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# Ontario Energy Storage Capabilities

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JUNE 2015

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MaRS

Developing talent • Growing ventures • Opening markets



MaRS

Our Future Matters

June  
2015





# PHASE 1

- 700,000 sq ft
- 100 Tenants – 50 startups
- 4:1 Private/Public
- 2,500+ People work at MaRS today

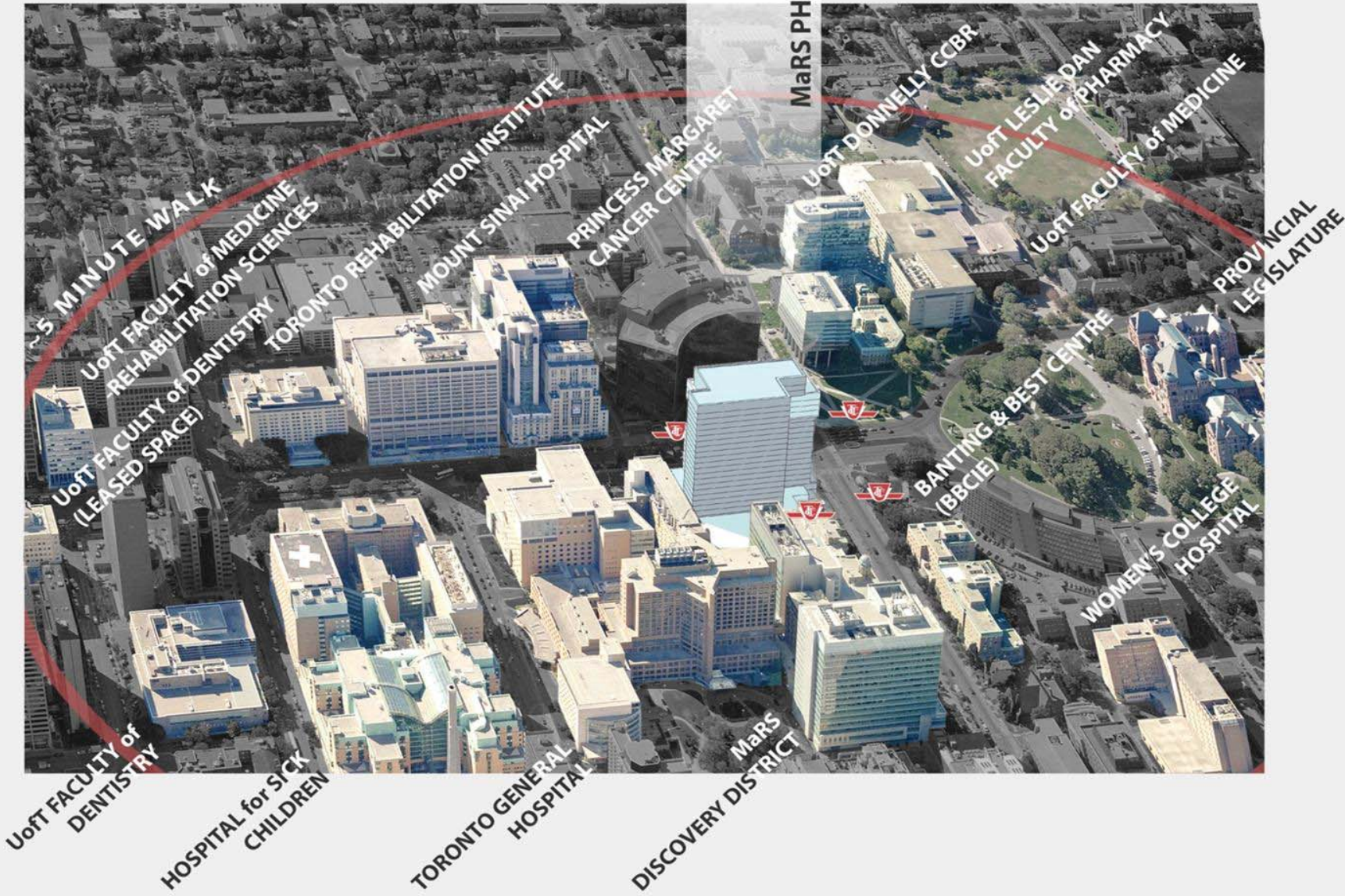
# PHASE 2

- 780,000 sq ft
- Opened Jan 2014

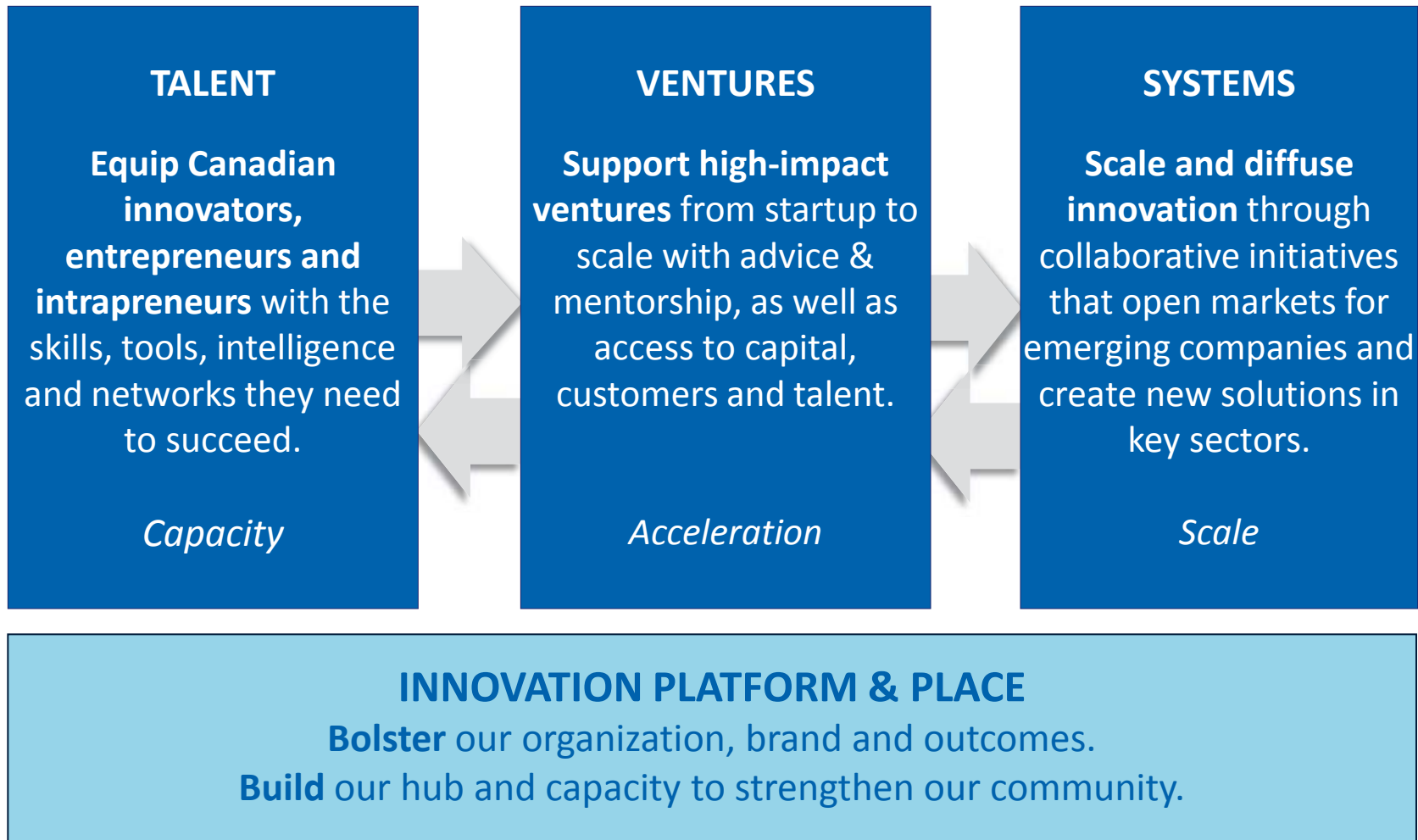




# MaRS Ecosystem

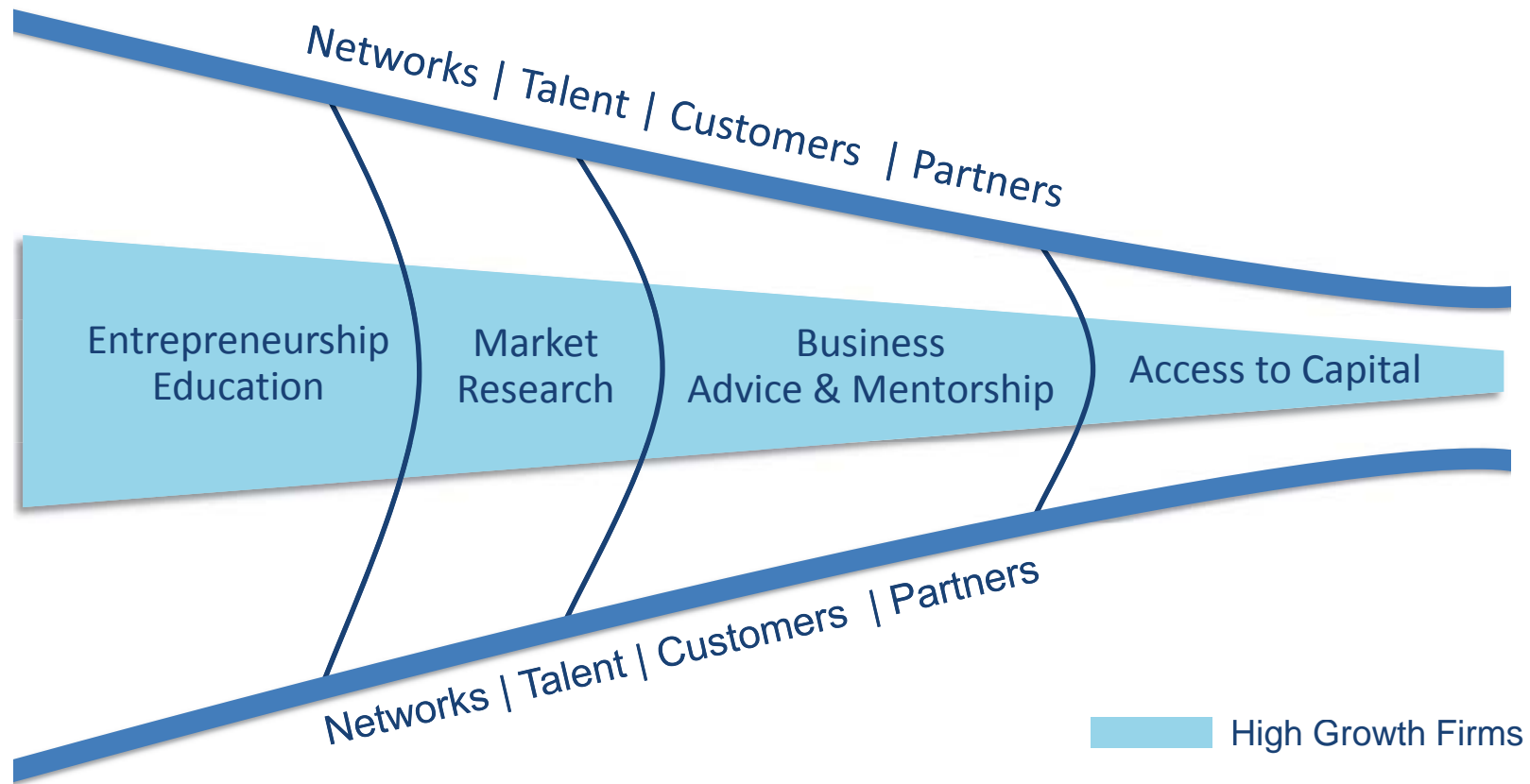


