



# SEAS

Sustainable Energy Association of Singapore



***Er. Edwin Khew***

***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

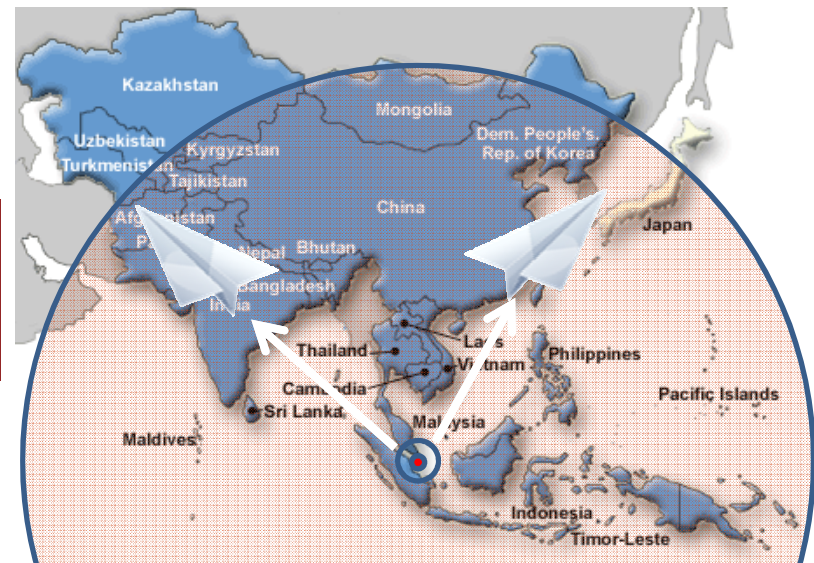


## Why Singapore?



- Singapore, Cleantech Hub of Asia in financing and technology
- “Living Lab” to testbed new innovations and tropicalize existing technologies
- Business incubation and commercialization hub to support regional sustainable development targets
- Robust investments in R&D

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



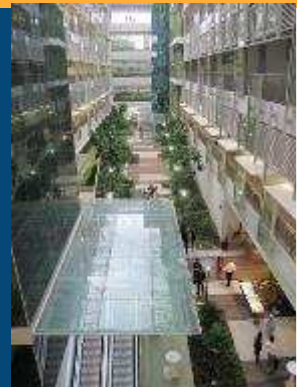


# SEAS

Sustainable Energy Association of Singapore



**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  
• 75,000 MW by 2030



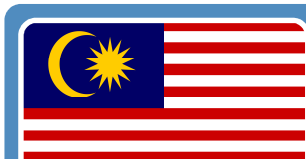
India  
• 10,000 MW by 2017



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





# SEAS

Sustainable Energy Association of Singapore



**Singapore's  
Vibrant Sustainable  
Cleantech Sector**



# Singapore's Cleantech Ecosystem

## CLEANTECH

### ENVIRONMENT AND WATER

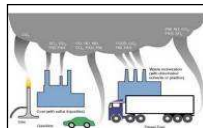


Water



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



Biomass/Biofuel



Smart Grids

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

**SOLARWORLD**  
THE SUNPOWER COMPANY  
Asia Pacific HQ

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

**REC**  
Integrated Solar Mfg Complex

**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**  
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

Foreign

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)



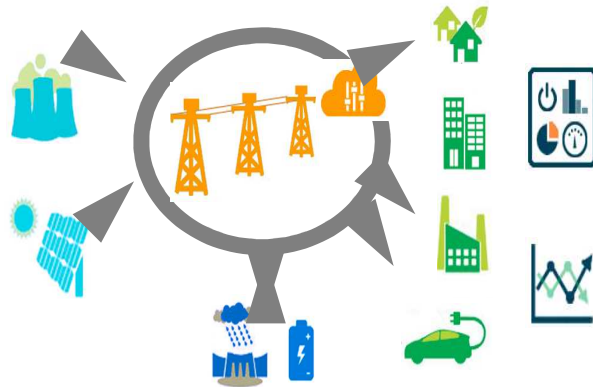
EPCs / Turnkey engineering solution providers / BOT, BOOT utility investors cum operators / water infrastructure consultancy & engineering services (e.g. municipal / township / industrial zones' water supply projects)



