

Inductive Power Transfer The Future of Electric Vehicles

Will Charles General Manager
Technology Development

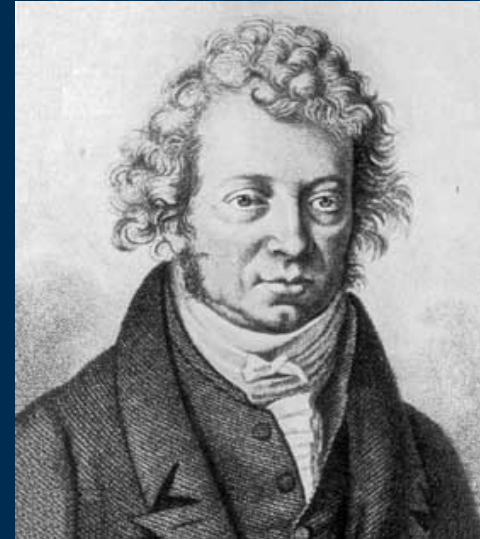
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IPT: What is it?

- IPT: A method of efficiently transferring electrical power without wires over relatively large distances.
 - No trailing wires
 - No sliding contacts
- Unaffected by dust, dirt, water, or chemicals
- IPT is based on Ampere's and Faraday's Laws

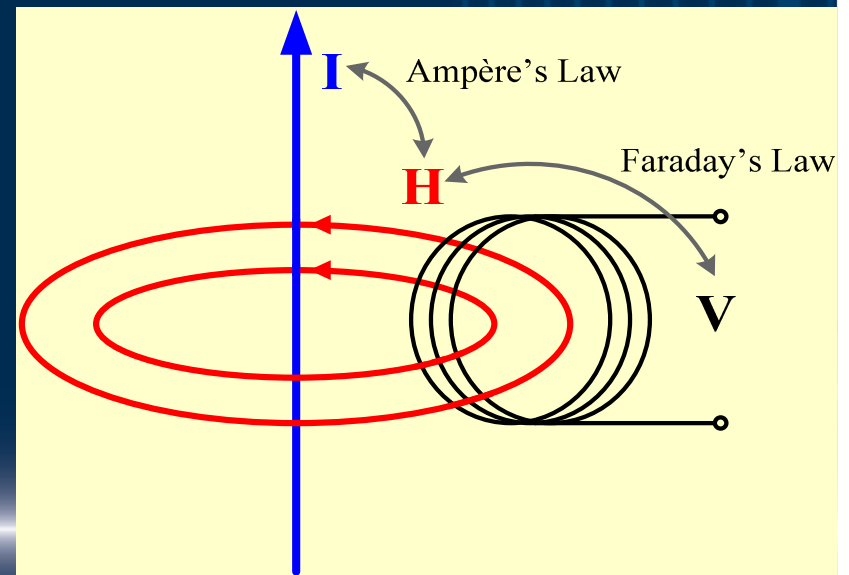
Fundamentals of IPT

- Andre-Marie Ampere:
 - Proposed that magnetic fields and electric currents must exist together
- Michael Faraday:
 - Discovered electricity could be generated by mechanical machines resulting in dynamos & electric motors