# Innovation Platform Levers

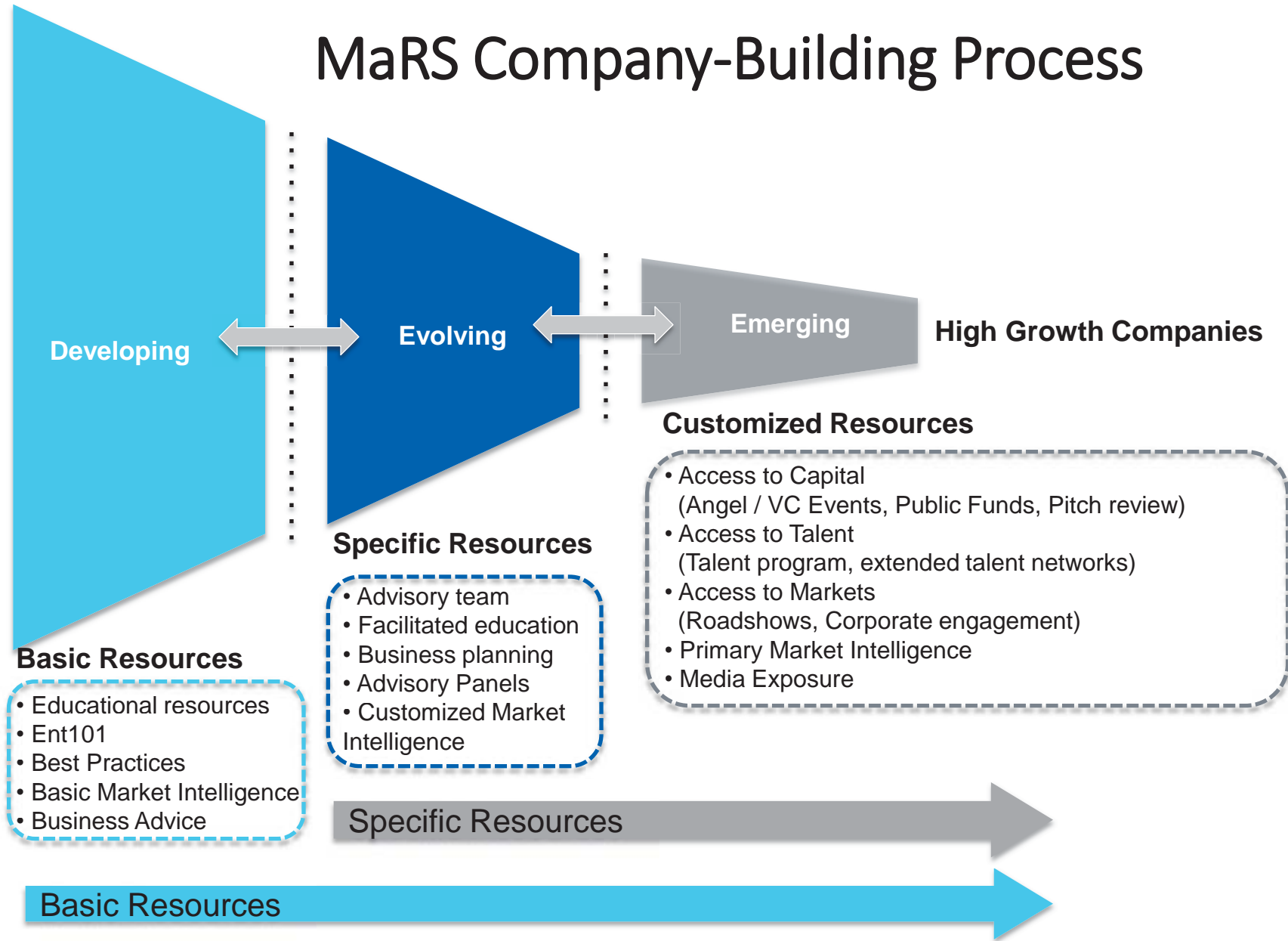


# Building Growth Companies

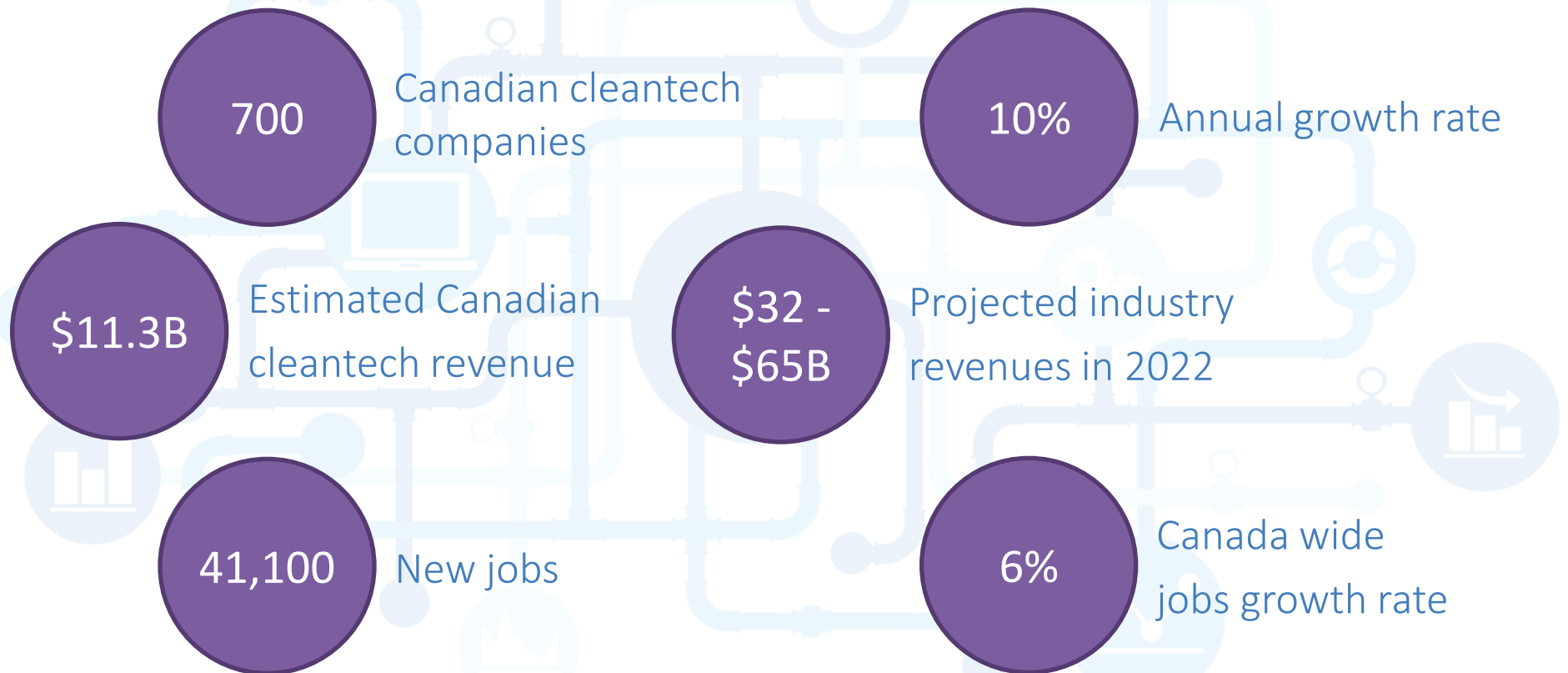
## *Acceleration Programs for High Growth Firms*



# MaRS Company-Building Process



# Canadian Cleantech Sector growth



Source: Analytica Advisors. (2014) Canadian Clean Technology Industry Report. (CAN\$)

16 June 2015



# Ontario's Energy Technology industry

2<sup>nd</sup>

In 2013, Canada was the second-fastest growing clean-energy market in the G20

45%

Increase in investment in 2013 to \$6.5 billion

300%

Increase in China's imports of Canadian cleantech goods and services over the last decade.

