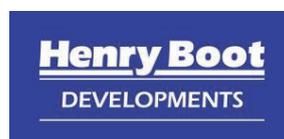


Investment Seminar: Sunderland, UK



How collaboration in the automotive and advanced manufacturing sector in the UK, particularly in the North East region, is driving co-creation and growth.

May 2018



MAKE
it Sunderland

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Welcome:



On behalf of Sunderland City Council, I am delighted and honoured to welcome you to this seminar focusing on how collaboration in the automotive and advanced manufacturing sector in the UK, particularly in the North East region, is driving co-creation and growth.

The close relationships we have forged with Japan and its automotive companies over the years are very strong and continue to be strengthened by events such as this.

I am proud of the City Council's committed, partnership approach which encourages new investments and automotive component manufacturers to the city and wider North East England region. We have an impressive track record of attracting support for the automotive sector, and for working with companies to help them locate, grow and thrive.

As the sixth fastest growing economy in the country and the fastest growing in the North East, we are a city that is going places. We top the league of the UK's exporting cities mostly due to our £4.48bn motor vehicle exports and we've also been named one of the best UK cities to start a business. Sunderland also has the people, the technology, the experience, the skills, the location and the drive to succeed, which combined offer automotive companies and potential investors an unbeatable, results-led package.

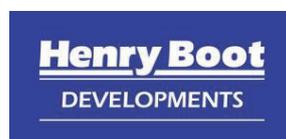
We also have exciting plans for the future. The International Advanced Manufacturing Park (IAMP) planned next to Nissan Motor Manufacturing UK plant in Sunderland has been identified by the UK Government as a Nationally Significant Infrastructure project. Being 150 hectares in size the project will have the magnitude and impact to boost the growth of the UK's high-tech, automotive and advanced manufacturing industries, and help to position the UK as a global player in these fast-growing sectors.

The IAMP, which has attracted more than £47m UK government funding, is expected to create more than 7000 jobs and bring in more than £500m of private sector investment during the next decade by attracting a wide range of international companies to invest in the area.

Sunderland has worked hard to carve a strong position on the global stage as a first-choice location for automotive companies. We are delighted to have the chance to discuss the importance of global automotive success.

Regards

Irene Lucas CBE
Chief Executive, Sunderland City Council



Profile of Sunderland in the global automotive sector:

The UK automotive industry has enjoyed a sustained period of growth with production nearing record levels, and overtaking Germany to become Europe's leading nation for automotive productivity. At the same time the sector is playing its role in building a strong knowledge economy with emerging technologies and process innovation key to driving the sector forward.

The automotive industry is a vital part of the UK economy accounting for more than £77.5 billion turnover and £18.9 billion value added, accounting for 12.0% of total UK export of goods. More than 30 manufacturers build in excess of 70 models of vehicle in the UK supported by 2,500 component providers and some of the world's most skilled engineers.

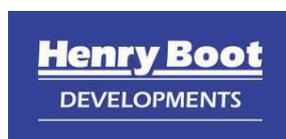
The City of Sunderland lies at the heart of Europe's foremost car manufacturing region - North East England – and is home to the UK's largest car plant, Nissan (NMUK). More than 30,000 people now work in the sector, with one in every three cars manufactured in the UK built in the city.

The region produces around 30% of the UK's passenger cars, 26% of all Electric Vehicle production across Europe and 6,000 non-highway vehicles. Since Nissan began production in Sunderland over 30 years ago, it has revolutionised car manufacturing across Europe, contributing to the resurgence of the UK automotive industries. More than 240 companies are now operating in the wider North East region, including substantial OEMs – Nissan, Komatsu, Caterpillar, Cummings & Eldis - supported by 28 tier one suppliers as well as a wealth of specialist SMEs and valuable R&D centres. The North East has built, and continues to grow its reputation in the global automotive industry, and is witnessing unprecedented levels of productivity, investment and collaboration.

Nissan has invested more than £4bn in its Sunderland plant since 1986, with total plant volume standing at 9 million units and 80% of production exported to over 100 markets worldwide. The plant produces the Nissan Qashqai, Juke, Infiniti Q30 and the 100% electric Nissan LEAF. In addition to the 7,000 direct employees at Sunderland, the plant supports a further 30,000 automotive supply chain jobs in North East England.

Following the announcement in October 2016 that Nissan will produce the new Qashqai and add production of the next X-Trail model at its Sunderland UK plant, there are new opportunities to become part of this exciting success story, with planned volume growth within the wider Nissan-Renault Alliance. There are also opportunities for companies to export automotive components, and supply OEMs located in other parts of the UK, from a strong Sunderland base.

Sunderland City Council works closely with the automotive and advanced manufacturing sector and the UK Government to ensure priorities which will sustain business confidence, attract investment and secure the growth ambitions of the sector - and welcomes statements made by UK Government in highlighting the importance of the UK automotive industry to the economy and the importance of its continued competitiveness in the global economy. Sunderland City Council have also been actively involved in the formation of Europe's fastest-growing industry-led automotive cluster group, the North East Automotive Alliance (NEAA).



The International Advanced Manufacturing Park (IAMP), between Sunderland and South Tyneside, has been awarded more than £42 million of UK Government funding and was also designated by the Secretary of State as a Nationally Significant Infrastructure Project which will bring thousands of new jobs and hundreds of millions public and private investment to the region boosting its already impressive record for exporting. Located next to the Nissan plant, the IAMP will provide approximately 392,000 sqm of new floorspace for automotive and other advanced manufacturing, engineering and related distribution businesses, delivered on a site of 150 hectare site.

Sunderland is open for business, open to business, with a comprehensive transport infrastructure, a deep-sea port, two regional airports and easy access to north-south road and rail routes. The attractions are strong, solid and proven. Put simply, we believe Sunderland is the easiest place in the UK to do business.

www.makeitsunderland.com

Contacts:

- Peter McIntyre, Executive Director Economy and Place, Sunderland City Council
E: peter.mcintyre@sunderland.gov.uk
- Tom Hurst OBE, Head of Automotive, Business Support & Investment, Sunderland City Council
E: Thomas.hurst@sunderland.gov.uk
- Catherine Auld, Head of International Relations, Business Engagement & Investment, Sunderland City Council
E: catherine.auld@sunderland.gov.uk
- Vicky Happer, Senior Economy Communications Officer, Sunderland City Council
E: Vicky.happer@sunderland.gov.uk
- Masao Kumori, Senior Inward Investment Officer, Sunderland City Council Japan Office
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Investment Seminar: Sunderland, UK:

How collaboration in the automotive and advanced manufacturing sector in the UK, particularly in the North East region, is driving co-creation and growth.

The UK's referendum in June 2016 on membership of the European Union has led to discussions across all sectors about the potential impact on the country's economy, including both potential challenges and future opportunities. For the automotive industry in particular, discussions include how the outcome of the referendum could change the dynamics for an industry which relies on an integrated global supply chain and cross-border trade, in both components and final products.

The automotive industry in the UK is world class and embracing emerging technologies as it continues to grow. The sector continues to be a key priority, with the UK Government recently setting out its Industrial Strategy which includes an expected rolling series of sector deals. The Automotive Sector Deal will grow the partnership between Government and industry, with finance of a quarter of a billion pounds to boost investment in emerging technology and in establishing the UK's leadership in meeting the Future Mobility and Clean Growth Grand Challenges. There are real opportunities for Japanese investors to build on a long and successful track-record within the UK to be at the heart of this growth sector.

