



# SEAS

Sustainable Energy Association of Singapore



## Singapore's Role As The Springboard To The Asian Clean Technology Market

*June 2014*

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***Chairman, Sustainable Energy Association of  
Singapore(SEAS)***  
***Managing Director, Anaergia Pte Ltd***



## Singapore is a small city state with limited alternative energy potential

- Land Area: 710.2km<sup>2</sup>
- No hydro or geothermal energy resources
- Negligible wind and low wind speed (2m/s)
- Variable and intermittent solar





- **Singapore, CleanTech Hub of Asia in Financing & Technology**
- **Robust Investments in R&D and IP Generation**
- **“Living Lab” to testbed new innovations, tropicalize existing technologies and regional commercialisation**
- **Business incubation and commercialization hub to support regional sustainable development targets**
- **Singapore is focusing its resources on solving problems faced by the developing economy environments...**

**Singapore offers access to 2.8 billion people, within a 7 hour flight radius**





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## Regional Clean Energy Market Opportunities and Targets





# REGIONAL PROJECT DEVELOPMENT OPPORTUNITIES IN ASEAN



Governments and International Financial Organizations (IFOs) are collaborating to scale up clean energy investments

# SOLAR PV TARGETS UP TO 2030



## China

• 50,000 MW by 2020



## India

• 10,000 MW by 2017



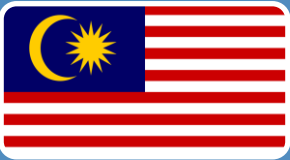
## Indonesia

• 620 MW by 2020



## Thailand

• 2000 MW by 2021



## Malaysia

• 854 MW with 17% of energy generation from renewables equivalent to 4,000 MW by 2030



## Philippines

• 285 MW with 40% of electricity generation from renewables by 2020





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**Singapore's  
Vibrant Sustainable  
Cleantech Sector**



# Singapore's Cleantech Ecosystem

## CLEANTECH

### ENVIRONMENT AND WATER

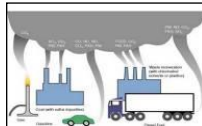


Water



Waste Management and Resource Recovery

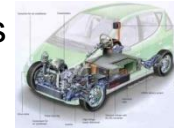
Pollution Control



Carbon Services



Green Building



Green Transportation



Energy Efficiency

### CLEAN ENERGY



Energy Storage



Solar



Fuel Cells



Marine Renewables



Wind



Smart Grids



Biomass/Biofuel

Key growth sector: S\$3.4B value-added and 18,000 jobs by 2015



# Clean Energy Hub



## SOLAR

**Trinasolar**  
Asia Pacific HQ & R&D Centre

**REC**  
Integrated Solar Mfg Complex

**SOLARWORLD**  
THE SUN-POWERED COMPANY  
Asia Pacific HQ

**YINGLI SOLAR**  
Asian HQ & R&D Centre

**phoenix SOLAR**  
Regional HQ

## ENERGY EFFICIENCY

**G-ENERGY**  
Global Pte Ltd

**Johnson Controls**

**CENDID**  
ENERGY SOLUTIONS

**AEG**  
POWER SOLUTIONS

**Schneider Electric**

## FUEL CELL

**Horizon**  
Fuel Cell Technologies  
Fuel Cell R&D

**GasHub**  
TECHNOLOGY  
Fuel Cell R&D

## WIND

**Gamesa**  
Joint R&D in Materials Technology

**Vestas**  
R&D Centre

## SMART GRID

**ST Electronics**

**Panasonic**  
Smart Utilities Centre  
Energy Solutions R&D

**GreenWave**  
Really™ The Right Way  
Home Energy Mgmt R&D

## MARINE

**ATLANTIS**  
RESOURCES CORPORATION  
Global HQ

**Asia Carbon Global**

**Sindicatum**  
Sustainability Resources

**carbon conservation**  
Global HQs

## CARBON

**DNV·GL**

**luxresearch**

## SERVICES

**NESTE OIL**  
Biofuels Plant

**CGN**  
Biomass- solar plant

**Anaergia**  
Agri-Energy

**ALPHA biofuels**  
Micro-refinery

## BIOENERGY

# Water – Global Hydrohub

Critical mass of about 130 water companies

## Upstream players

## Midstream players

## Downstream players

Manufacturers / providers of water-related parts and components (e.g. pumps, valves, pressure gauges, membranes, pipes)