60%

Of Canadian Energy IT projects are in Ontario

50%

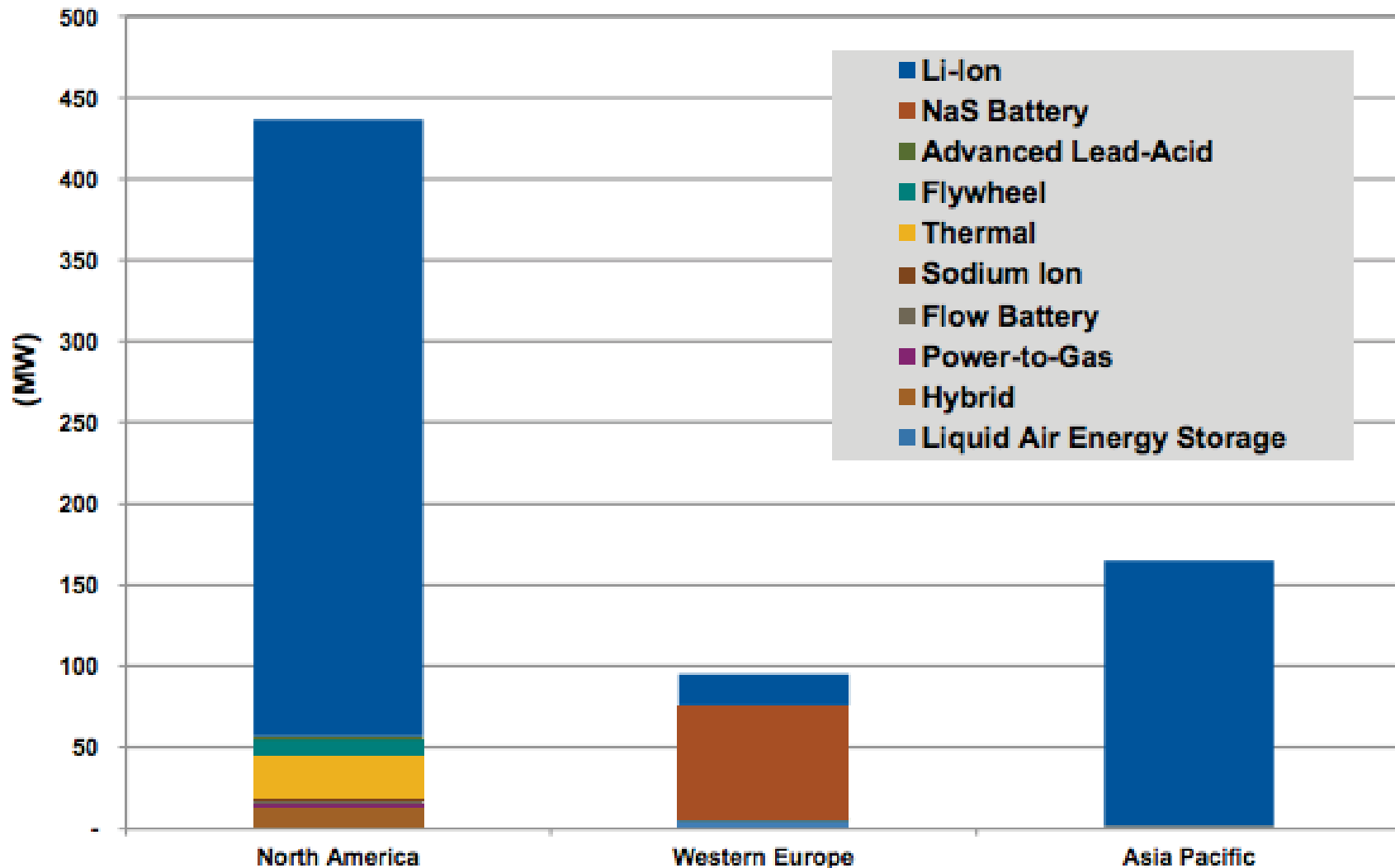
**Of Canadian Energy Storage projects are in Ontario**

# Energy Storage



- Global installed distributed energy storage systems capacity is expected to grow from 172 MW in 2014 to 12,150 MW in 2024 (Navigant).
- Expected worldwide revenue growth from energy storage enabling technologies from \$605 million in 2015 to more than \$21 billion by 2024.
- Approximately \$1.5 billion invested in energy storage, hydrogen and fuel cells in 2014 across M&A, VC/PE and the public markets (Bloomberg NEF).