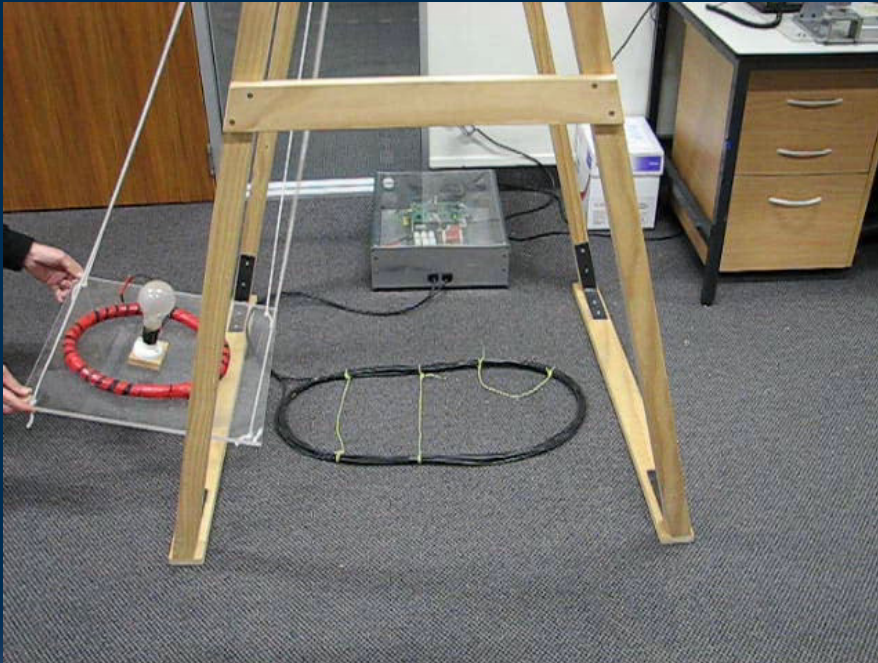
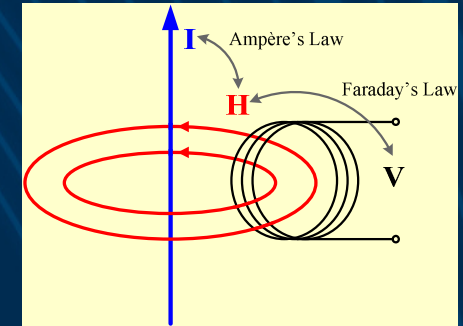


Simple Demonstration

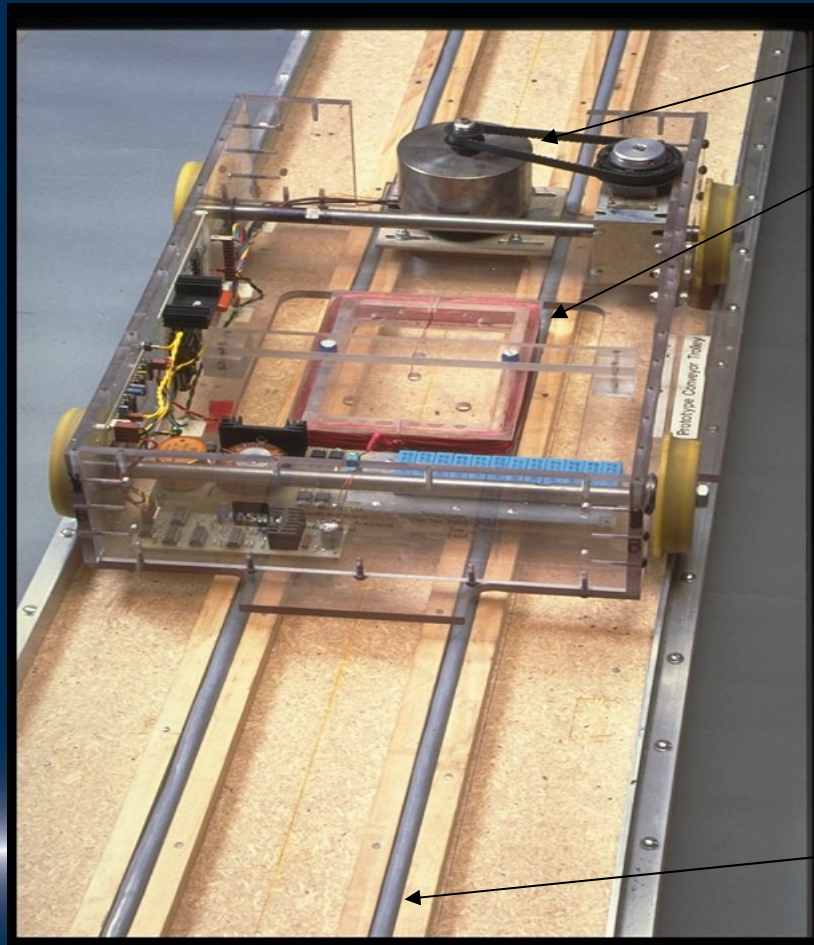
- There is a current in the wire (I)
- This current produces a magnetic field (H)
- A coil that intercepts this field has voltage (V) induced in it driving a light bulb.
- Requires a high frequency generator
- Needs modern controllers



IPT Lighting



In 1990 at the U of A: A first IPT System



Brushless DC Driving Motor
2mm Operating air-gap

- Alignment non critical
 - No power regulation
 - Maximum 1 trolley/track
 - Large pick-up coil
 - Low efficiency
- But it worked!!!