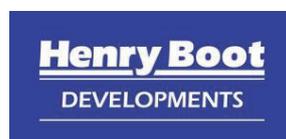
Nissan, Toyota, BMW and Vauxhall have all announced important investments in the UK within the last eighteen months. As the UK redefines its position in the global economy, it will offer a range of potential opportunities for the automotive industry as it adopts new technology and moves to electric, as well as connected and autonomous vehicles. A comprehensive modern industrial strategy will support those advances and improve the competitiveness of the industry and its supply chain in the UK, with the ambition to increase locally sourced parts and components, currently at 44 percent, to 60 percent.

This seminar highlights:

- High-level insight into opportunities with future mobility and clean growth in accelerating the transition to ultra-low and zero emission vehicles
- Investment opportunities to access wider UK growth in the automotive sector
- Innovation and collaboration opportunities for companies developing connected cars and autonomous driving in the European market



- **Organiser:** MAKE it Sunderland (Sunderland City Council)
- **Supporters:**
 - Department for International Trade, British Embassy Tokyo
 - Hyperdrive Innovation Ltd
 - Japan External Trade Organization (JETRO)
 - North East Automotive Alliance
 - Tokyo Chamber of Commerce & Industry (TCC&I)
 - Vantec Europe Ltd,
- **Capacity:** 60 people
- **Participation Fee:** Free of Charge
- **Language:** Japanese/English Simultaneous Interpretation
- **Date & Time:** Tuesday 22 May 2018 (Registration Start: 14:00)
 - Seminar: 14:30 – 17:00
 - Reception: 17:15 – 19:00
- **Venue:**
 - Seminar: Room A, WTC Conference Room, World Trade Center 3F (<http://www.wtc-conference.jp/access.html>)
 - Reception: Tokyo Kaikan, World Trade Center 39F



Seminar Programme:

(MC: Ms. Catherine Auld, Head of International Relations, Business Engagement & Investment, Sunderland City Council)

| | |
|--------------|---|
| 14:30 | Opening remarks: Sunderland – a leading automotive hub Peter McIntyre, Executive Director, Sunderland City Council |
| 14:40 | Welcome address & Brexit – the UK as a global investment location Mr Darren Goff, Head of Investment Japan, Department of International Trade, British Embassy Tokyo |
| 15:00 | Keynote speech: How the UK is leading the way in world-class automotive and advanced manufacturing Dr. Richard Parry-Jones CBE, Chair of the Government's Faraday Challenge Advisory Board (former Group Vice-President-Global Product Development, Chief Technical Officer and Head of Global R&D Operations at Ford Motor Company, former Chairman of the Welsh Assembly Government Ministerial Advisory Group and the UK's Automotive Council) |
| 15:30 | Q&A |
| 15:40 | Coffee break |
| 16:00 | Insight 1: Investing in emerging technologies – The UK as a location of choice Mr. Martin Kendall, Managing Director Vantec Europe Limited Deputy Division Director S.Q.C |
| 16:20 | Insight 2: Access to innovation – Technologies to shape the future of the sector Mr. Stephen Irish, Managing Director, Hyperdrive Innovation Ltd and Advisory Board Member, North East Automotive Alliance |
| 16:45 | Q&A |
| 16:55 | Closing Remarks Tom Hurst OBE, Head of Automotive, Business Support & Investment, Sunderland City Council |
| 17:00 | End of the seminar |
| 17:15 | Networking reception - Tokyo Kaikan, World Trade Center 39F |
| 19:00 | End of the reception |



Profile of Speakers:

(In order of speaker)



Peter McIntyre, Executive Director Economy and Place, Sunderland City Council

Peter is an experienced economic development professional with a demonstrable track record of leadership and delivery in complex organisations and environments.

He has built his career on delivering significant economic and social value by creating and implementing innovative commercial business models for the public sector. Peter has a strong track record in the UK of development, regeneration and infrastructure delivery, building bespoke solutions to execute strategic economic priorities.

He leads the Economy and Place Directorate within the Council which covers functions as diverse as Economic Development, Inward Investment and Regeneration, Planning and Housing, Highways and Infrastructure and Property and Place Management, employing over 1000 dedicated staff.



Darren Goff, Head of Investment, Department for International Trade, First Secretary, British Embassy

Darren Goff is the Head of Investment at the British Embassy in Tokyo. His role is to provide support to Japanese companies already investing in the UK and to promote the UK as a destination for new investors. Darren has spent most of his career working in the Department of Business and UK Trade and Investment most recently leading the Strategic Relationship Management programme in London which focused on supporting the largest 80 investors and exporters in the UK.

April 2016

Nov 2015

April 2014 – Oct 2015

July 2013 – April 2014

Oct 2011 – June 2013

Sept 2008 – Oct 2011

July 2002 – Aug 2008

Sept 2000 – Sept 2002

Oct 1997 – May 2000

Head of Investment, British Embassy Tokyo

Language training, FCO, London

Head of Strategic Relationship Management (SRM), managing relationships between UK Government and some of largest foreign investors. (UK)

Head of Finance and Performance, Investment Group, UKTI (UK)
Higher Education Policy and Finance, Department for Business, Innovation and Skills (UK)

Corporate Finance roles, Department for Business, Innovation and Skills

Further Education and Higher Education roles, Department for Innovation, Universities and Skills and Department for Education and Skills

Reed Elsevier, New business (UK) and English teaching in UK

Language school manager (Japan)





Professor Richard Parry-Jones CBE
Feng, FIMechE FRSS

Richard Parry-Jones has had a glittering 50 year career in the Automotive Industry, and continues to be a key influencer in his consulting and public appointment roles. After joining Ford in the UK in 1969 as an undergraduate apprentice, he went on to become a key leader in Ford's R&D activities, developing many award-winning and successful models in the 1970s and 80s, leading Research Labs in the UK and in the US, and running manufacturing operations in Germany.

In the 90s he was recalled to head up Ford's European Vehicle Engineering centre, and famously developed the Mondeo for global markets which won Car of the Year at launch and began to redefine Ford's brand positing away from a fleet appliance maker to a maker of rigorously engineered, desirable high quality vehicles that were delightful to drive. He went on from there to head up Ford's global R&D Centre for small and medium cars and led the development of the game-changing Ford Focus launched in 1998.

In 1998 he was selected to head up all of Ford's Global R&D activities, leading a team of 33,000 engineers, scientists and designers around the world, and added the role of Chief Technical Officer in 2000, roles he held until his retirement from Ford in 2008. During this time he oversaw R&D activities in Ford's family of Brands including Jaguar, Aston Martin, Land Rover and Volvo, during a time of heavy investment and growth in the premium sectors.

Professor Parry-Jones worked extensively throughout his career in Japan, and is well known to the Japanese Auto industry, having worked with many of the large Japanese Tier 1 suppliers. He was involved with partnerships and relationships with companies such as Toyota, Nissan and Yamaha, and has appeared numerous times in interviews with member of the Japanese Auto press. He also served as a senior advisor to Mazda, including a period of four years as Chairman of the Mazda Advisory Board.

Since his departure from Ford in 2008, he has held a number of Non-Executive positions and runs his own Consulting company, RPJ Consulting, with an impressive portfolio of blue chip clients in the international Auto, Mobility, Aerospace and Energy sectors. Until recently he was founder Chairman of the UK Automotive Council, working with UK auto OEMs such as Nissan, Honda and Toyota and Tier 1 suppliers to promote investment and growth in UK auto R&D and Manufacturing. He still serves on the Council, with a special remit on Electrification. He was recently announced as Chairman of the UK Faraday Challenge Advisory Board – whose role is to steer the UK's path to becoming a major player in the rapidly evolving battery technology and manufacturing market.





