Energy Innovation

Energy Economics Summer School
18 - 21 February 2019
Agenda

» Callaghan Innovation
» Why innovation?
» What is innovation?
» How Callaghan works with energy businesses
» Digital Energy Hub
» Breaking new ground
» Solving customer problems
Innovation is Critical to NZ’s Future

INNOVATION =

- Increased Productivity
- Economic Diversification
- Export Growth
- Sustainability
- Wage Growth
### What does good look like?
Business-led R&D by NZ’s largest tech companies

<table>
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<tr>
<th># companies by revenue band</th>
<th>Revenue band</th>
<th>R&amp;D as % of Revenue</th>
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<tbody>
<tr>
<td>5</td>
<td>&gt;$200m</td>
<td>6%</td>
</tr>
<tr>
<td>38</td>
<td>$50-$199m</td>
<td>10%</td>
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<tr>
<td>90</td>
<td>$10-49m</td>
<td>12%</td>
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<tr>
<td>67</td>
<td>&lt;$10m</td>
<td>25%</td>
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Largest 200 technology companies
Technology Investment Network Report 2017
StatsNZ, 15 of the 40+ industries and sub-industries shown

Significant variation in R&D investment

Research & Development by Industry ($, 2016)

- Computer systems design
- Professional, scientific, and technical services
- Telecommunications
- Information media and telecommunications
- Transport, postal, and warehousing
- Construction
- Electricity, gas, water, and waste services
- Other machinery and equipment
- Transport and industrial machinery and equipment
- Petroleum, coal, chemical, and associated product
- Food, beverage, and tobacco
- Manufacturing
- Forestry and logging
- Commercial fishing
- Agriculture, forestry, and fishing
Domestic industries vulnerable to disruption

- 40% businesses investing in R&D
- 90% businesses with no export revenue

- Other machinery and equipment
- Petroleum, coal, chemical, and associated product
- Computer systems design
- Transport and industrial machinery and equipment
- Commercial fishing
- Telecommunications
- Information media and telecommunications
- Forestry and logging
- Agriculture, forestry, and fishing
- Transport, postal, and warehousing
- Construction
- Manufacturing
- Professional, scientific, and technical services
- Food, beverage, and tobacco
Rationale for business-led energy innovation in NZ

» Convert potential technology disruption into opportunity
» Business growth
» Future employment, revenue & exports
» Next generation of emission reduction technologies
» Demand from EVs and digital technologies
» 100% renewable electricity by 2035
What is innovation?
Structured Innovation
“If in principle we are all in favour of innovation, in practice we try to make our world safe and certain.”

Larry Keeley, Ten Types of Innovation: The Discipline of Building Breakthroughs
“Innovation is the elegant integration of many things.”

Larry Keeley, Founder, Doblin
Volume of innovation efforts
10 years 2002 - 2012

Source: Doblin
Cumulative value creation
10 years 2002 - 2012

Pareto Revisited
Less than 2% of projects produce
More than 90% of value...

Source: Doblin
Doblin research shows that businesses using their framework are 9 times more successful with their innovation efforts.
### 10 Types of Innovation

**Configuration**
- **Profit Model**: Do you make money in ways that are different from competitors or industry norms?
- **Network**: Do you work with other firms or surprising collaborators to develop new offerings that drive a shift from business as usual?
- **Structure**: What are you uniquely skilled at doing or delivering across products, services, and platforms?

**Offering**
- **Product Performance**: Do you make multiple products that connect with one another in unique ways?
- **Product System**: Do you produce a notably better offering that dominates market share or earns a substantial premium?
- **Service**: Does the company deliver its offerings to customers and users in ways that challenge or confound what is usual within the industry?

**Experience**
- **Channel**: Do customers rave about their interactions with your company - particularly those instances where things went wrong and the company somehow made everything right?
- **Brand**: Do you have an unusually distinct or vivid identity, particularly compared to your rivals?
- **Customer Engagement**: Do take the arcane, difficult, or complex and make it easy for users to accomplish or master?
How does Callaghan work with energy businesses?
Energy businesses we partner with
Keeping up with exponential technologies

Think Big. Start small. Scale fast.
How we work with energy businesses

<table>
<thead>
<tr>
<th>Company</th>
<th>R&amp;D</th>
<th>Programs</th>
<th>Grants</th>
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<td>Mitton</td>
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<td>Embrium</td>
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“Funding and support from Callaghan Innovation has enabled GoodMeasure to go from strength to strength, investing in R&D to further the development of cutting-edge meter-data communications technology in New Zealand.”

Peter Sandston, Business & Channel Development Manager, GoodMeasure
What if established & start up businesses worked together more?
DIGITAL ENERGY HUB.NZ

Liberating energy innovators
Critical issues - IOT, Data, AI
"We've developed data analytics software but don't know how to commercialise."

“We want to revitalize our innovation…. we’re talking to big players about their assets…we need to understand machine learning.”

“We felt isolated whilst validating our IoT technology”

“Our team arose from software industry…. We needed help to find an energy industry partner.”

“We’re trying to innovate, have lots of ideas…want to find out who to team up with”

“We've never been more productive, nor have we iterated so quickly as we did through the Lightning Lab Electric.”

“Callaghan Innovation’s support of Harmonic in the fields of innovation and R&D capability development have helped position us as the leading data science practitioner in specific industry sectors, such as energy, across Australasia.”

Phil Shepherd, CEO, Harmonic
How do we liberate innovators for the digital disruption of energy?
Play the Digital Energy Hub video
Liberating energy innovators

• Collaborate on energy innovation that breaks new ground
• Explore how digital technologies can address customer problems
• Invest in R&D like technology companies
• Connect with Callaghan Innovation and the Digital Energy Hub
Breaking new ground
What if we could radically reduce the cost of satellite launches?

Rocket Lab CEO, Peter Beck, has acknowledged the importance of Callaghan Innovation's help, saying:

"The funding towards the development phase of our Electron launch vehicle was critical, allowing us to invest significant capital, time and expertise into developing all our systems in-house. The innovations that resulted mean we now have a vehicle with an unprecedented low price, which is highly manufacturable."
What if Artificial Intelligence reduced energy demand by 30-40%?
What if Blockchain authenticated emission reductions in NZ and overseas?
What if digital technologies meant that electricity consumers did not need or want to be engaged?
What if energy and composite materials businesses worked together to create new technology for export?
Solving customer problems
“We want to improve the way we inspect our physical assets.”
“We want to find a better way to invest in our electricity network.”
“We’ve tried everything but want to reduce energy consumption further.”
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“Anyone who has never made a mistake has never tried anything new.” - Albert Einstein.
“I think that’s the single best piece of advice: constantly think about how you could be doing things better and questioning yourself.” - Elon Musk
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