100 pair telephone cables

Evolved into a number of commercial areas

- Electronic factory automation (eFA)
- Automatic Guided Vehicles
- Roadway traffic guidance (Road-studs)
- Lighting
- Slip Rings
- Industrial Actuators and Switches

Electronic Factory Automation



70% of World Microchip FABs

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Automotive Factories

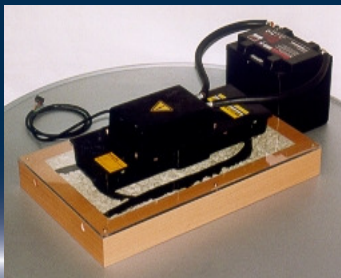


Daifuku services

First People Movers -2001

- Charging bays
 - Rapid charging
 - Computer controlled
 - 20kW charge 7min/20min
- 3kW pick-ups
 - 10 per vehicle
 - 5 vehicles

Whakarewarewa
Rotorua Charging Bay



First People Movers

Genoa, Porto Antico



- 3 buses each with 56 x 6V Batteries
- Charging 60kW for 10 minutes/hour
- Narrow Gap

Wampfler: 30kW Charging Pick-ups

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Roadway Lighting



Tunnel (Wellington NZ)



Tunnel (Sydney Australia)



Double left turn (Illinois USA)

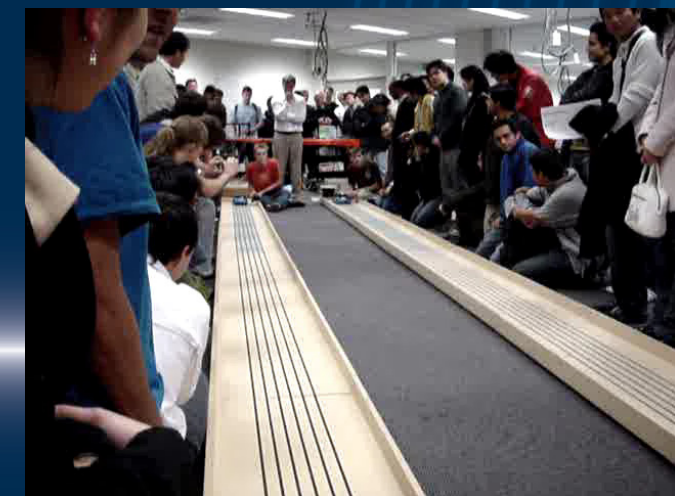
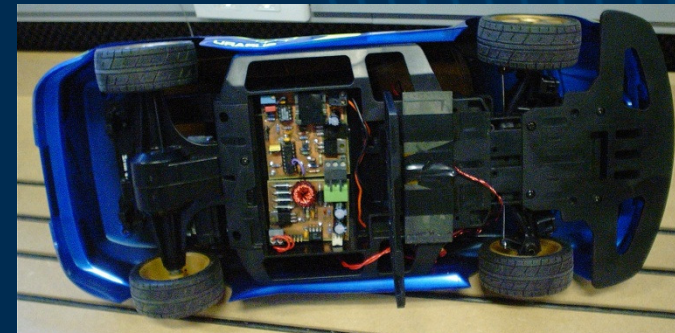
3i Innovation