**Martin Kendall, Managing Director, Vantec Europe Limited
Responsible for logistics in Europe and Russia and Global
responsibility for Safety Quality and Cost**

Joined Nissan 1986

- Material Handling Team Leader 1988
 - Material Handling Supervisor 1990
 - Material Handling Engineer 1999
 - Joined Autrans = Vantec 2002
- Nov 2002 – General Manager
 - April 2012- Managing Director Vantec Europe Ltd



**Stephen Irish, BEng, CEng, MIMechE
Managing Director - Commercial
Hyperdrive Innovation Ltd**

Stephen has substantial experience in technology development and product delivery having worked in tier one automotive supply chain companies, OEMs and engineering consultancies. He wrote his degree thesis on electric and hybrid vehicle technology almost 20 years ago and is a founding director of Hyperdrive Innovation.



Tom Hurst OBE, Head of Automotive, Business Support & Investment, Sunderland City Council

Tom worked for a number of years in the private sector in the financial world within construction, food and metal industries.

Tom has also carried out considerable consultancy work in South Africa and has worked in the local Government sector for approximately 25 years. He has headed up projects which have brought in over one billion pounds of private sector investment and led to the creation of over 20,000 jobs.

Thomas headed up the award winning Doxford International Business Park, which alone was responsible for over six hundred million pounds of investment, and the creation of 8,000 new jobs.

Tom jointly heads up Sunderland's international links with China and the United States.

(Moderator of the seminar)



Catherine Auld, Head of International Relations, Business Engagement & Investment, Sunderland City Council

Catherine Auld has developed her career in the public sector, focusing initially on international engagement within local government before taking on wider responsibilities related to Sunderland's economic development. After graduating from the University of Edinburgh, she began international work in the Higher Education sector before joining Sunderland City Council.

Catherine was responsible for developing Sunderland's approach to international engagement with key partners across the city, and continues to develop and strengthen relationships with Sunderland's formal international partner cities in France, Germany, the United States and China through a range of joint projects. Her responsibilities include working with a wide variety of businesses from Sunderland's key sectors - from small and medium-sized businesses, which are developing emerging technologies in the City Council's own business centres, to large multinational companies who have chosen or are considering Sunderland as their location.

Catherine holds a Masters in Business Administration from Newcastle University Business School and her dissertation focused on the role of local government in economic development. She is committed to working with colleagues and partners to create the best environment for companies to thrive and prosper in Sunderland and the wider North East England region.



Presentations:

- 1. Opening remarks: Sunderland – a leading automotive hub**
Peter McIntyre, Executive Director, Sunderland City Council
- 2. Key note speech: How the UK is leading the way in world-class automotive and advanced manufacturing**
Dr. Richard Parry-Jones CBE, Chair of the Government's Faraday Challenge Advisory Board
- 3. Insight 1: Investing in emerging technologies – The UK as a location of choice**
Mr. Martin Kendall, Managing Director Vantec Europe Limited Deputy Division Director S.Q.C.
- 4. Insight 2: Access to innovation - technologies to shape the future of the sector**
Mr. Stephen Irish, Managing Director Hyperdrive Innovation Ltd and North East Automotive Alliance Advisory Board Member



MAKE it Sunderland

Sunderland, UK

Our city, our economy and our
growing automotive sector

Peter McIntyre
Executive Director Economy and Place
Sunderland City Council

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Sunderland, UK

Located at the Heart of North East England

1.2 million live within a 10 mile radius

Working age population is 780,000

Key location for industry

17% of Sunderland's workforce
is engaged in manufacturing
(vs. 8% nationally)



World-class location for advanced manufacturing...

Long tradition of engineering excellence

A centre for advanced manufacturing including automotive, aerospace and defence

Major companies include Nissan, Rolls Royce and BAE Systems, along with their suppliers

Other key sectors include software/digital, financial and customer services, offshore and renewable energy and logistics





A world-renowned centre for the automotive industry

One of Europe's principal automotive locations in just 30 years

Nissan's has attracted tier one suppliers to the area

Due to skills availability and unparalleled productivity rates, these plants have repeatedly expanded

These companies now serve OEMs located throughout Europe



Investment track record

Overseas investment has been key to Sunderland's success

86 companies originating in 21 countries have chosen to locate in the city

Together these employ 26,000 people (31% of all jobs in the city)

The biggest source of FDI is Japan, 12 companies = 11,000+ jobs mostly in the automotive sector - 7,000 Nissan

8,600 jobs and £1.1 billion of investment secured during the past five years

Home to a successful cluster of global tier one supply chain companies



Sunderland's biggest asset is its workforce...

Business growth isn't constrained by skills shortages, as it is elsewhere

Programmes are in place to ensure that labour availability keeps pace with demand

12.4% of Sunderland's workforce has skills that are key to advanced manufacturing* (vs. 6.2% nationally).

*skilled metal, electrical and electronic trades; skilled process, plant and machines operatives





North East Automotive Alliance (NEAA)

Established to support the economic sustainable growth and competitiveness of the sector in North East England

Largest automotive cluster in the UK and fastest growing in Europe

Industry led with a strong Executive and Advisory Board

Number of thematic working groups including business excellence (competitiveness), skills and innovation and technology



International Advanced Manufacturing Park (IAMP)

Partnership between Sunderland and South Tyneside Council

150 hectare site north of NMUK plant with 260,000m² developable floor space

Recognised as a nationally significant infrastructure project with Enterprise Zone status and Centre of Excellence for Sustainable Advanced Manufacturing (CESAM)

Will lever-in £500 million (¥74bn) of private sector investment, creating more than 5,000 jobs by 2024

Henry Boot
DEVELOPMENTS

Invest
SOUTH TYNESIDE

MAKE
it Sunderland



Port of Sunderland Enterprise Zone

Deep water port with 24/7 access

New Enterprise zone status offering 8.3 hectares with
49.930m² developable floorspace

Sits on the city's Strategic Transport Corridor and ideally
located to meet the needs of the automotive sector

Intermodal hub for sea, road and direct rail

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it Sunderland

UK Auto Industry

Challenges and Opportunities from a North East perspective

Automotive in the UK

Turnaround to a position of strength vital to UK:

- 1.7 M cars built (versus 1M in 2009)
- Massive investment -- £2.4Bn R&D, £2.1Bn Capital annually
- Partnership with Government with clear strategy focusing on areas of strength and opportunity
- Overseas owners – Japan, America, India, China, Germany continue to invest
- Strong supply chain with 40% local content (up from 35% in 2011) with more upside
- 160,000 direct manufacturing jobs – many more dependent jobs
- 80% of vehicles are exported with a £40 Bn export value – 12% of all UK goods
- 18 global Tier 1 suppliers
- Motorsport -- nine of the 11 F1 teams in the UK. Sector sales of over £10bn.
- The UK is the No 1 producer of construction equipment in Europe and No 5 in the world.

