Sustainable Transportation / Great Products

Accelerate the Electric Vehicle Revolution

1. Selling Tesla EVs

2. OEM Tesla powertrains
What is the Problem we are solving?

Fossil Energy

Renewable Energy
Two main centers of Innovation

• Electric Energy Storage (Batteries)
  – Battery lifetime
  – Battery safety, cooling, management
  – Battery cost reduction
  – Energy density and range improvement

• Electric Power Conversion and Control (Power Electronics)
  – Chargers
  – Traction inverter (motor control)
  – Supercharging (off board high-power DC charger)
  – Renewable Energy Integration (grid-tie inverter/chargers)
  – Cost, efficiency, power density
Power Electronics for Sustainable Transportation

Manage ALL energy flow

Grid

Solar

Power Electronics

Batteries

Motor

AC

DC

AC

DC
Efficiency is 3-5x as important!

Solar

Drive Inverter

Inverter/MPPT

Charger

Grid

Batteries
Power Electronics Directions to Focus

• **Efficiency**
  – Compounded benefits, more fundamental than simply higher power density

• **Advanced Control Algorithms**
  – Clever ways to save 0.1% in software are worth a huge amount

• **Higher operating Temperatures**
  – Power density
  – Lower Cost
  – Reliability

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Efficiency Compounding

Efficiency Increase

- Higher Power Density
  - Fewer Parts
  - Less Volume/Mass
  - Lower Cost

- Lower Die Temp.
  - Longer Range
    - Faster Acceleration
    - Faster Cruise/Climb
    - Lower Wh/mile
  - Smaller Heatsink
  - Longer Life
  - Higher Reliability