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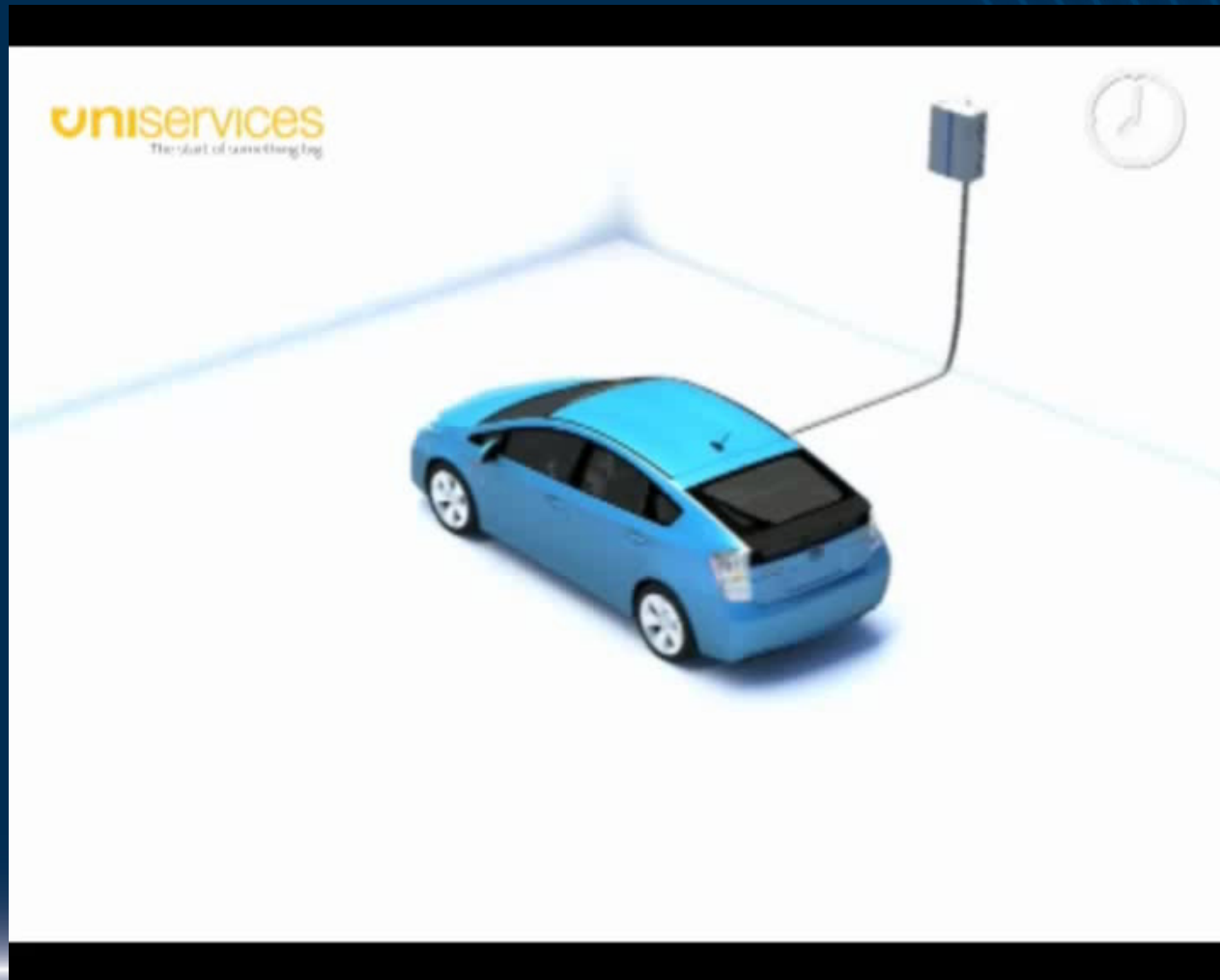
Electric Vehicles

The challenge

We had.....

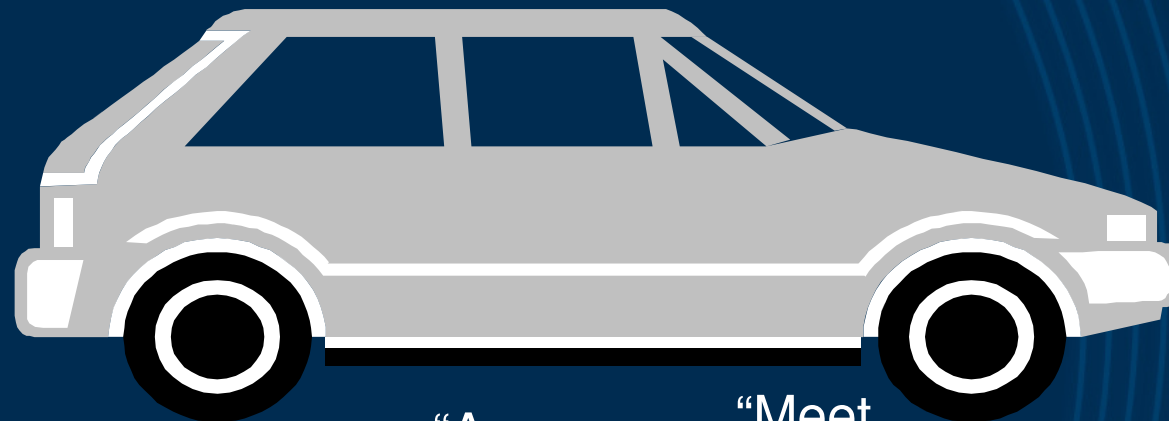


The Dream



The Challenge EVS23 2007 – what the Industry said

“Lateral Tolerance +/-80%”



