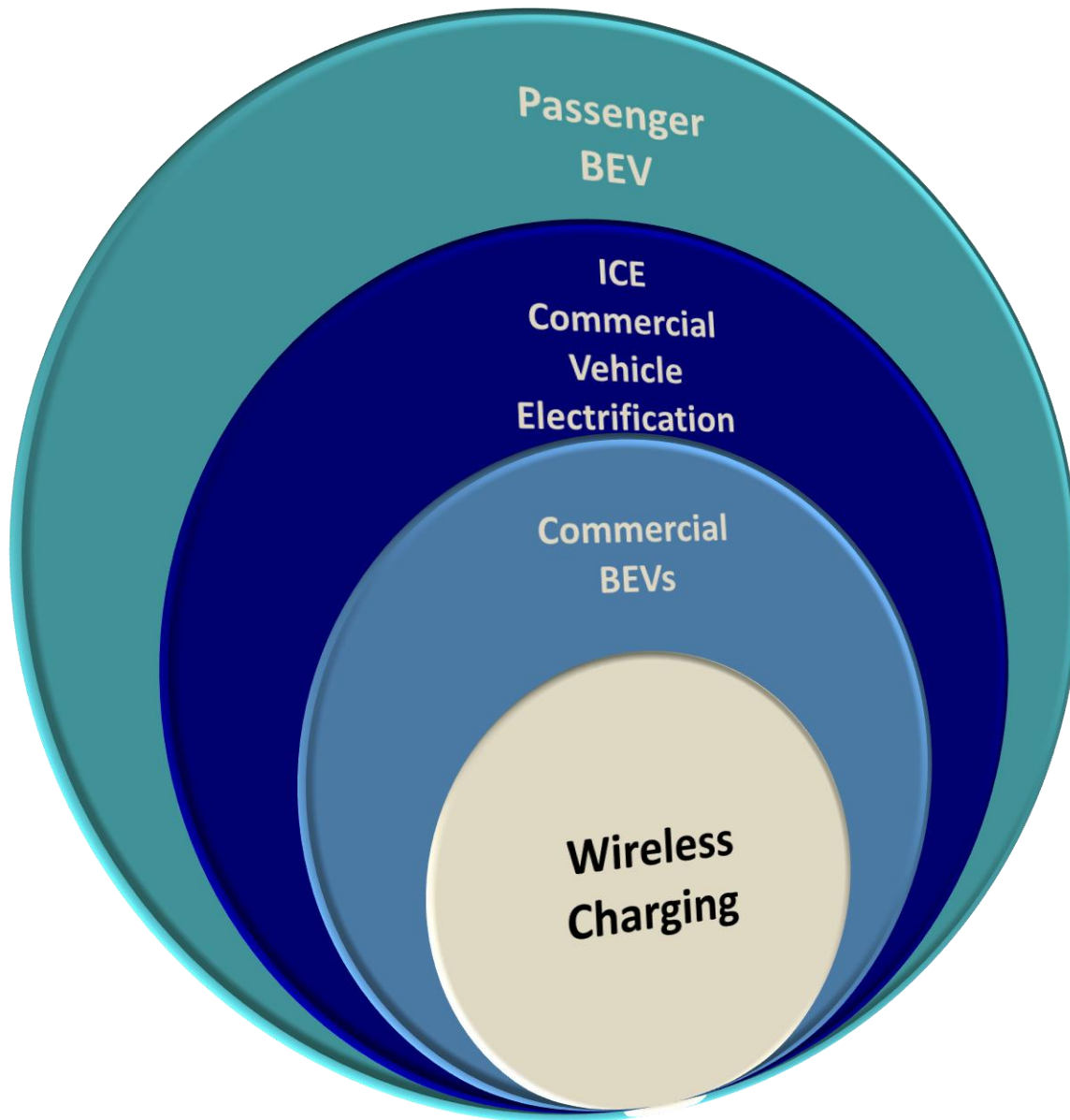


Alternative Powertrain Technologies

Current Trends in Wireless Power

Presented by
Andrew Daga, CEO
Momentum Dynamics Corporation
Andrew.Daga@MomentumDynamics.com