Integrators of partial / complete water treatment systems / Design Build (e.g. UF, RO, IX, MBR, sand filter, activated carbon systems)

EPCs / Turnkey engineering solution providers / BOT, BOOT utility investors cum operators / water infrastructure consultancy & engineering services

(e.g. municipal / township / industrial zones' water supply projects)

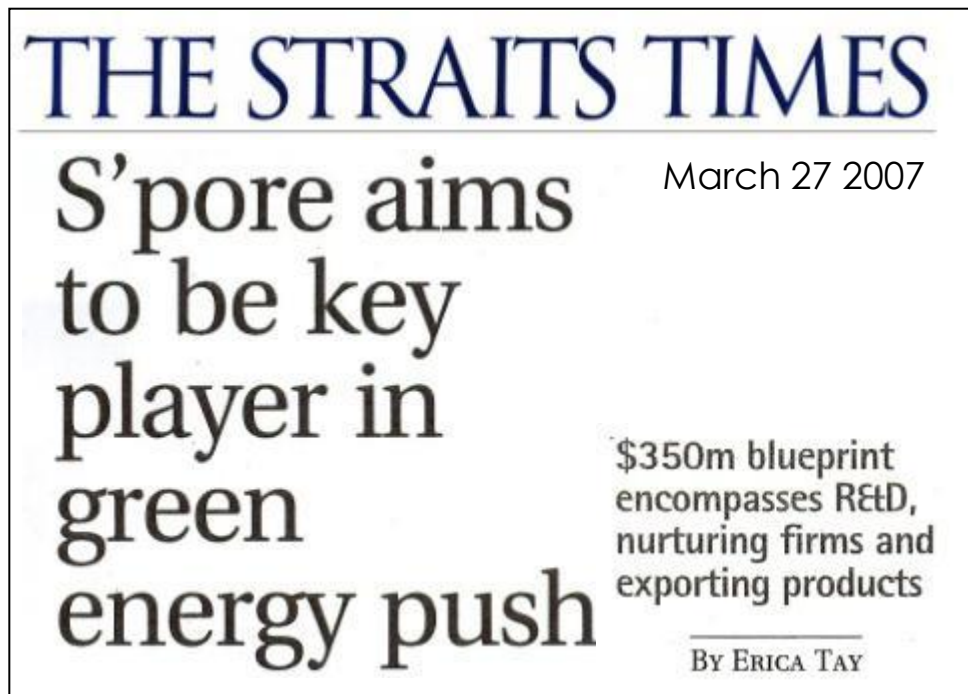


Foreign

Local



Prime Minister Lee Hsien Loong



- S\$350 million funding to grow **Clean Energy** with focus on solar energy announced by Prime Minister Lee in March 2007
- Announced in 2011: Additional **S\$195 million** in R&D funding and **S\$300 million** for National Innovation Challenge on Energy Resilience
- Overseen by a council chaired by PM Lee and a Ministerial Committee

## Technology

- Strong commitment to research & innovation

## Markets

- Living Lab with a growing base of local projects

## Capital

- Growing base of project financing and VC/PE firms

## Talent

- Specialized manpower training programs and scholarships



## National Climate Change Targets

- **Up to 16%** emissions reduction below BAU levels by 2020 if there is global agreement
- If there is no agreement, **7-11%** emissions reduction



- **35%** improvement in energy efficiency from 2005 levels
- **80%** of all buildings green by 2030