“Vertical Tolerance
from 10cm to 40
cm”

“As
efficient
as a
plug”

“Meet
ICNRIP
Guidelines
for
Magnetic
Emissions”

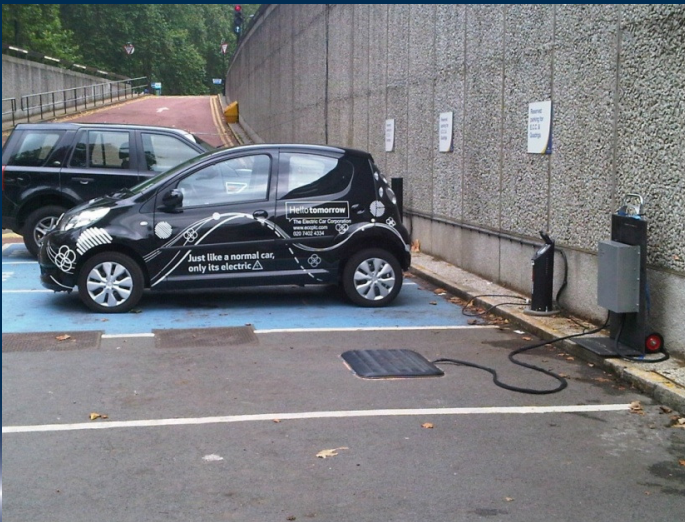
EVS 24 – Stavanger Norway – Proof of Concept Formation of Halo



Case Study – 3kW Citroen Field Test



Case Study – 3kW Citroen Field Test



3kW Citroen Field Demonstrations

- 3kW system fitted on two vehicles
- Operating since September 2010
- Vehicles now operating under continuous monitoring within UK's CABLED programme
- Independent performance measurement programme with Oxford Brookes University:
 - System efficiency
 - Emissions protection
 - Mis-alignment tolerance

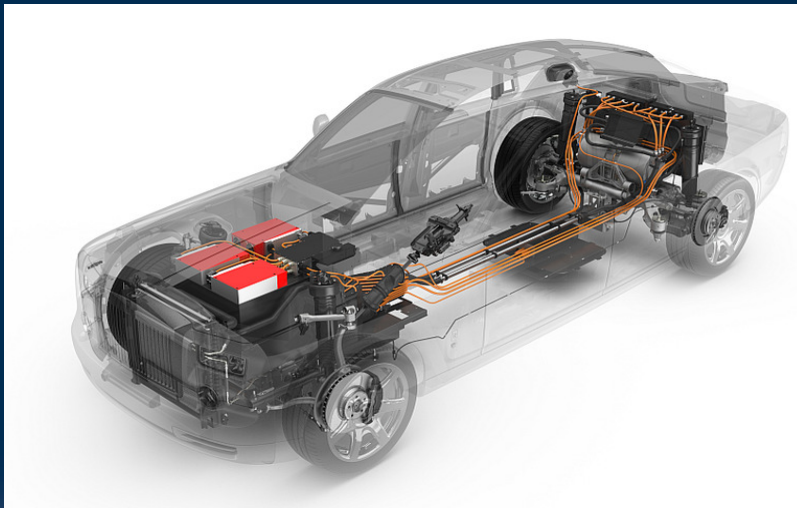


Case Study – Rolls Royce Phantom 102EX



Case Study – Rolls Royce Phantom 102EX

- 7kW system installed in Feb 2011
- Fully integrated with vehicle's electrical system and driver interface
- Well publicised at the Geneva Motor Show launch
- The vehicle is now on a world-wide demonstration tour



EVS 25 China – Validation



Two new technical challenges

- Interoperability – enables flexible standardisation
- Future proofing – stationary and dynamic charging capability

Purchase by Qualcomm

- In October 2011 Halo purchased by by Qualcomm, a Fortune 500 company listed
- Multi-vehicle trial Announced in the UK

David Cameron “This wireless charging technology is a giant leap forward for the electric car industry and I am delighted that London businesses will be among the first to benefit from the trial.”

