

# Graphene Energy Storage for the IoT

Simon Savage, Managing Director August 2017



Ionic Industries is a technology platform based on our unparalleled knowledge and research capabilities in the field of graphene materials. With our novel approach to leveraging the depth of talent in Australian universities, we are aiming to commercialise university-born technologies in revolutionary applications – in water treatment and energy storage.







storage



### Our Business



Ionic Industries is a technology platform based on our unparalleled knowledge and research capabilities in the field of graphene materials. Our graphene oxide (GO) based technologies have broad application across a number of industries and markets.





### The "Internet of Things"



Cisco believes the market size will be \$19 trillion by 2025. By comparison, world military expenditure is about \$1.8 trillion. The opportunities in the IoT are enormous and any technology that is central to it will ride this wave of extraordinary market growth.





By 2025, there will be over 70 billion connected devices...

All of these things will need power and most will need energy storage from one source or another: lead-acid, Li-lon or **next generation graphene supercapacitors** 

#### "Things"

- Heart monitoring implants
- Biochip transponders on farm animals
- Automobiles with built-in sensors
- Field operation devices that assist firefighters in search and rescue operations
- DNA analysis devices for environmental/food/pathogen monitoring
- RFID and remote sensing devices
- Electric clams in coastal waters



industries Next Generation: Graphene Micro Planar Supercapacitor



Parameters	lonic Technology	Best competitors
Response time (ms)	0.033	19
Energy Density (Wh/cm <sup>3)</sup>	0.173	0.002
Capacitance (mF/cm <sup>2</sup> )	102	2.314
Equivalent series resistance (m $\Omega$ cm <sup>2</sup> )	0.35	3600

- Faster Charging
- Higher Output
- Cheaper
- Smaller
- Environmentally and biologically safe







## What are the potential markets?

Widely divergent energy storage demands will be met by a changing mix of technologies over a long period and with large overlaps between predominant technologies



The inherent strengths of graphene supercapacitors will see them used in smaller applications early on, especially where safety and environmental concerns are paramount, with gradually increasing market share in larger applications over time





## What are the challenges/risks we're facing?

Business collaboration with higher education



- Innovation and technological advancement critical to leveraging IoT opportunities, but Australia is ranked only 22th in the world on the <u>Global Innovation Index</u>. In our own region, we are outperformed by Singapore, Korea and China.
- Australia has very low collaboration between industry and universities (lowest in the OECD) and at the same time, has a very high proportion of researchers in universities compared to industry (60% compared to 30% in other high-performing countries - same as UK but they perform better at collaboration)
- We need to bridge the gap between Universities and Industry to better leverage our R&D resources, to drive growth in our knowledge economy and take advantage of the massive opportunities in IoT revolution





Ionic has been working in this gap and received critical support through Australian Government tax incentives and research grants, but we cannot rely on this alone.

# While the Government may be challenged in the level of stimulus it can deliver, it is important that we take advantage of the huge range of Australian skills to commercially develop world class products for the IoT revolution

Need to focus on developing models that build industry-university collaboration including models that give stakeholders (universities, governments and institutions) more skin in the game and a more direct benefit from commercial outcomes

Counteract "brain drain" by working with universities and students to build internships and employment programs that incentivise our best and brightest to remain in Australia

Increase links with key economies and international stakeholders in places like the United States, Japan or Germany to build working relationships and to attract venture capital into Australia.







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