- **Energy Conservation Act** – Mandatory energy management practices for large consumers of energy







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## Singapore's CT R&D & Solar Landscape



# Industry-Oriented Research Centres



- World's most comprehensive environment and water research centre
- Focus on membranes, environmental biotechnology and waste management



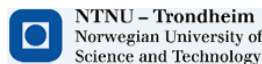
- Top solar research centre in Asia, outside Japan
- Focus on c-Si, thin-film technologies, novel PV devices and solar systems



- Global network of top research partners
- Focus on wind & marine, e-mobility, smart grid and green building technologies



- Largest pilot smart grid facility in the world



## *Photovoltaic electricity generation:*

- Silicon wafer solar cells
- Thin-film solar cells (OPV, CIGS)
- Characterisation of PV materials, cells, modules
- Simulation of solar cells & modules
- PV module development, PV module testing
- PV systems (on-grid and off-grid)

## *Main R&D areas of SERIS*

- Energy simulation of buildings
- Facade technologies (BIPV, windows)
- Solar thermal systems
- Solar mapping of roofs

***Supporting regional growth of PV solutions through research and development,  
project design and technology refinement***



\* **ERI@N Structure | Matrix**




**Industry Partnerships & Spin-off**  
*TRL 4-7*


**Technology Groups Translational RD&D**  
*TRL 3-6*  
*191 Researchers*


**Basic Research Technology Pipeline**  
*PhD (150)/MS (65)*


**ERI@N**  
Energy Smart, Research & Innovation.


Materials, Simulation & Modeling, Multi-Energy Grids, Reliability


 **Wind & Marine**


 **Maritime Clean Energy**

 **Energy Storage**

 **Fuel Cells**

 **Solar & Solar Fuels**

 **Electromobility,**

 **Sustainable Buildings, Grids**

Professors, Principal Investigators, Research Staff, Infrastructure

Colleges of Sciences, Engineering, Humanities, Arts, & Business

## Key to adoption is to price energy correctly – “True Cost of Energy”

- **PV and bio-energy already viable without subsidies NOW!**
- **By 2025, Renewable energy can meet 7% of demand in Singapore**
- **LCOE is already below retail tariffs making renewable energy competitive with conventional energy sources**
- **SGD \$3-4 billion investment opportunities over next 12 years**





## SolarNova government programme committing Singapore towards implement 350MW of Solar PV projects by 2020

- *Mr. S. Irwaran, Minister, Prime Minister's Office, Second Minister for Home Affairs and. Second Minister for Trade and Industry*

## Intermittent Generation Threshold being raised from 350MW to 600MW recently to cater to direct grid connections.

- *Energy Market Authority of Singapore*

## National industry driven target to generate solar power can contribute 4.8% of 2025 forecasted demand, or 2,400 GWh/year

- *SEAS White Paper on the Economic Case for Accelerating Renewable Energy Deployment*



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Business Incubation & Seed Funding



Government Grants & Tax Incentives



Private Equity / Venture Capital



Development Financing



Bank Loans

*“Connecting to the Right Investor to Fuel Business Growth Through...”*



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**Supporting  
Business Growth**

# Sustainable Energy Association of Singapore (SEAS) :



- Launched on 12<sup>th</sup> July 2006 by **Dr Yaacob Ibrahim, Minister of Environment and Water Resources**
- Our Patron is **Ms. Grace Fu, Minister, Prime Minister's Office, Second Minister for the Environment and Water Resources, and Second Minister for Foreign Affairs**
- The mission of SEAS is “**To be the Voice of Sustainable Energy Industry**”
- Non-profit Association promoting **Renewable Energy & Energy Efficiency** industry growth
- **190+ Corporate Members**
- **Sectors:** Energy Efficiency, Renewable Energy, Carbon Asset Management, Finance & Sustainable Mobility