Automotive in the North East

Key facts:

- Sales of £11bn, exporting £5.1bn and a trade surplus of £2.6bn
- Employees – 30,000 direct and impacting 141,000
- 46 regional investments totalling £1.6bn in past 5 years
- 1/3 of all UK car production is from the NE
- NE accounts for 26% of all EV production across Europe

The region is home to substantial automotive sector:

- OEMs – Nissan, Komatsu, Caterpillar, Cummins & Explorer
- 21 Tier 1 Suppliers
- 240 automotive companies in the direct supply chain

Massive Change

Driven by:

- External environmental concerns
- Safety and congestion pressures
- Changing customer tastes

Enabled by new technologies and innovation

Environmental Concerns

Climate Change

- CO2 Emissions reduction – 130g/km 2015
- 95g/km 2021
- Potentially 75g/km 2025
- California and other US states driving zero emission quotas
- China policy shift to accelerate electrification

City Air Quality

- NOX concentrations causing respiratory disease
- Lack of progress despite stricter standards (10-fold reduction in 15 years)
- Correlation between standard test protocols and real world emissions addressed with WLTP in 2017
- Implications – retreat of diesel growth especially small cars, widespread AdBlue use, PHEV and urban BEV volume increases

Traffic external costs

Safety, Health and Congestion are the overriding societal concerns about road traffic

- Collisions are 95% caused by driver error/road design
- Crash protection yielding diminishing returns
- Accident avoidance the biggest opportunity
- Emissions

Solutions

- Connectivity
- Autonomous control
- Modal integration
- Ride sharing

Customer change

Mass customisation

- Expanded model choices
- Increased personalisation
- Accessorisation quality concerns
- Instant order fulfilment

Car sharing

- Urban dwelling density
- Parking space supply shortage
- Improved mass transit provision
- Digital device technology enabler
- Car-to-infrastructure connectivity

Technological change

Electrification

- Hybridisation pervasive by 2025 – 48v and PEHV
- BEV growth restricted by affordability and charging station infrastructure
- Range anxiety restricts BEVs to either urban duties or expensive vehicles

Digital Connectivity

- Emulation of nomadic devices
- Vehicle communications with smart infrastructure to improve routing and traffic flow
- 5G enabler to greater sophistication
- Security concerns

Technological change

Autonomous control

- Progressive rather than 'big bang'
- Increasing levels of authority for autonomous control
- Timescale 10-15 years for significant scale
- Acquiring early IP crucial to avoid becoming franchisee

Factory automation – low cost flexible robots and Cobots

- Increasing intelligence of devices and software
- Machine learning developing rapidly
- Internet-connected machines increase productivity
- Human-friendly robots as colleagues

Regional focus

Spread throughout UK but especial 'hotspots' are:

- West Midlands – Birmingham and Coventry (Jaguar Land Rover), Oxford (BMW Mini), Tier 1 Suppliers
- Wales and West – Ford, Aston Martin, Toyota, Honda, Jaguar Land Rover) Tier 1 suppliers
- North East England – Sunderland Nissan, Tier 1 suppliers

Decarbonisation

- **UK CO2 glidepath**
 - Tougher than EU to 2030 and 2040
- **UK market -- electrification pace faster than most EU countries**
 - UK Auto Council (Joint Industry/Government body) strongly committed to establishing the UK as a pre-eminent source of electrification value creation.
 - Nissan and Jaguar producing BEVs, Toyota and Honda producing hybrids,
 - Growth plans for electrification in the UK production base will drive demand for up to 500,00 vehicle sets of motors, inverters and battery packs by 2025
- **Low Carbon Technologies**
 - Advanced Propulsion Centre (APC). 10 year (2013-2026) £1.3 billion joint investment between government and the automotive industry to research develop and commercialise the next generation of low carbon propulsion technologies.
 - Faraday Challenge launched 2017.

Background

- **Automotive Council UK partnership**
- **Faraday Challenge -- Chairman of Faraday Challenge Board**
- **Leading joint efforts on battery commercialisation in UK**
- **Need for battery Research, Development, Commercialisation and large scale production**
- **Focus on the entire Value Chain – electrode materials and fabrication through cell assembly to battery pack structures and systems,**

Roots of the Battery Challenge

- CO2 pressures and regulatory reduction glidepaths force end game of EVs
- City air quality concerns reinforcing and accelerating trend
- Cost of meeting emissions using fossil fuelled vehicles increasing
- EV enabling technologies developing rapidly BUT not yet able to meet market needs at scale
- But there is a huge cost penalty -- driven largely by excessive battery costs for acceptable range
- **Technology not yet ready for mass adoption!!!**

Battery and Charging -- barriers to widespread EV adoption

Battery

Immediate:

- Cost per Kwh
- Energy density -- driving weight and cost

Longer term:

- Recyclability, battery life extension,

Charging

Immediate:

- Long charging time when range-limited
- Charging point availability

Longer term:

- Electric power load capacity

Battery basics

- **Range**
 - Current customer demand of range of a BEV is much higher than typical daily mileage – they are looking for over 200 miles.
 - This may change with greater familiarity and as charging systems become more widespread, but the evidence is not *yet* strong
- **Cost**
 - For this range, BEV propulsion systems cost £10,000 more than ICE powertrains
 - Of this cost, 80% is the battery pack. The largest component of the pack cost is the cells.
 - Battery cost reduction progress– down from £800/Kwh to £200/Kwh in 8 years driven by scale, learning curve and technology
- **This is too currently too slow to deliver market potential in line with desired regulatory and societal timescales**

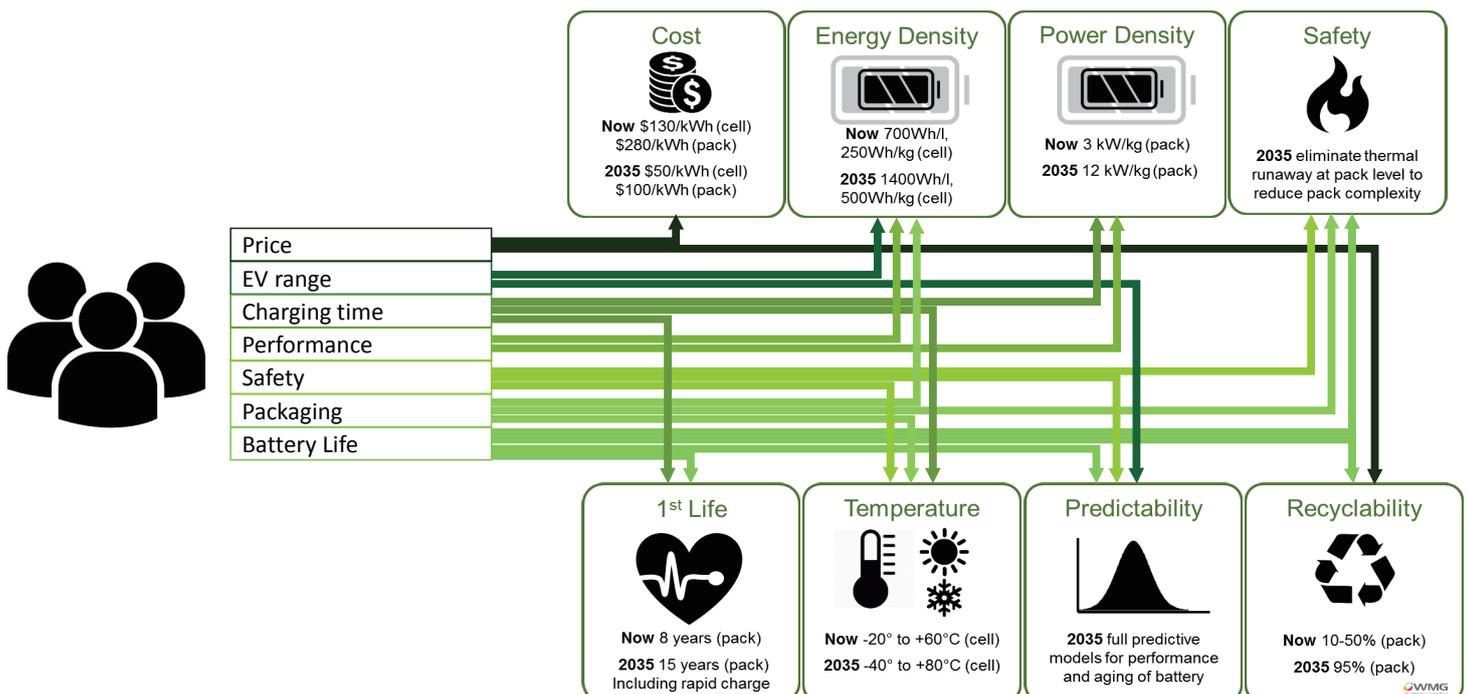
Chemistry wars

- We need to invest in battery cell and pack capacity using current technologies for expensive premium BEV/PHEV vehicles in the next 3-5 years
- Normal continuous improvement development will drive costs down further, but not to the levels required for near-universal customer adoption.
- Major innovations in cell chemistry and the cell materials and design value stream are urgently needed
- This is the thinking behind the Automotive Council partnership's agenda and the Faraday Challenge