**Wireless Power
can positively
impact multiple
sectors within the
commercial
vehicle market.**

**It's not just about
charging EVs.**

**Conventional ICE Vehicles
(anti-idling shore power)**

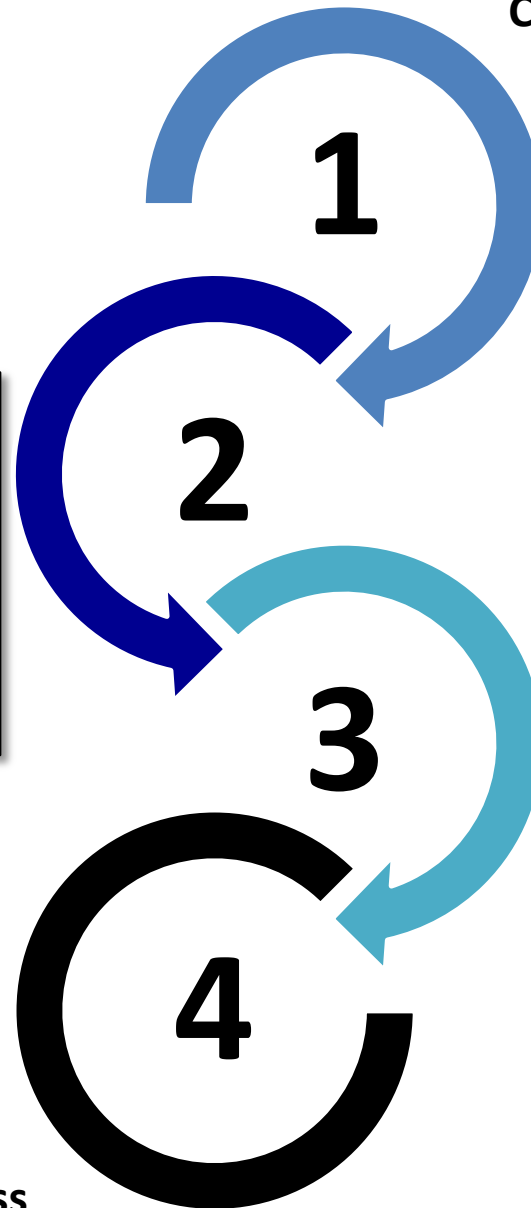


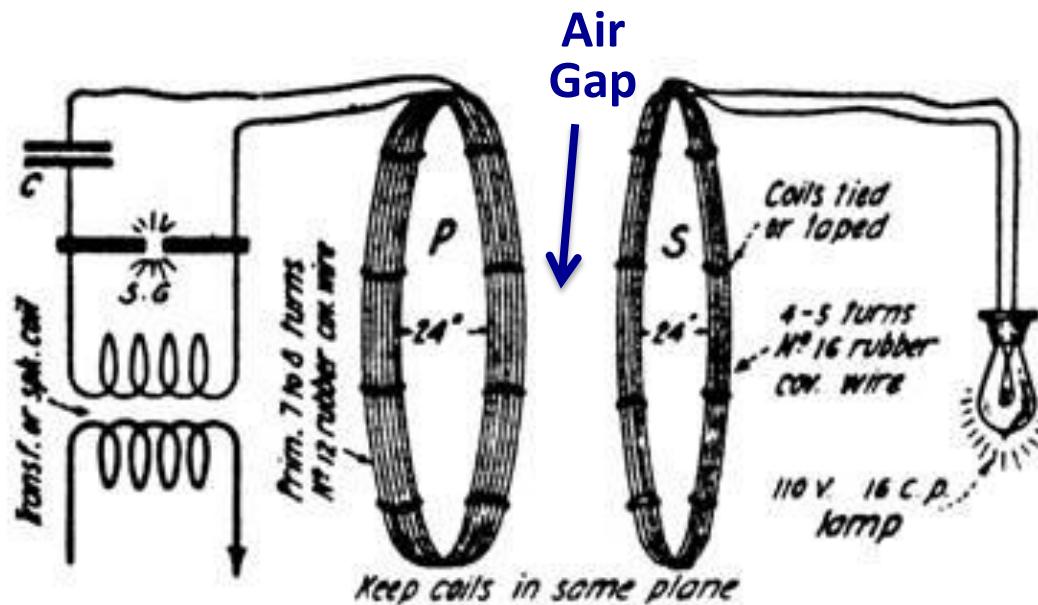
**Derivative Wireless
Power Technologies**