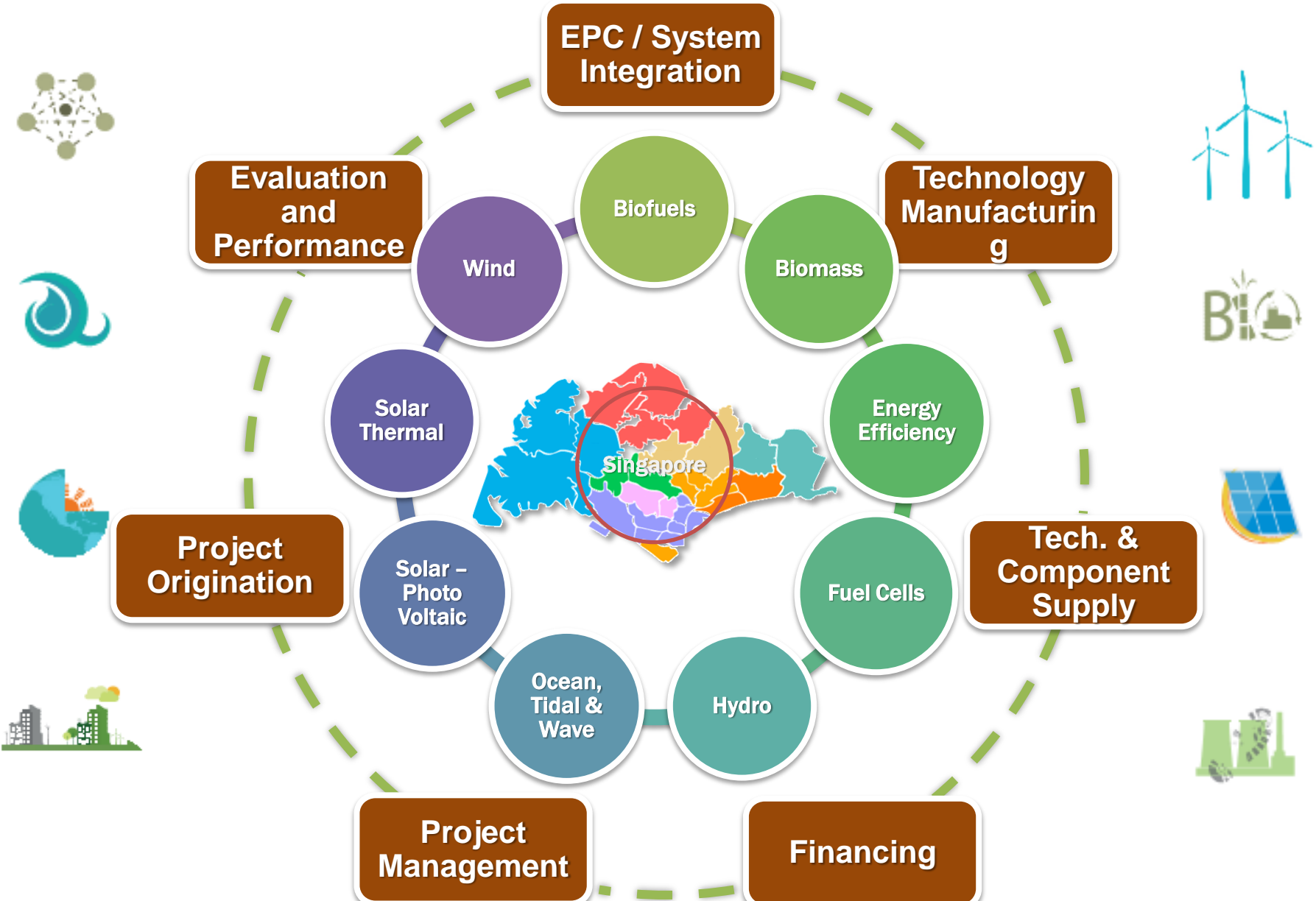
**Promote Energy Efficiency & Awareness**