Chemistry wars (cont)

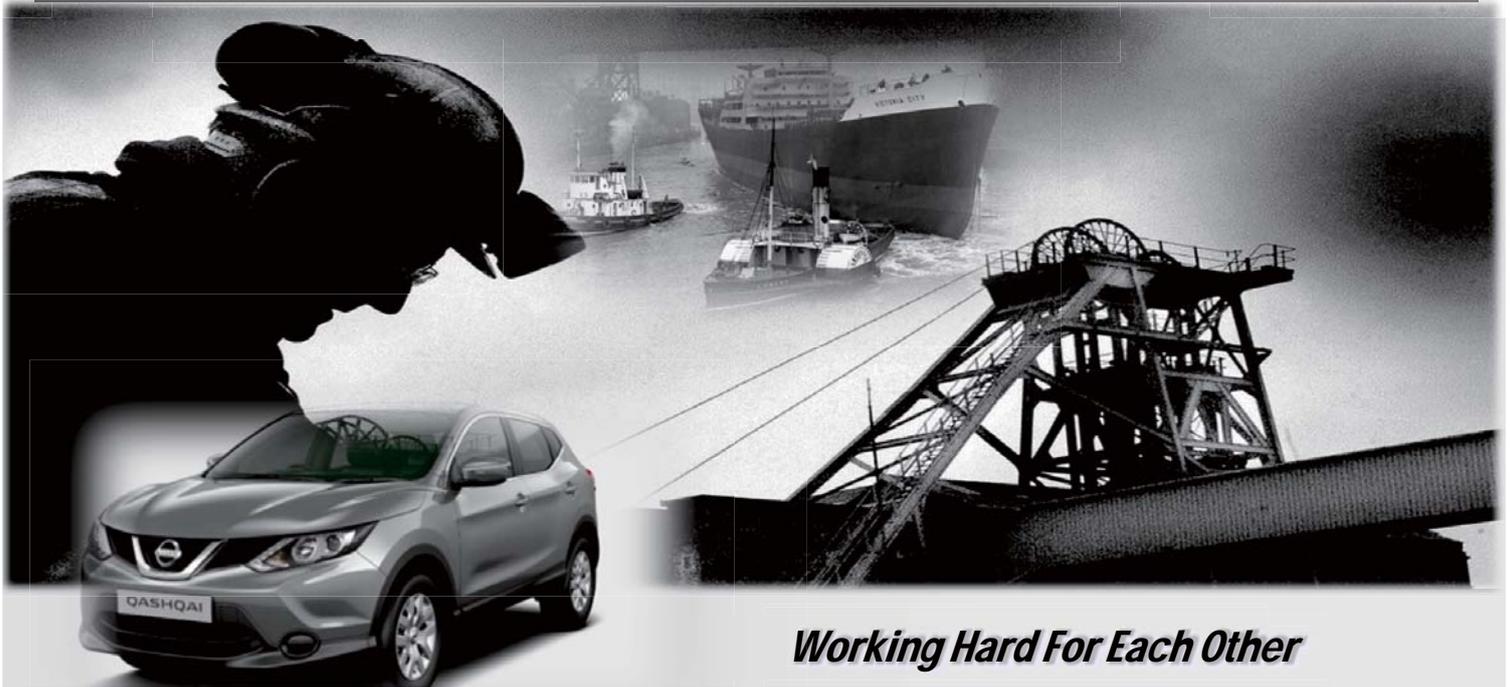
- **The Faraday Challenge** sets out to stimulate in the UK, uniquely among the competing nations of the world, a fundamental science-led research and development program with a joined-up industrialisation delivery program for electrical energy storage innovation. The main focus is on mobility applications, but synergistic storage opportunities will be addressed
- ***“The power of the Faraday Challenge derives from the joining-up of all three stages of research from the brilliant research in the university base, through innovation in commercial applications to scaling up for production. It will focus our best minds on the critical industrial challenges that are needed to establish the UK as one of the world leaders in advanced battery technologies and associated manufacturing capability.”***

Consumer requirements drive technical targets for 20 year timeframe



Next steps

- **Investors in:**
 - Giga-plant scale
 - Local electrode production
 - Large scale e-Drive unit production
 - Power inverter control production
 - Battery R&D as part of Faraday



Introduction



Martin Kendall

*Managing Director, Vantec Europe Limited
Responsible for Logistics in Europe and Russia
Global responsibility for Safety Quality and Cost*

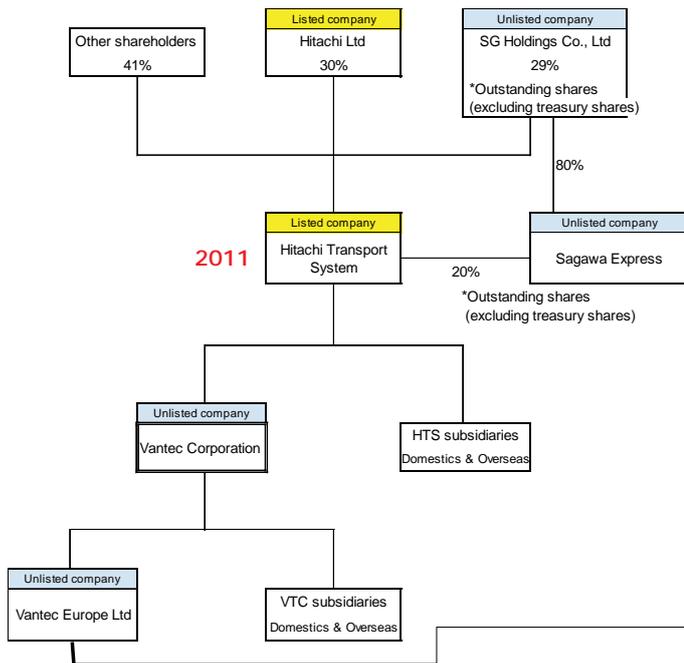
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- *Material Handling Team Leader 1988*
- *Material Handling Supervisor 1990*
- *Material Handling Engineer 1999*

Joined Autrans = Vantec 2002

- *Nov 2002 - General Manager*
- *April 2012- Managing Director*

HTS and Vantec Global Structure



| Company Name | Vantec Europe Ltd |
|-----------------------|---|
| Head Office | 3 Infiniti Drive, Hillthorn Business Park, Sunderland, Tyne and Wear, NE37 3HG T: +44(0)191 416 1133 / F: +44(0)191 416 1970 |
| Managing Director | Martin Kendall |
| Established | 1990 |
| Capital Stock | £2 million |
| Employees | 1065 Permanent headcount + 250 temp (April 2018) – Total 1315 |
| Consolidated Sales | £46.5 million (FY2017) |
| Vantec Europe Website | https://www.vantec-gl.com/uk |