**Commercial Battery
Electric Vehicles**



**Passenger Class
BEVs and PHEVs**



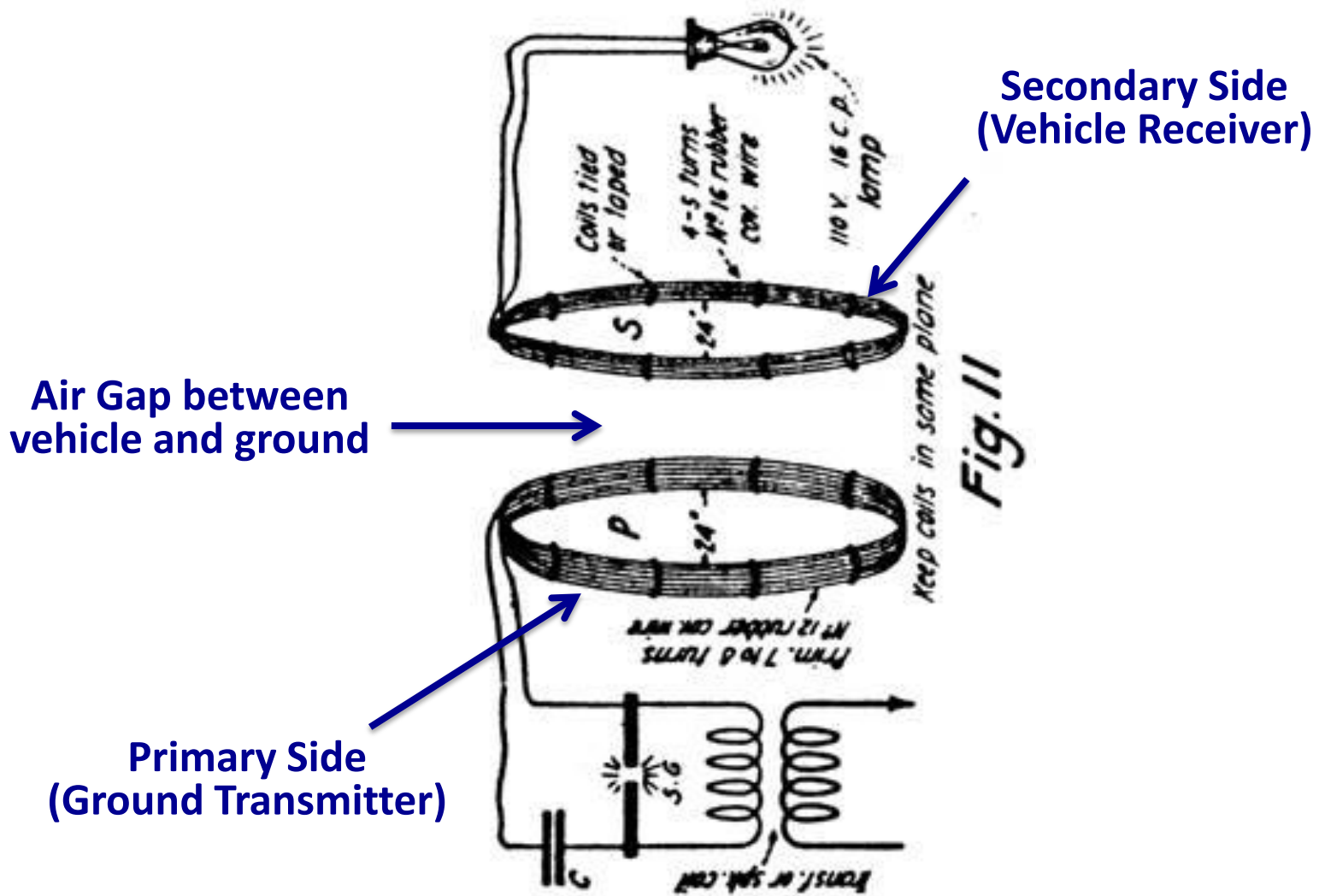


**Primary Side
(Ground Transmitter)**

Fig. II

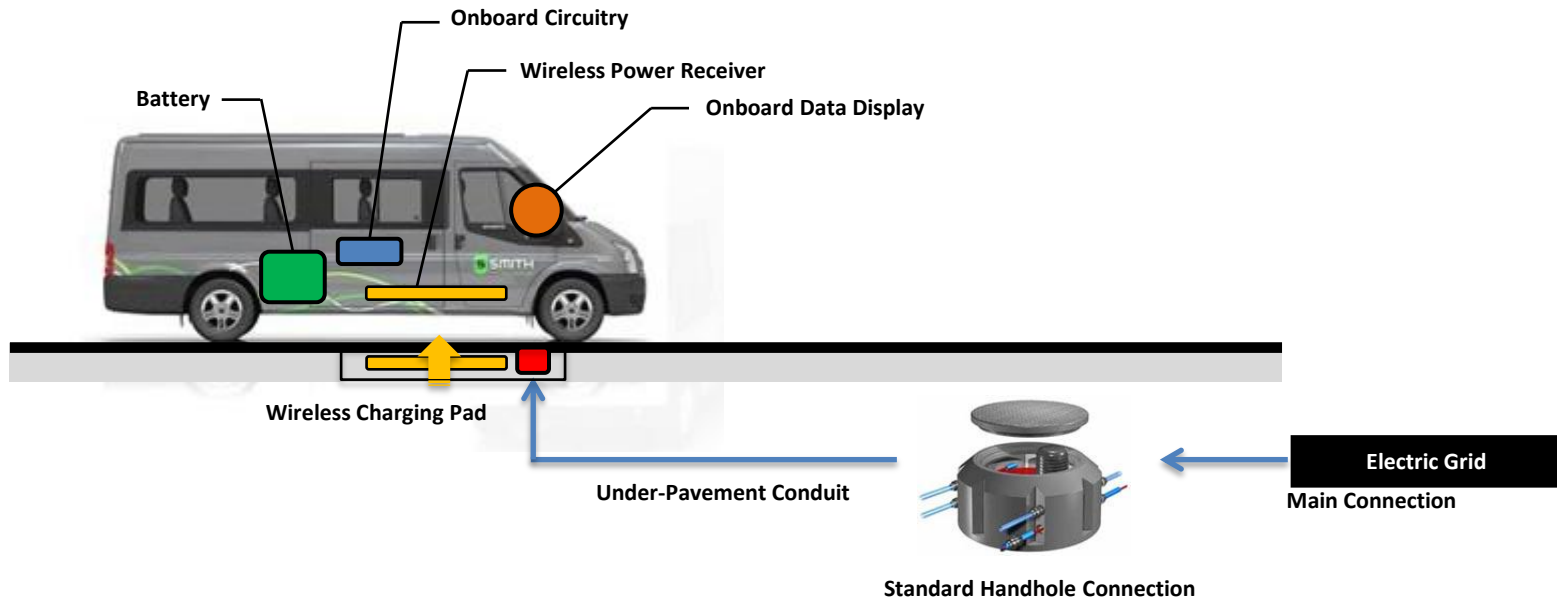
**Secondary Side
(Vehicle Receiver)**

- ✓ **Wireless power operates on the principle of induction.**
- ✓ **Alternating current in one coil produces a magnetic field, which then induces a current in the second coil.**
- ✓ **Water and human tissue are nearly transparent to the magnetic field.**



Momentum Wireless Charger

Automatic Wireless Charging



Recharge battery at 10,000 Watts for Cars
60,000 Watts for Commercial Vehicles



Plug-In Charging

Principle: Conduction

Efficiency: 96%

Cost: ~ \$.85/kW



Wireless Charging

Principle: Induction

Efficiency: 91%

Cost: ~ \$.33/kW

**Automatic Operation Enables
Opportunity Charging**

Current EV Recharging Technology

Plug-In Recharging Stations



- ✓ Low Power
- ✓ Not Automatic
- ✓ Not conducive to Opportunity Charging
- ✓ Long recharging time
- ✓ High cost of stations
- ✓ Safety is a problem
- ✓ Vandalism