## New Announced Projects by Technology and Region, Excluding Pumped Storage, World Markets: 3Q 2014-1Q 2015

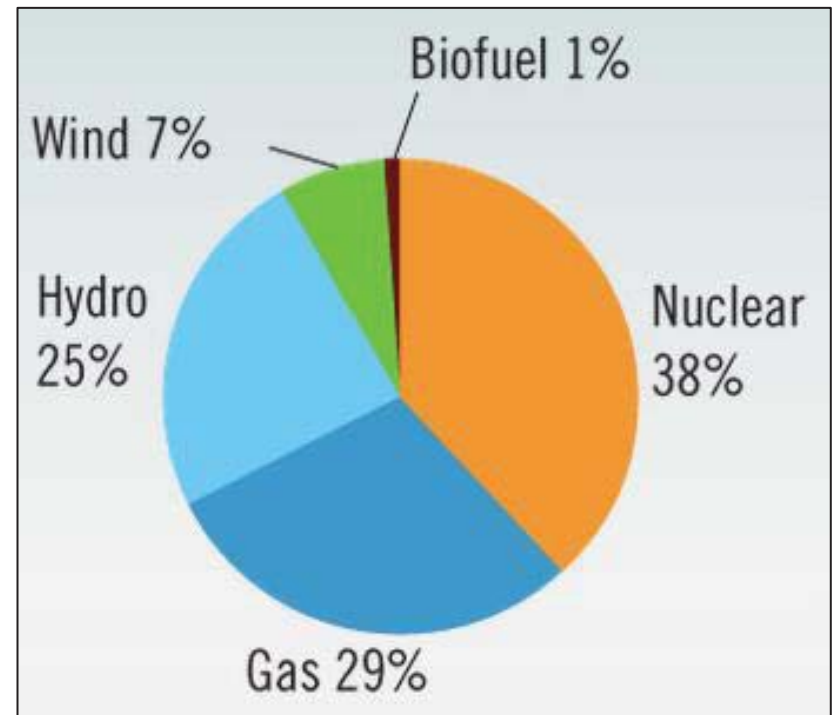


(Source: Navigant Research)



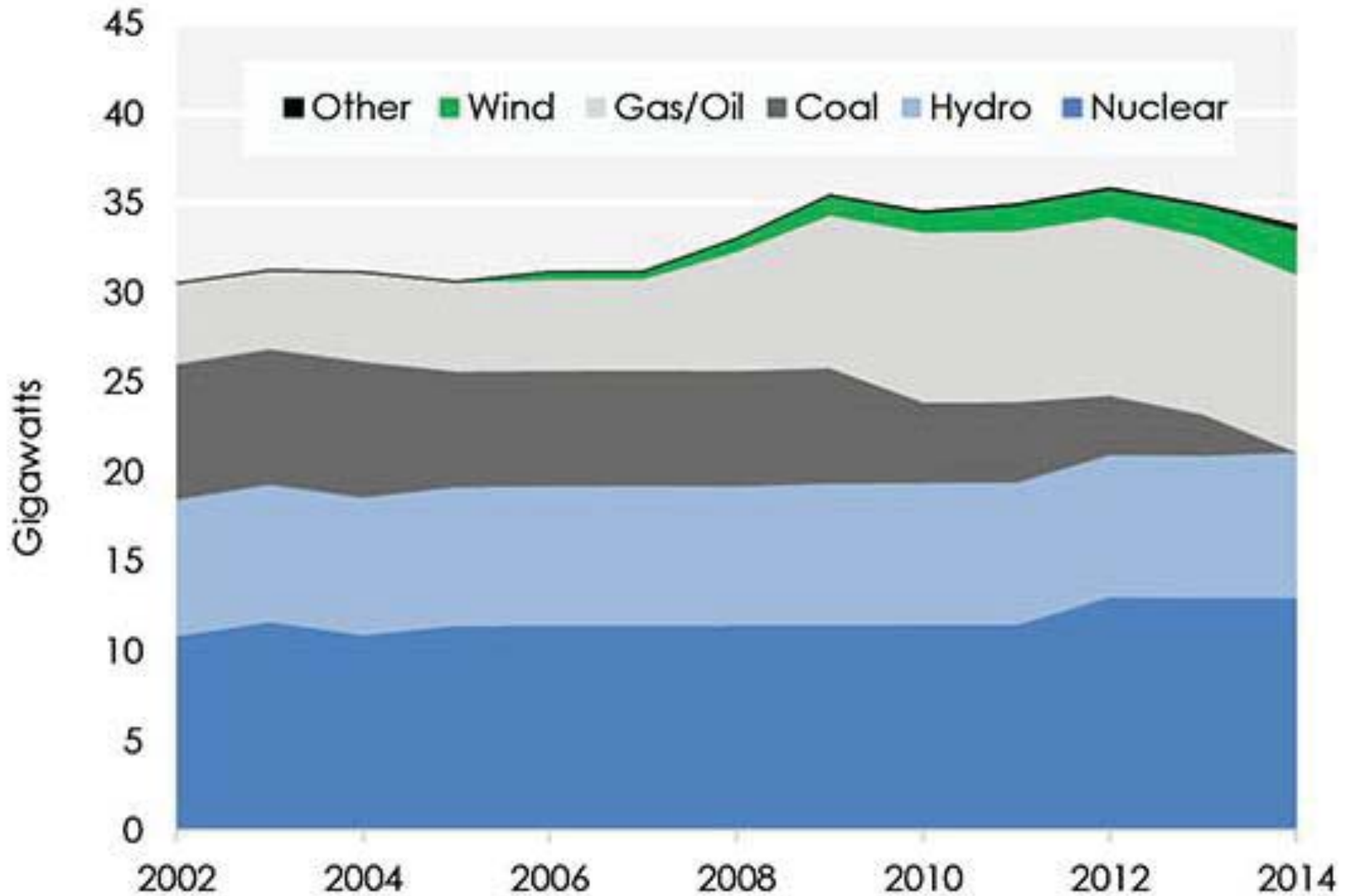
# The Ontario Energy Mix

	Nuclear:	<b>12,947 MW</b> or 38%
	Gas/Oil:	<b>9,920 MW</b> or 29%
	Hydro:	<b>8,462 MW</b> or 25%
	Wind:	<b>2,543 MW</b> or 7%
	Biofuel:	<b>455 MW</b> or 1%
	Solar:	<b>40 MW</b> or 0.1%



**34,367 MW Total**

# Ontario's Installed Capacity



# Ontario's Storage Procurement

- **December 2013**: Government Request for a Proposed Design & Outline of an Energy Storage Procurement Framework by January 2014
- **March 2014**: Government directive to procure 50 MW of Energy Storage by the end of 2014.
- Focus on storage “as part of a suite of ancillary services designed to promote system reliability”.