Local



# Cleantech Addressing Singapore's Sustainability Needs



Sustainable Energy Management



Green Sustainable City  
(Clean Energy, Green Buildings, ect)



Green Mobility



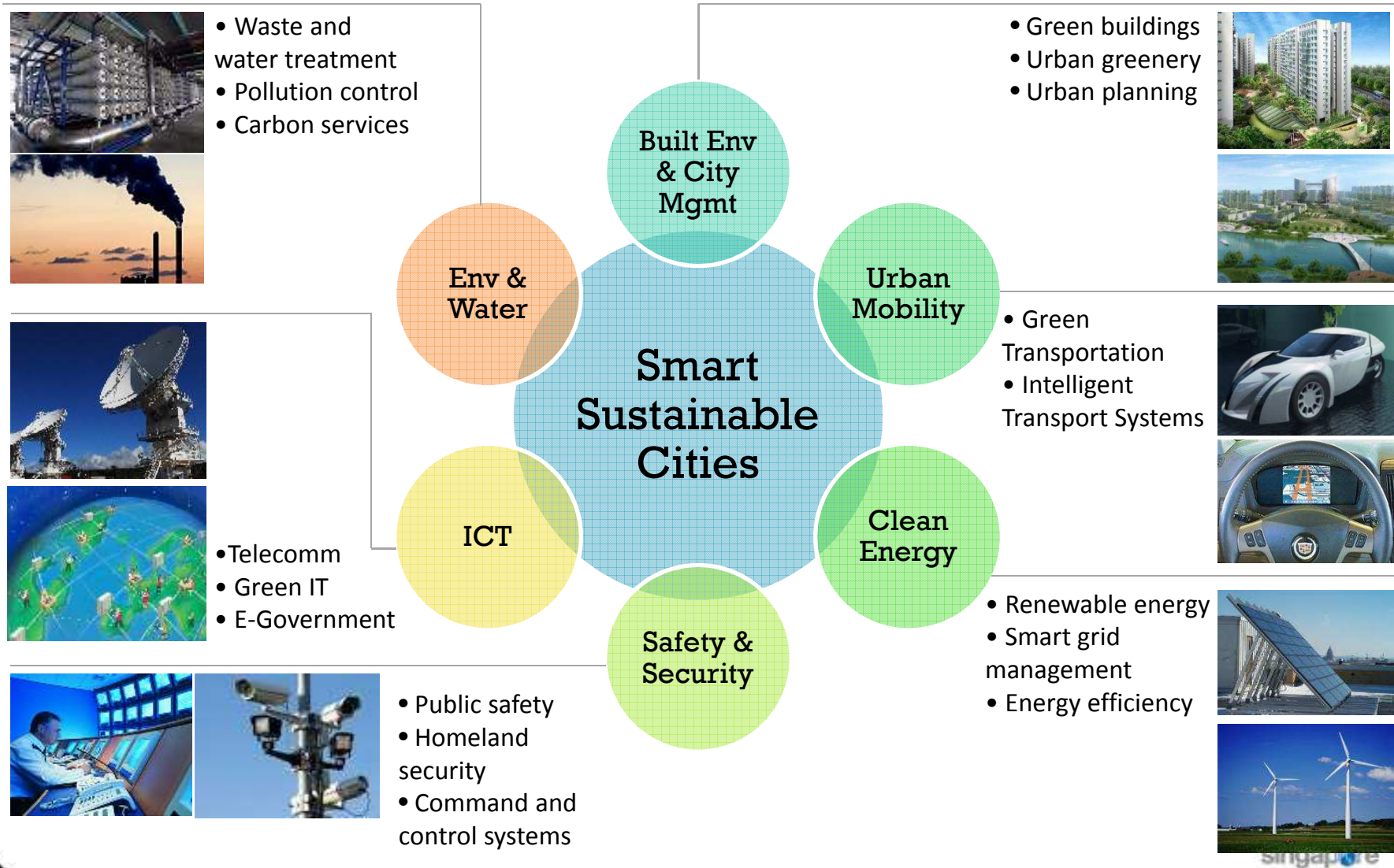
Industrial Efficiency  
(Energy, Water, etc)