HTS and Vantec Global Locations



VEU - Core Values & Guiding Principles



Compliance

We will adhere to Legal and Corporate Rules and Regulations

LAW/REGULATIONS
ETHICS

Customer Focus

We will strive to delivery a quality service to our customers in a safe manner

SERVICE
COST

Innovation and Excellence

We will develop our people and processes for business improvement, sustainability and growth

TRAINING & DEVELOPMENT
CONTINUOUS IMPROVEMENT
TECHNOLOGY

Diversity and Inclusion

We will provide an equal opportunities environment that promotes trust, communication and teamwork

EQUALITY
COMMUNICATION
TEAMWORK

Sustainability

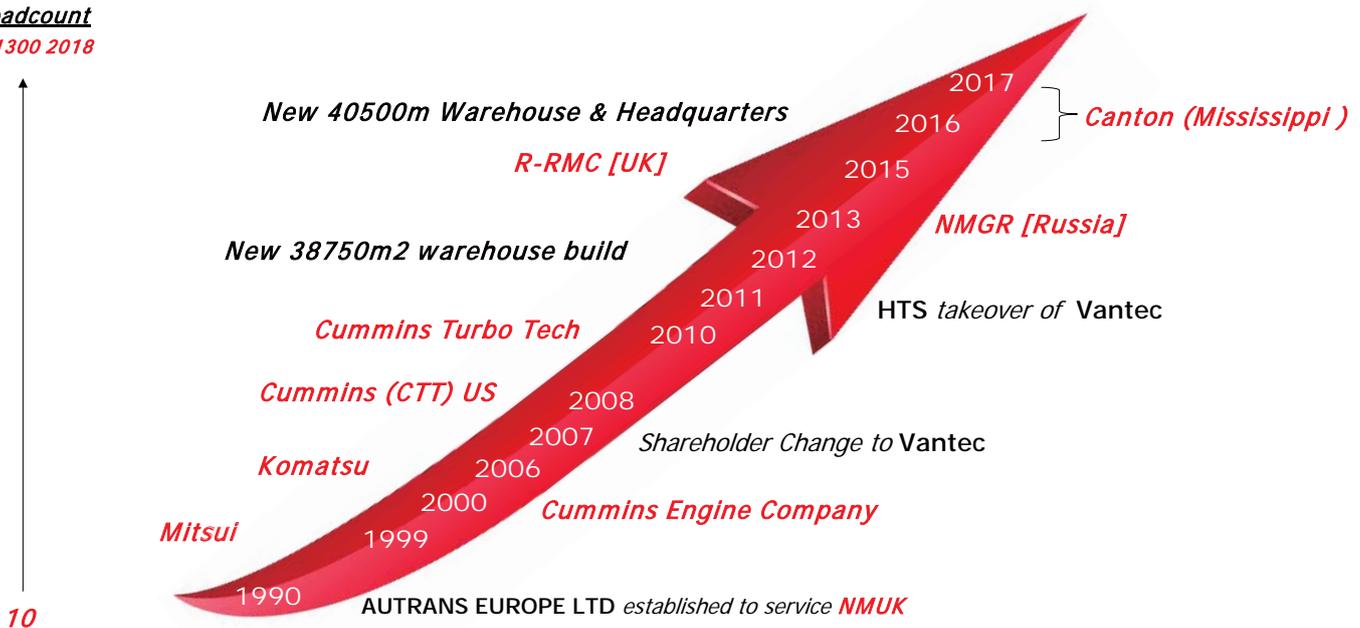
We will provide a place of work that promotes a positive impact on the Environment, Society and Economy

ENVIRONMENT
SAFETY
JOBS

VEU - Evolution



Headcount
> 1300 2018



VEU - Customer Base



• *792 employees*

- **NMUK & Global Support**
 - NMGR - St Petersburg
 - NNA- Canton
 - NSA – Pretoria [System Setup]



- **Rolls-Royce Motor Cars**
 - *165 employees*



- **Thorn Lighting**
 - *59 employees*



• *89 employees*

- **Komatsu**
 - Construction Equipment



• *114 employees*

- **Cummins**
 - Engines
 - Emission Systems
 - Turbo Technologies [Consultancy]

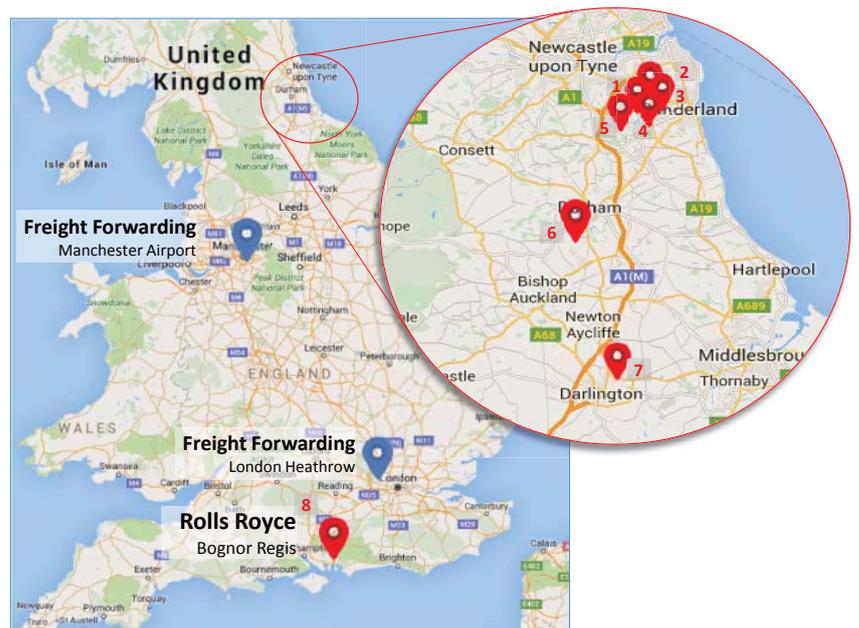
VEU - UK Domestic Logistics Locations

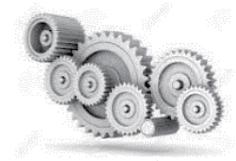


1. Nissan

- Hillthorn Farm**
Washington, Sunderland
- Cherry Blossom Way**
Sunderland
- Turbine Business Park**
Sunderland
- Freemans**
Washington, Sunderland

- 2. **Komatsu**
Birtley
- 3. **Thorn**
Spennymoor
- 4. **Cummins**
Darlington
- 5. **RRMC**
Bognor Regis





| Core Logistics Competencies – 3PL |
|---|
| 3 rd Party Logistics Warehousing |
| Decant Operations |
| Kitting and Sequencing |
| Returnable Packaging Control |
| Warehouse to Plant Transportation |
| Container Vanning/devanning |

| Additional Operational Competencies |
|--------------------------------------|
| Quality Control Inspections |
| Rework Operations |
| Sub Assembly |
| Pre-Production Product Configuration |
| Line Side Support |

| Engineering & Associated Competencies |
|---|
| New Facility Build |
| Project Management |
| Strategic Warehouse Capacity Planning |
| Optimised Warehouse Layouts |
| Consultancy |
| Supply Chain Development |
| Warehouse Management System [VIMS] Design and Development |
| Systems Hardware Infrastructure |