# Ontario's Storage Procurement

Policy goal of using this procurement to drive information and analysis on how best to integrate energy storage into the Ontario electricity system; continue exploring commercial mechanisms for integrating energy storage into the Ontario electricity market

Part of a broader push to innovate and test out multiple technologies, and could provide important insight into how such different technologies compare to one another in terms of cost and effectiveness -- or, perhaps, can be combined in ways that add up to more than the sum of their parts.

# Ontario to Become Energy Lab with 34MW of 'All-of-the-Above' Energy Storage



Batteries, flywheels, hydrogen and thermal energy storage in mandated mix

Jeff St. John  
July 28, 2014

California may have the world's biggest grid-scale energy storage mandate -- but Canada's Ontario province may have the world's most varied one.

<b>Proponent</b>	<b>Technology</b>	<b>MW</b>
Canadian Solar Solutions	Battery	4
Convergent Energy and Power LLC	Battery Flywheel	12
Dimplex North America LTD	Thermal	0.74
Hecate Energy	Battery	14.8
Hydrogenics Corp.	Hydrogen	2
	<b>Total</b>	<b>33.54</b>

Participants required to provide one of two types of fast-reacting ancillary services:

- Frequency regulation
- Voltage control and reactive power support



# Ontario Energy Storage Companies

**temporal**

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**eCAMION**  
POWER OVER ENERGY

**KELVIN**  
S T O R A G E



 **electrovaya**

 **NRSTOR** INC

 **CLEARBLUE**  
TECHNOLOGIES

 **opusone**  
solutions

**EGUANA**   
TECHNOLOGIES

 *Blueprint Energy Inc.*

 **Panisolar Inc.**  
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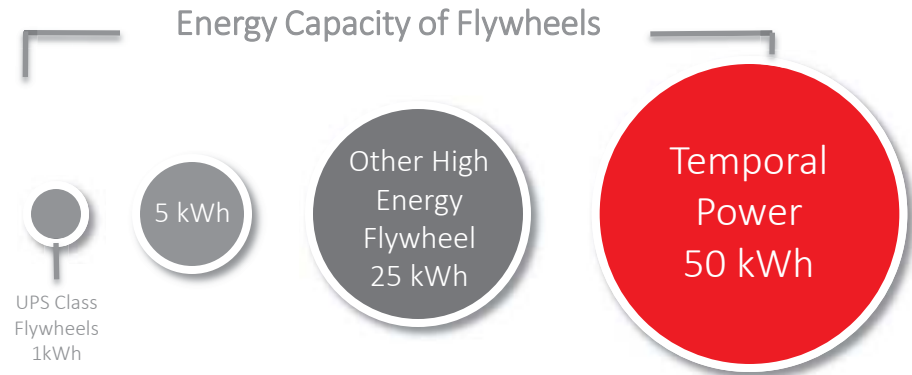
 **ENERGY  
STORAGE  
ONTARIO**

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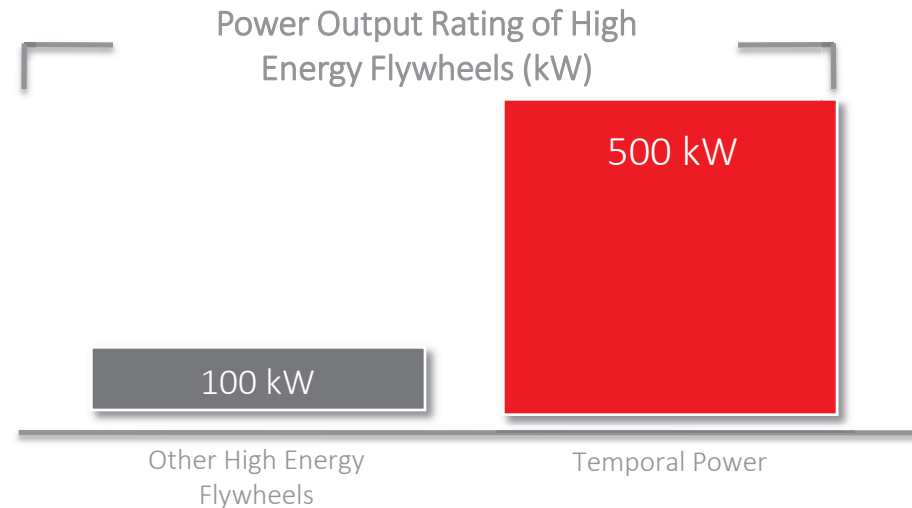
high-performance energy storage