Water independence



# Smart Sustainable Cities Solutions





## CLEAN ENERGY AS A KEY GROWTH AREA



Prime Minister Lee Hsien Loong

### THE STRAITS TIMES

S'pore aims  
to be key  
player in  
green  
energy push

March 27 2007

\$350m blueprint  
encompasses R&D,  
nurturing firms and  
exporting products

By ERICA TAY

- 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

# Key Ingredients To Support Industry Growth



## 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

# Singapore's Commitment to Sustainability Through Targets



## 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

Sustainable  
Singapore  
Blueprint



- **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





# SEAS

Sustainable Energy Association of Singapore





# Industry-Oriented Research Centres



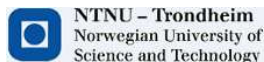
- World's most comprehensive environment and water research centre
- Focus on membranes, environmental biotechnology and waste management



- 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)
- Characterization of PV materials, cells, modules
- Simulation of solar cells & modules
- PV module development, PV module testing
- PV systems (on-grid and off-grid)

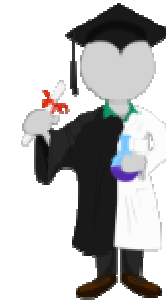
## *Main R&D areas of SERIS*

- Energy simulation of buildings
- Facade technologies (BIPV, windows)
- Solar thermal systems
- Solar mapping of roofs in Singapore
- Tropical PV modules



*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)