Investing in Sunderland – Stakeholder partnership



- Passionate workforce with historical hard-working ethics
- Sociable, friendly and caring communities
- Highly supportive and enthusiastic Local Government promoting growth and investment
- Extensive collaborative links for business productivity and educational research innovation
- Excellent commuting and transit links [road, sea, air, rail]

Investing in Sunderland– Facilities



- Almost £50 million invested in the last 5 years on warehousing facilities to consolidate Nissan product.
- Turbine Warehouse [38750m²] was the UK's first and largest development built on 2012 Enterprise Zone
- Turbine was one of the fastest build programmes for a project of its size in the UK. Hillthorn faster!!
- Hillthorn took just 9 months from initial concept to being fully operational.
- Combined warehousing space is almost 80,000m²

Investing further in Sunderland– Future Vision



- **VEU's sustainability model - Innovation**
 - VEU see Innovation as a pre-requisite for maintaining a sustainable business with improved growth and profit aspirations
- **VEU investment in innovation**
 - To promote a safe, positive and embracing culture [management]
 - Establish an environment to encourage creativity [facility]
 - Provide fearless opportunity for people to express ideas openly [people involvement]
- **VEU collaborative partnerships with stakeholders**
 - **External partnerships**
 - Customer – Establish needs of the customer to focus direction
 - Sunderland University – Utilisation of educational and research specialists, tools and techniques.
 - Sunderland Council – Access to business links and potential funding/ Investment/promotional opportunities
 - **Internal stakeholder partnership**
 - To invest in our people and harness the best conceptual ideas
 - Win the common goal with can do attitude and a desire to succeed
 - Work with Global Vantec partners to harness best practice

Technology

- Automated Pick and Place
- IT Hardware
- Materials Transfer Systems
 - MHE / AGV
 - Electric HGV
 - Driverless vehicles
- Robotics
- Artificial Intelligence - Visual recognition for quality [type /qty]
- Drone

Process

- Quotation / RFQ turnaround and accuracy
- Smart applications to assist process mgmt.
- Document control
- Electronic Purchase Request
- Cross functional business improvement

Environment

- Improved Warehouse utilisation
- Health & Safety initiatives
- Green credentials – renewables
- Anti-collision
- Artificial Intelligence – Visual recognition for safety

Data

- Communications technology [Alexa–live help]
- Data collection and interpretation
 - SMV live update
- Smart signage [wi-fi interconnectivity]
- Improved forecasting /budget creation

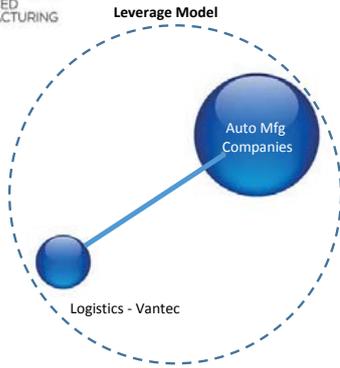
iving Warehouse



Living Warehouse

- Explore use of graphical interactivity to simulate differing and configurable live environments
- Health & safety interactivity
- Equipment use simulations
- Warehouse functionality testing
- Process proofing
- Simulated constraint impact management
- Problem solving and solution evaluation
- Commercial evaluation





IAMP

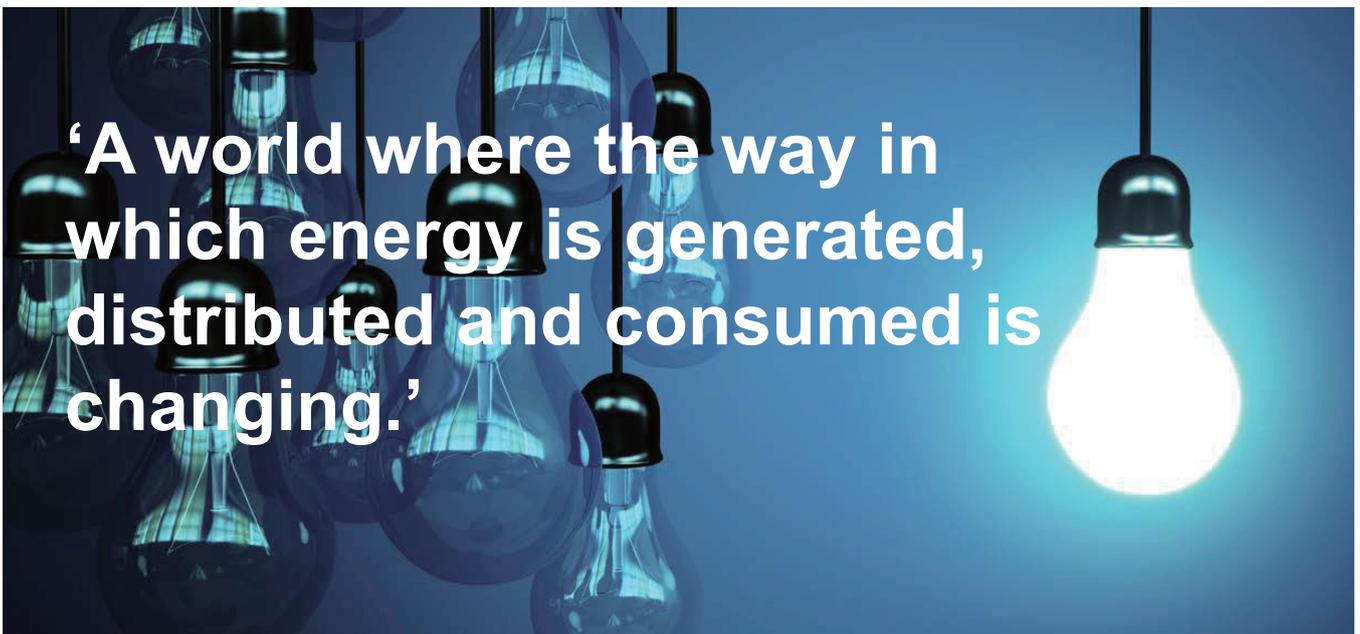
- Sunderland & South Tyneside council Initiative
 - Partnership preparation for significant projects approval
 - Classed as “Nationally Significant Infrastructure Project”
- Create 5000 jobs
- £300m Inward investment
- 260000m² developable floor space

Opportunities

- Exposure and relationship IAMP organisations
- Labour Investment potential

Thank You for your time

MAKE
it Sunderland



‘A world where the way in which energy is generated, distributed and consumed is changing.’



Welcome to Hyperdrive



Technology developer of industry leading lithium-ion energy solutions

Manufacturer of modular and bespoke energy storage systems

Designer and integrator for:

- Electric Vehicles
- Portable Power Supply
- Battery Energy Storage



Why Hyperdrive and Nissan?



Powered by

NISSAN
MOTOR CORPORATION

Hyperdrive is the first company to secure the supply of **Nissan LEAF** cell technology:

Proven Automotive Quality

Class-leading Energy Density

Global High Volume Supply





Why Lithium-ion NMC Polymer Cells?



Nissan LEAF is the world's best selling electric vehicle and uses lithium-ion NMC for:

High energy density

- 103 WH/kg and 135 WH/l

Extended life cycle

- 6,000 cycles @ 80% DOD

Fast & efficient charging

- 2C rating

Wide operating temperatures charge/discharge

- -20 +45/-26 + 60 degrees Celsius

100% depth of discharge available

- 2000 cycles



Why Hyperdrive Universal Battery Pack?