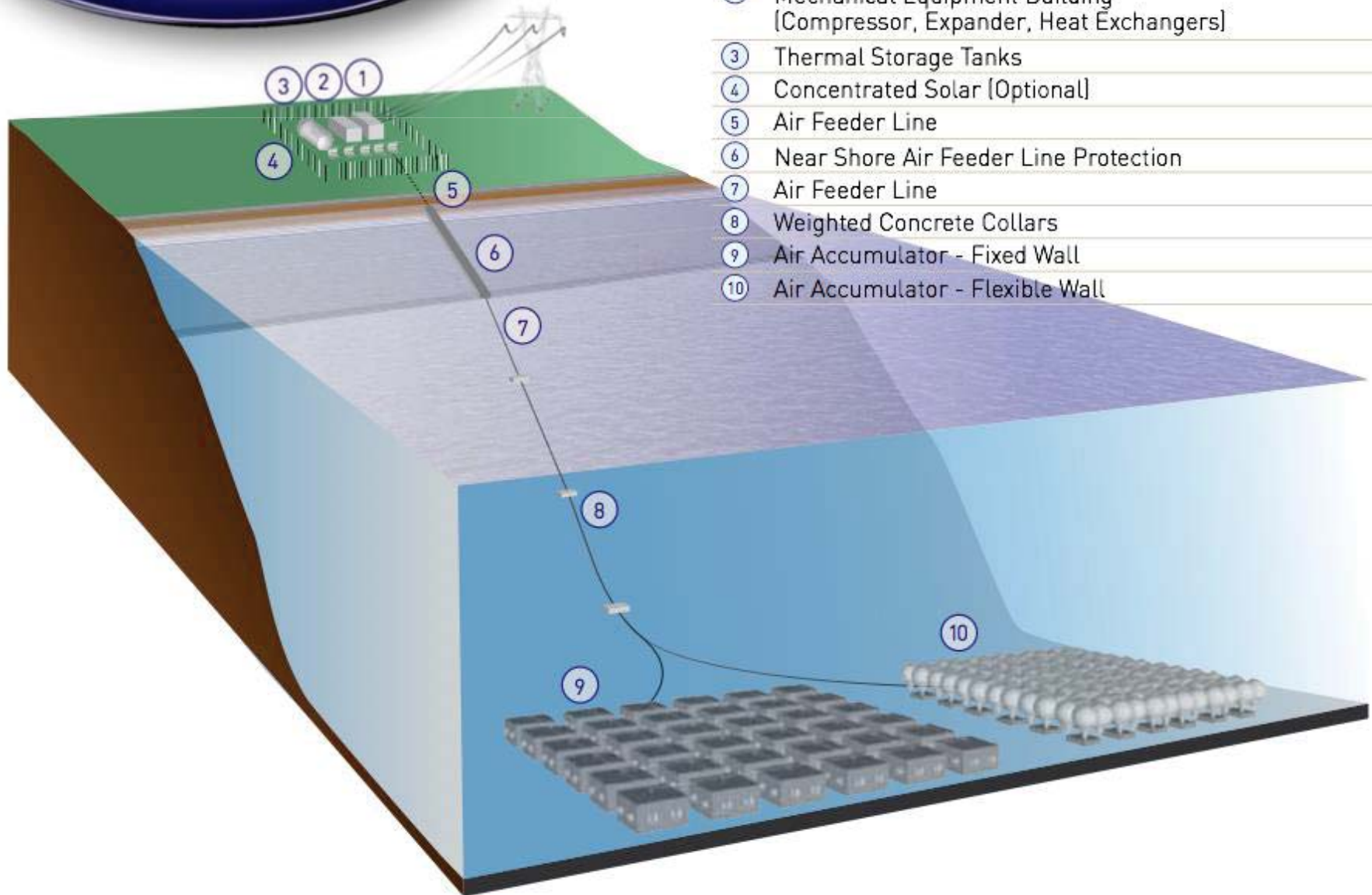
Temporal Power is the leader in energy storage capacity suitable for utility storage



Temporal Power has 5 times the power rating of the next closest competitor flywheel







- ① Electrical Equipment Building
- ② Mechanical Equipment Building [Compressor, Expander, Heat Exchangers]
- ③ Thermal Storage Tanks
- ④ Concentrated Solar [Optional]
- ⑤ Air Feeder Line
- ⑥ Near Shore Air Feeder Line Protection
- ⑦ Air Feeder Line
- ⑧ Weighted Concrete Collars
- ⑨ Air Accumulator - Fixed Wall
- ⑩ Air Accumulator - Flexible Wall

	Large, Proven			Scalable, Costly	
	Pumped Hydro	Underground Compressed Air		Aboveground Compressed Air	Batteries
Capital Cost (\$/kWh)	\$50-200	\$50-200	\$250-500	\$600-1,200	\$500-2,000
Life Cycle (years)	>30	>30	>30	>20	10
Scale (MW)	>100	>100	1-50	1-50	1-50
Locations	<5%	<5%	~30%	>80%	>80%
Efficiency	70-80%	50-70%	55-70%	60-70%	70-90%
Other Restrictions	Long Lead-time, Geological Features		Deep Water	Pressure Vessel CAPEX & Safety	Operating Limits, OPEX Costs
Notable Companies	Various Utilities & IPP's	General Compression, Dresser Rand	Bright, Arothron	LightSail, SustainX	Primus Power, EOS, Ambri, EnerVault, NGK





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