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


 **Wind & Marine**


 **Maritime Clean Energy**

 **Energy Storage**

 **Fuel Cells**

 **Solar & Solar Fuels**

 **Electro-mobility,**

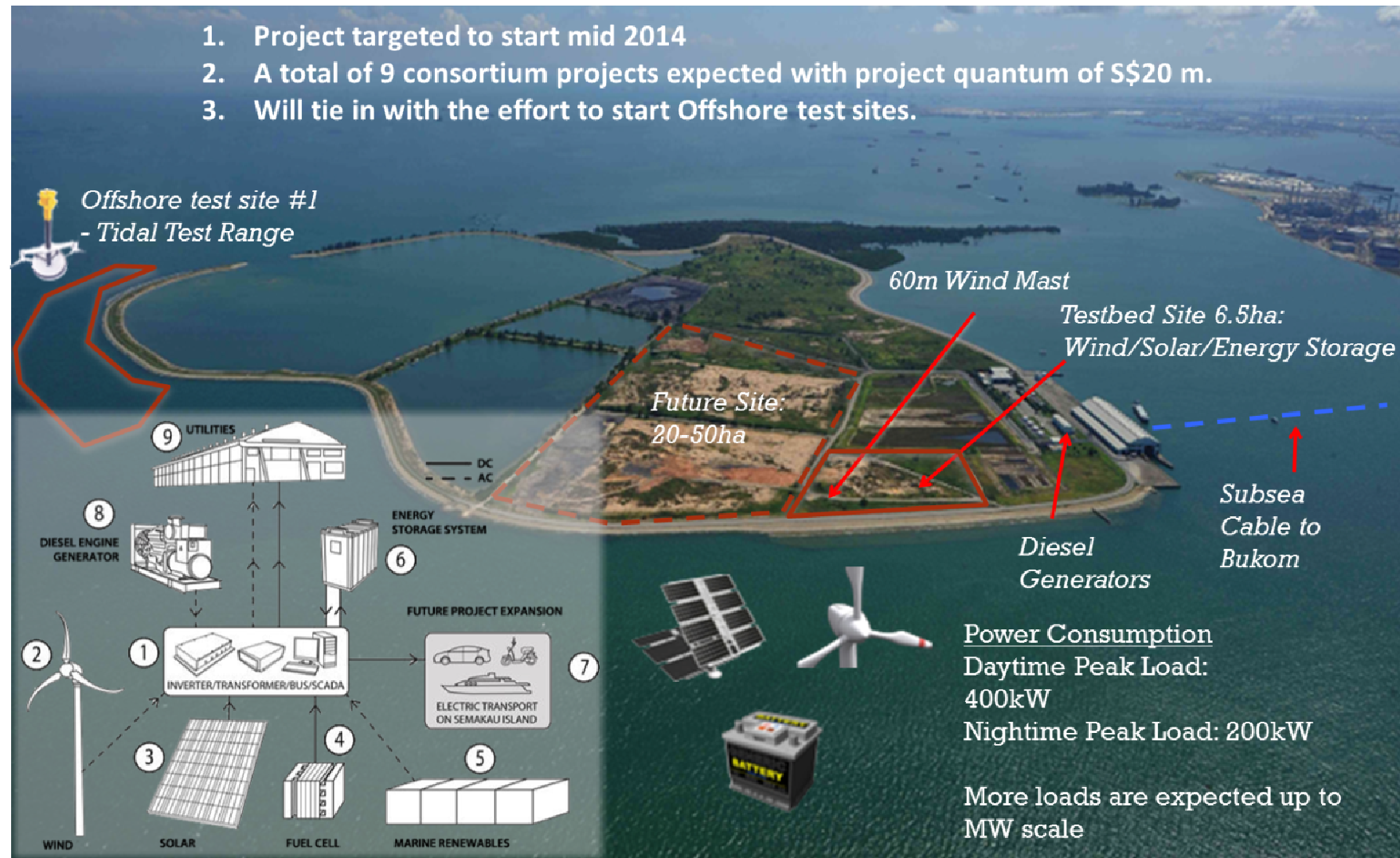
 **Sustainable Buildings, Grids**

Professors, Principal Investigators, Research Staff, Infrastructure

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

# SEMAKAU RENEWABLE ENERGY INITIATIVE

1. Project targeted to start mid 2014
2. A total of 9 consortium projects expected with project quantum of S\$20 m.
3. Will tie in with the effort to start Offshore test sites.







# SEAS

Sustainable Energy Association of Singapore



## Singapore's Solar Deployment



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



## Singapore Pioneering PV solutions



Since 2013 Singapore is Asia's first PV market needing no subsidies to sustain it  
Half the global population is urban; most aspire to Singapore's living standards

- Simple payback periods of 6-10 years, thanks to combination of:
  - relatively high (unsubsidised) electricity tariffs
  - moderately high Equatorial sunshine
  - competitive EPC companies
- First projects >100kW installed in 2009
- Trend towards bigger rooftop projects
  - By Q1/2014, at least four MW-sized rooftop systems
  - All roof types – reinforced concrete, metal, tiled, trellis
  - Total capacity 25 MW in 2013 with Installed Capacity doubling each year...

Singapore's largest PV system (1.4MWp) on Sheng Siong HQ,



## **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*





# SEAS

Sustainable Energy Association of Singapore





Access to Capital



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...”*

## Singapore as Financial Hub



AAA Economy with 700+ financial institutions present in Singapore...

- 120 foreign banks
- 330 fund management companies
- Leading capital market services institutions
- And other organizations such as 200+ insurance companies, financial advisors, etc.

... Driving a world-class financial market center in Asia...

- US\$1 trillion Asian Dollar Market
- Wealth management hub with US\$1 trillion AUM
- Equity / Debt / Foreign Exchange Market and now RMB clearing services

... With a living laboratory for testing clean technologies and cutting-edge institutions

- The Energy Research Institute @ NTU (“ERI@N”) to develop innovative energy solutions
- The Solar Energy Institute of Singapore (“SERIS”) to provide cutting edge solar energy research for the region
- C.US\$150m from National Research Foundation to promote R&D in energy (2011-2015)



# SEAS

Sustainable Energy Association of Singapore



**Supporting  
Business Growth**



# Sustainable Energy Association of Singapore (SEAS) : Background



- 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
- **200+ Corporate Members**
- **Sectors:** Energy Efficiency, Renewable Energy, Carbon Asset Management, Finance & Sustainable Mobility