**Promote Renewable Energy Technologies,  
Services, &  
Project Development**

**Facilitate Carbon Asset Management Projects &  
Carbon Emissions Reduction Trading**

**Provide a Platform for Investors to Engage with  
Developers of RE & EE Projects**

# Ecosystem of Singapore Sustainable Energy Sector



## **Enterprise Development**

*Supporting Growth of Locally Based Businesses*

**Business Acceleration | Landing Pad for Foreign Companies |  
Technical Assistance | Research & Development |  
Commercialization Assistance**

## **Market Development**

*Supporting Regional Expansion of Industry by Providing:*

**Access to Markets | Business Intelligence | Project Access  
Regional Commercialisation | Finance Facilitation  
Partnership Opportunities**

## **Knowledge Development**

*Capacity Developing and Skills Upgrading*

**Managerial-level Training | Technical Certification Programmes  
Seminars | Conferences | Forums**

## a. Business Incubation For Emerging Technologies

- **Connectivity To R & D And Testbedding Opportunities**
- **International Partnerships (Solutions Multipliers)**
- **Grant & Private Financing Access**
- **Incubation**



## b. Business Establishment, Setup & Acceleration

- **Strategic partnerships with trade associations and tech. dev. institutions**
- **Project origination and innovative business strategies**
- **Growth in market capitalization and technical excellence**

## c. Local Consortium Development

- **Connecting complimentary capabilities to produce innovative solutions**
- **Energy Efficiency for Buildings and/or Manufacturing**
- **Biofuels, Solar, Wind, Integrated Solutions, etc.**



# Examples of Living Labs and Testbeds



## Smart Grids

Intelligent Energy Systems testbed incorporating research elements



## Cleantech Park

Green business park in the tropics & test-bed for RE and EE solutions



## Punggol Eco-Town

Sustainable public housing solutions



## Public Utilities

>100 municipal water test-bedding projects with PUB from 2006 to 2011



## Jurong Island:

Industrial resource efficiency and industrial water treatment



## EV Testbed

Trialing of EVs & charging solutions



## Solar leasing

Solar capability building on public housing





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**CleanTech Business  
Acceleration Center**