- 20KWatt Race Car System



Horizontal vs Vertical Business Models

There are two approaches to an industry business model for wireless electric vehicle charging (WEVC): a fragmented vertical model where multiple companies vie for market position based on a mostly proprietary technology offering; or alternatively, an horizontal model, where a common standardized technology forms the basis for multiple suppliers of wireless charging solutions

Both business models offer technology innovation, which is essential to drive market adoption, but only the horizontal business model can deliver keen market competition and long-term economies of scale to drive down costs

Licensing

The Qualcomm business model is founded on 26 years of investment in research and development – over \$2.9 billion in 2011. Qualcomm is an innovation engine – investing up front in projects, such as Wireless Electric Vehicle Charging – and then licensing its technology broadly, to multiple companies, thereby encouraging innovation and delivering a vibrant and competitive supplier market

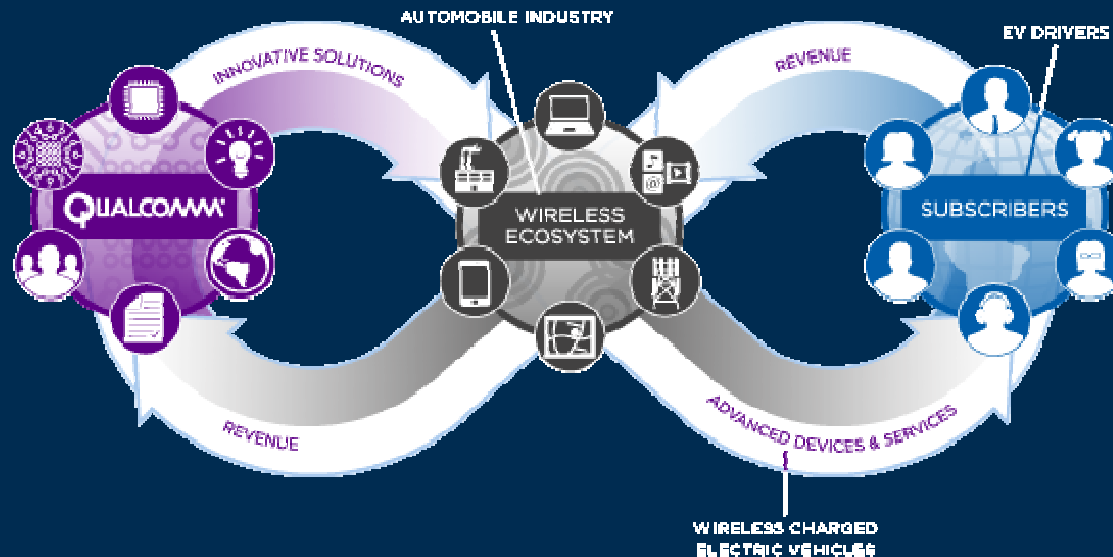
This business model is collaborative and means that multiple companies can bring their own inventiveness to the table, while enabling eco system partners to focus on their own core competencies, to develop unique product features and build total system capabilities

Validation

The validation of this model is apparent in the extensive competition in the markets in which Qualcomm operates and is highlighted by the growth these markets continue to experience. In addition, Qualcomm participates in relevant standards bodies to help drive common standards that foster rapid transition to new technologies

It's a win-win-win situation; for the auto manufacturers who get competitive offers for a standards based interoperable technology; for component suppliers who can innovate at a feature level while benefiting from industry-wide R&D programs; and for customers who get cost efficient wireless charging and don't have to worry about the compatibility of wireless charging points

Qualcomm Halo Business Model and the Opportunity for NZ



The original
The most efficient and flexible
The most interoperable
Static and dynamic – future proofed
The best business model

Thank-you

The start of something big

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**2010 WINNER
LARGE BUSINESS
CATEGORY**

VERO
EXCELLENCE IN
BUSINESS SUPPORT
AWARDS