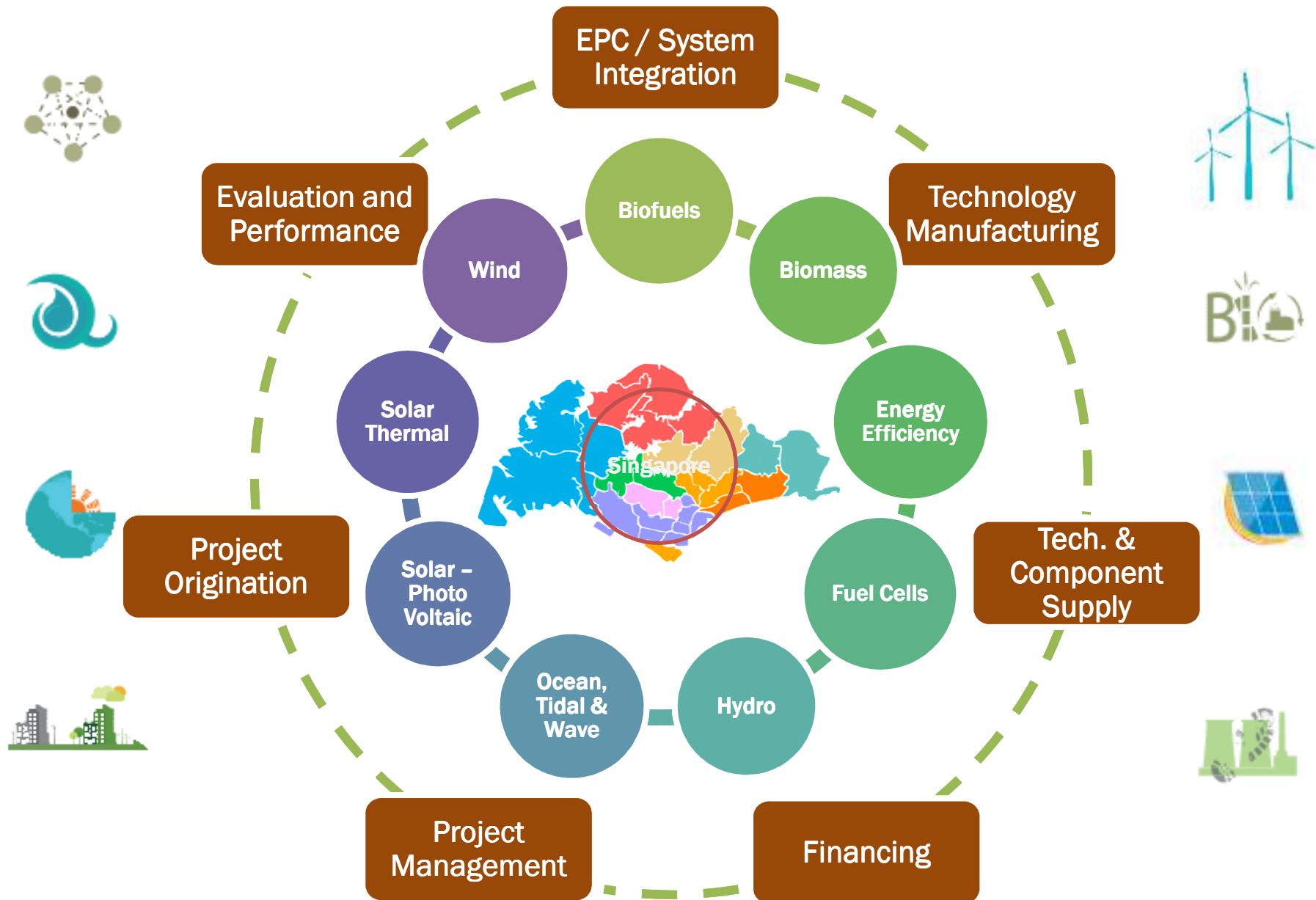
Promote Energy Efficiency & Awareness

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 Commercialization | 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