# Showcase Your Solutions Regionally @ CleanTech Eco-Business Park



**CleanTech One**



**CleanTech Two**



**Green Core**

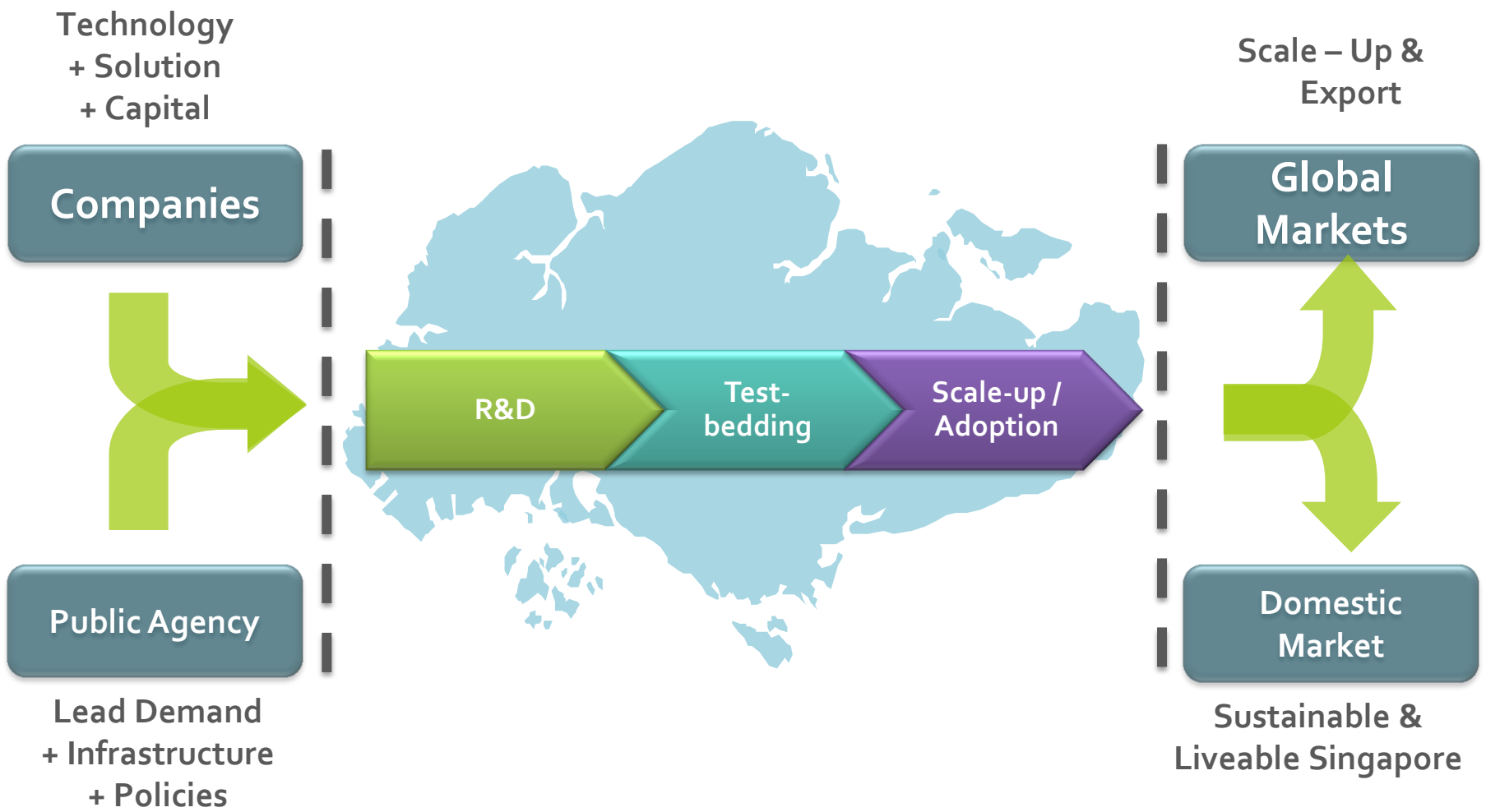


**Phase 1 Infra**

- 50 ha site to be developed in 3 phases, over 20 years
- Total 39 ha of allocable land
- Average land plot size of 1ha - 2ha
- 2 JTC Developments: *CleanTech One* & *CleanTech Two*

- Winner of Numerous Green Awards**
- PUB - ABC Water Certified – 2010
  - BCA – Nparks Green Mark for Parks Award (Platinum - 2011)
  - BCA Green Mark New Building (Platinum) 2011
  - BCA Green Mark for District (Platinum)
  - IES Prestigious Engineering Award-2011
  - GM Design Prototype Award (industrial) 2011
  - MIPIM Asia, Best Futura Project - Silver Award (Estate Level) - 2011

# Innovation & Commercialisation



# Setup in Singapore as a Regional Hub



*Grow Into the Region*



*Offered Through The*  
**CleanTech Incubator /  
Accelerator**





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*Singapore*  
**A Springboard  
into Asia for Cleantech**





# Market Access through International Events

## Smart-Sustainable Cities



- Global platform to address urban challenges & forge partnerships

## Building



- Premier business platform for green building technologies
- Co-located with International Green Building Conference

## Energy & Smart Grid



- Annual event for energy companies, professionals & policymakers to discuss solutions and best practices within the global energy space