Photos Source: Wikipedia, Wikimedia Commons

Dispelling some Myths about Wireless Charging

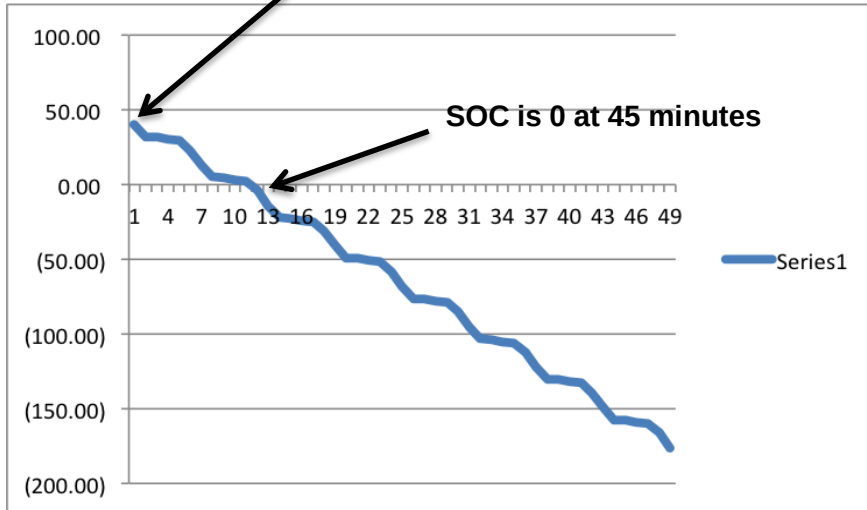
1. Power: It is JUST AS POWERFUL
2. Safety: It is not dangerous
3. Efficiency: It is 90% efficient
4. Cost: It is LESS EXPENSIVE
5. Availability: Wireless charging is available now

Power (watts)	Candidate Vehicles	Trials	Where?	Plug-In Equivalent
3,300	Cars (residential)	Underway	Multiple Countries	Level 2
10,000	Cars and Light Commercial Vehicles	Underway	US (California and Pennsylvania)	
30,000	Medium Duty Commercial	Underway	US (California and Pennsylvania), Germany	
60,000	Heavy Duty Commercial Vehicles including Buses	Planned		Level 3
100,000	All Commercial Vehicles	Planned		

Electric Hospitality Shuttle Scenario

Shuttle goes from Hotel to 2 Airport Stops

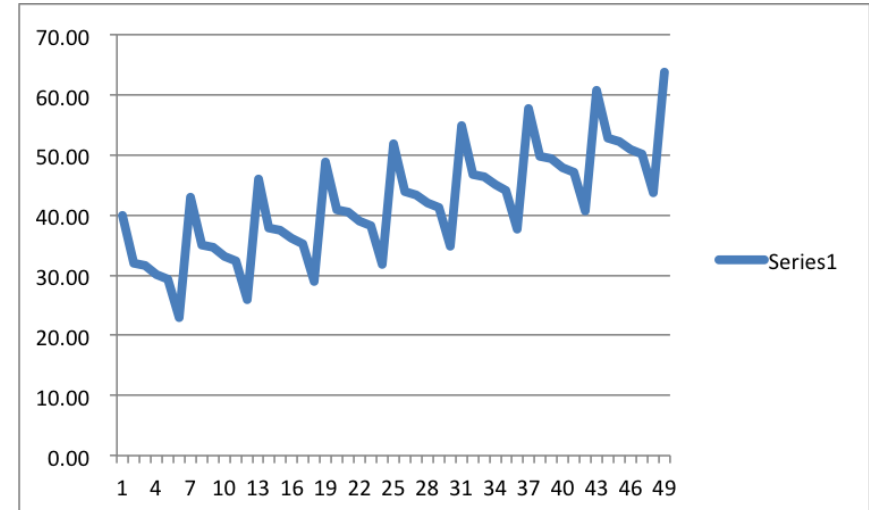
Vehicle battery is small – 40 kWh (lower vehicle cost)



In this scenario, an electric shuttle bus is NOT charged opportunistically. After less than an hour, it's SOC reaches zero.

A larger capacity battery will merely delay this.

SOC = State of Charge



In this scenario, the vehicle is charged at each hotel stop during normal loading and off-loading of passengers. Air conditioning (or heating) is provided by grid power.

The SOC remains above 50% and the vehicle can remain in operation 24/7.

Summary

- ✓ **Wireless power is an emerging technology, but...**
- ✓ **It's here now!**
- ✓ **It's ideal for commercial vehicles.**
- ✓ **Why? Automatic Hands-Free Operation!**
- ✓ **It can work with any Commercial Vehicle.**
- ✓ **Opportunity Charging increases range and reduces TCO.**
- ✓ **It can work anywhere.**

One more thing...

Don't believe everything you read – it's less expensive.