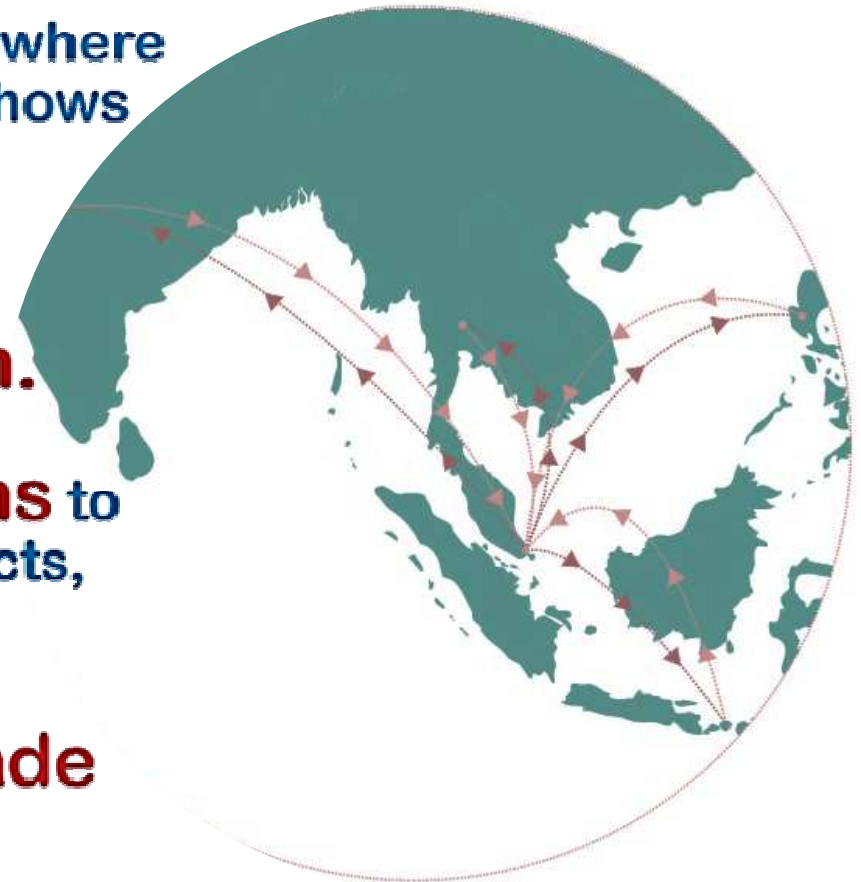
**Solar leasing**  
Solar capability building on public housing



SEAS coordinates **Trade Missions** where members attend exhibitions and tradeshows to showcase their products and capabilities. These activities involved **61 companies and generated estimated sales of \$22 million.**

SEAS organised **Business Missions** to connect member companies with projects, key decision makers and financiers.

**Total expected sales from Trade and Business Missions is in excess of \$50 million annually.**



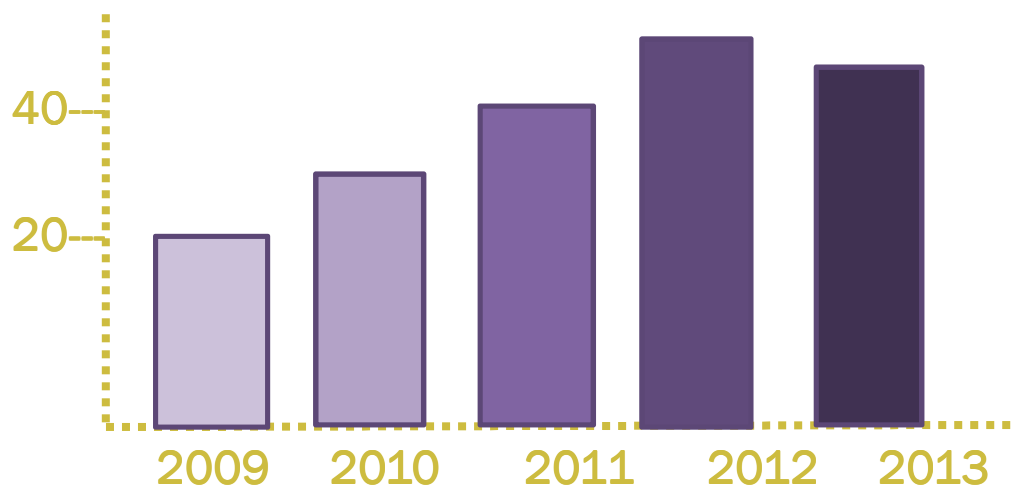
# Regional Capacity Building Through Knowledge Development