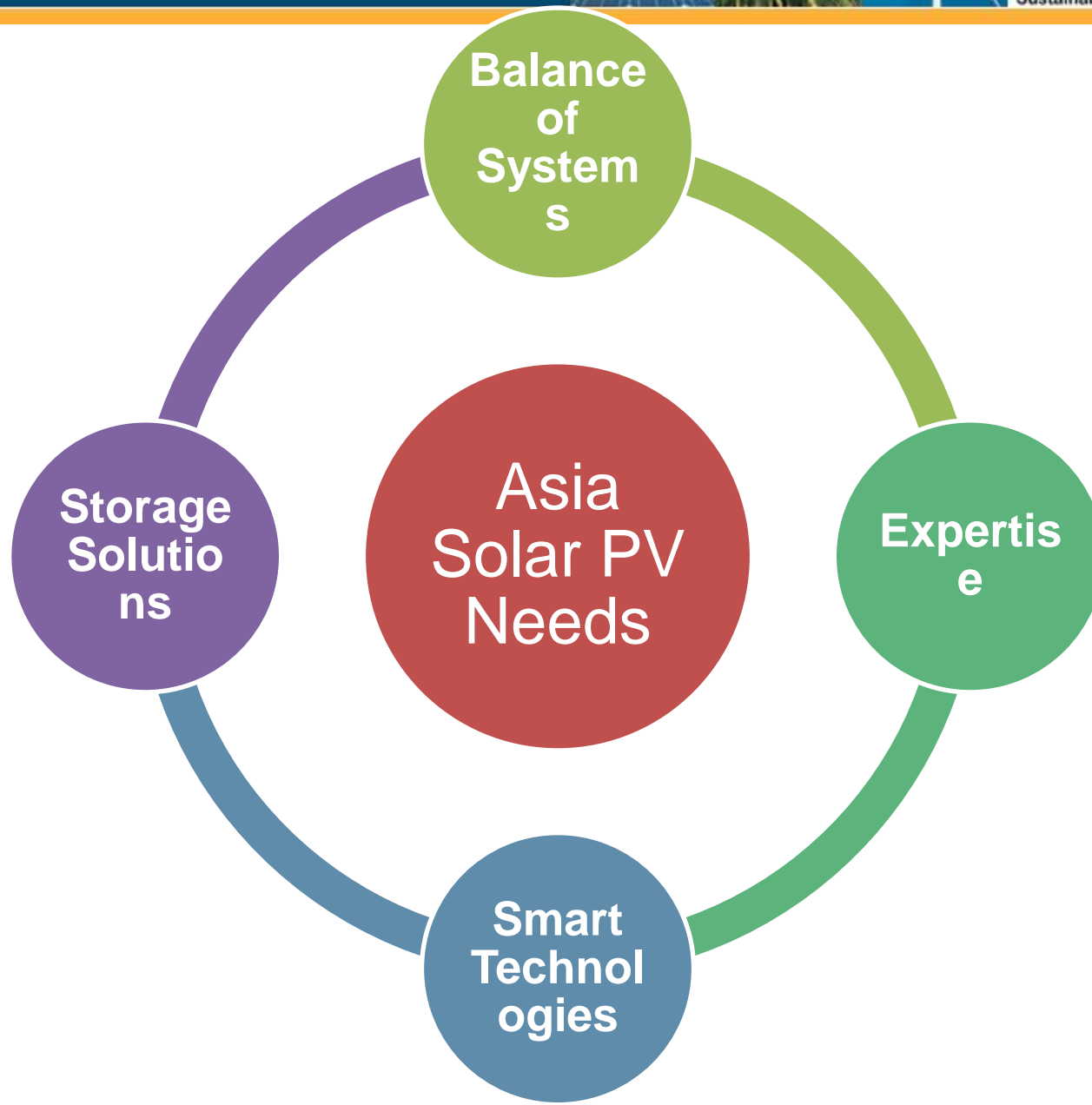
## Water



- Global platform to share business, technology and policy developments, and co-create innovative water solutions

# Exporting Solutions from Singapore







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## Thank You

[www.seas.org.sg](http://www.seas.org.sg)

Join our Group on **LinkedIn**

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