Integrated Charger Controls

Access to World-Class Battery Cell Technology

UN38.3 Certified

- Approved for Global Shipping

Versatile

- Scale Up Capacity Without Additional Controllers

High Voltage

- Connect Packs in Series for Systems Up to 700V

CAN Enabled BMS

- Master and Slave Arrangement



HIGH PERFORMANCE ENERGY SYSTEMS

LNMC Battery Pack

A scalable, modular energy storage solution providing the opportunity for a common architecture across a range of niche electric vehicles.

| Specification | GEN2 | GEN4 |
|-------------------------------------|---------------------------------------|---------------------------------------|
| Nominal Voltage | 52V | 44V |
| Capacity | 66Ah | 111Ah |
| Max Continuous Charge and Discharge | 130A | 130A |
| Mass | 33kg | 33kg |
| Energy Density | 104 WH/kg | 152 WH/kg |
| Dimensions | 243mm (X) 297.5mm (Y) 352mm (Z) | 243mm (X) 264.5mm (Y) 352mm (Z) |
| Certification | UN38.3 | Ongoing |



Powered by
NISSAN
MOTOR CORPORATION



HIGH PERFORMANCE ENERGY SYSTEMS

Hyperdrive Battery Management System (BMS)



Dissipative Balancing, Actively Controlled

- Maximise cell life

Safety

- Integrated temperature sensors

Charger Control

- Algorithm manages Rate, Temperature and Voltage via CAN

State of Charge Measurement

- Fuel gage readings

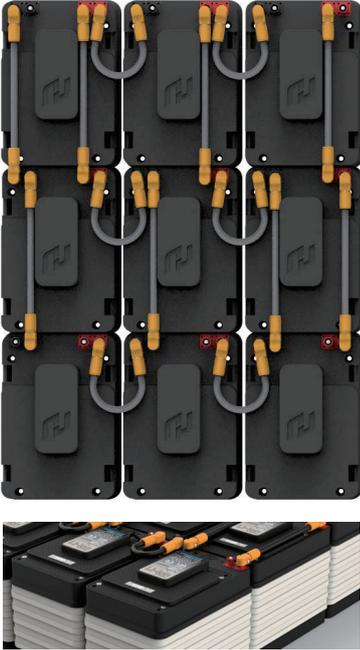
Warranty Protection

- Data and event logging, time stamped



HIGH PERFORMANCE ENERGY SYSTEMS

System Installation and Scalability



High Voltage/High Energy Capacity

- 11S 15P arrangement max

Easy Fitting

- Mounting fixtures for secure connection

Easy Connection

- Design for efficient installation

CANbus integration

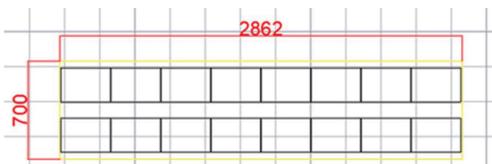
- Automatic master and slave communications

System Safety protection

- External contactor controlled from BMS

HIGH PERFORMANCE ENERGY SYSTEMS

Example Larger Systems



Example 8 x 2 Array

- 16 x 3.5kWh (Gen 2) = 56kWh
- 16 x 5kWh (Gen 4) = 80kWh

Stack 2 High

- 32 x 3.5kWh (Gen 2) = 112kWh
- 32 x 5kWh (Gen 4) = 160kWh

Opportunity for Several Enclosures

Powered by

NISSAN
MOTOR CORPORATION



HIGH PERFORMANCE ENERGY SYSTEMS

Modular Pack Applications - EV



HIGH PERFORMANCE ENERGY SYSTEMS

Case Study – Off-highway Vehicles



Aircraft Push Back Tractor



Engineering innovative solutions to reduce carbon emissions at major international airports through the electrification of ground fleets.

Diesel Electric Hybrid: Peaks of very high power. Long periods of rest in between.
48V Pack Arrangement: 12S 2P
Voltage: 576-720V
Capacity: 84kWh
Peak Current: 528A
Peak Power: 160kW

Driverless Vehicles



Enabling new autonomous passenger shuttles being adopted at major transport hubs to provide emission free driverless connections.

Fully Electric: Leading UK trial to understand the technical challenges of implementing automated vehicles in urban environments.
48V Pack Arrangement: 2P
Voltage: 40.6-58.1V
Capacity: 7kWh
Peak Current: 300A
Peak Power: 13kW



HIGH PERFORMANCE ENERGY SYSTEMS

Case Study – Off-highway Vehicles



Construction Equipment



Providing a high performance technology platform accelerating the electrification of construction machines and delivery vehicles.

Electric Hydraulic:
Electrification of an excavating machine for a leading OEM.
48V Pack Arrangement:
4P
Voltage: 40.6-58.1V
Capacity: 14kWh
Peak Current: 200A
Peak Power: 9kW Peak

Municipal Vehicles



Powering a new generation of electric municipal vehicles to reduce carbon emissions in major cities across the world.

Fully Electric:
Street sweeper for municipal and contractor use in towns and shopping centres.
48V Pack Arrangement:
10P
Voltage: 40.6-58.1V
Capacity: 35kWh

HIGH PERFORMANCE ENERGY SYSTEMS

Case Study – Portable Battery Energy Storage



Airport Ground Power



Ground Power Unit (GPU) for trials at major European airport.

Battery Energy Storage
Fully electric, zero emissions aircraft ground power equipment.
48V Pack Arrangement:
7S7P
Voltage: 284.2-406.7V
Capacity: 171kWh

Mobile Energy Storage



Providing cleaner options for supplying portable power to construction sites, temporary events and utility response.

Diesel Hybrid Electric
Battery inverter generator units of 40kVA output used on network faults affecting an estimated 1 to 7 domestic customers on single or three phase networks.
48V Pack Arrangement: 12P
Voltage: 40.6-58.1V
Capacity: 42kWh

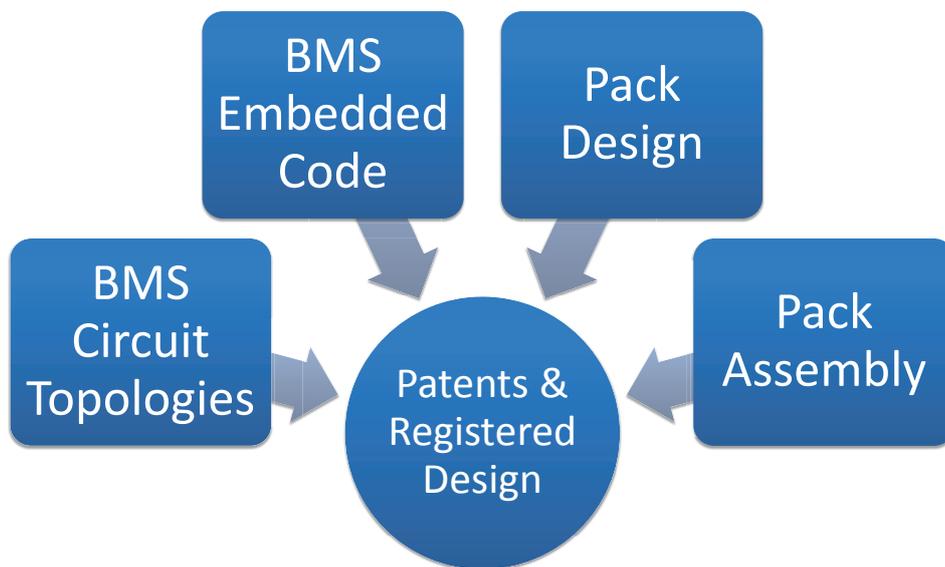
HIGH PERFORMANCE ENERGY SYSTEMS

Case Study– Stationary Energy Storage



HIGH PERFORMANCE ENERGY SYSTEMS

Patent Activity Summary



Innovation Challenges