*“Due to SEAS’s dedication to the quality of their training courses, the courses were well-received by the industry, and proved useful for their business needs”*

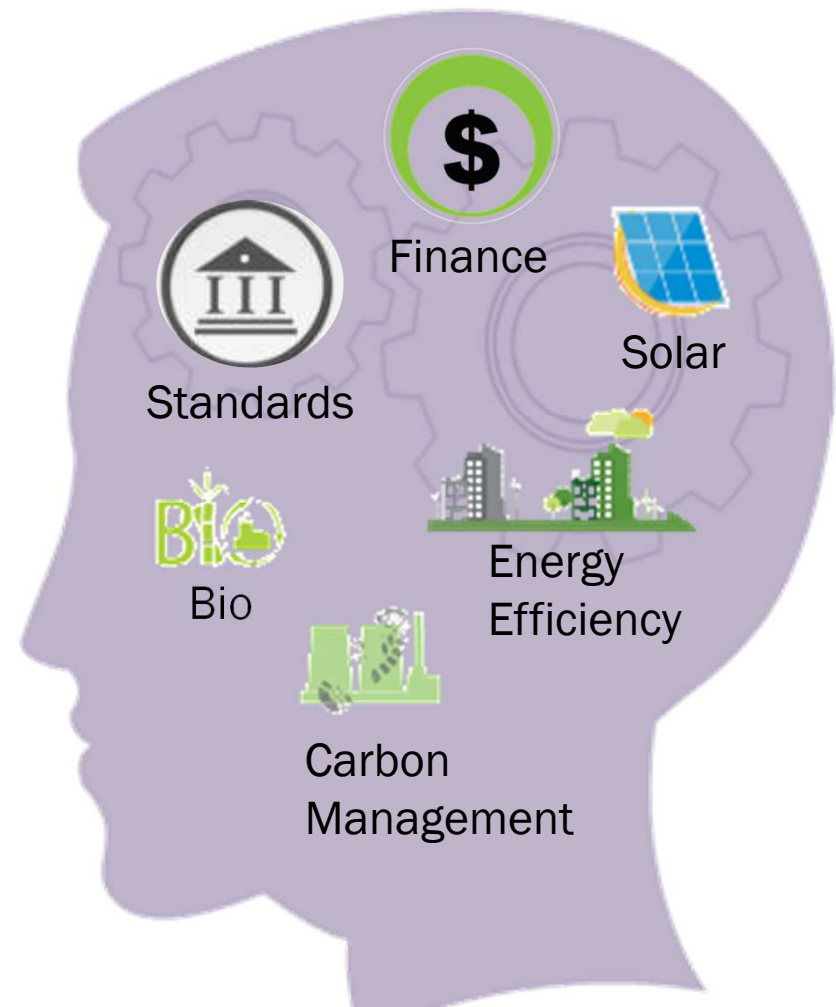
*-Fort & Sullivan, Case Study on LEAD Initiative, Singapore*

No. of Courses Offered Annually



**Over 7000 Professionals  
Trained To Date**

**200 Training Programs  
Delivered To Date**



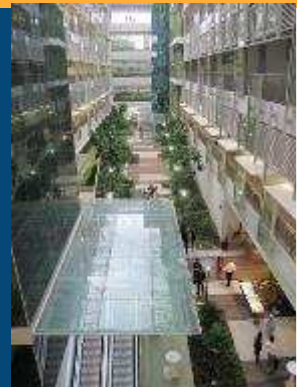


# SEAS

Sustainable Energy Association of Singapore

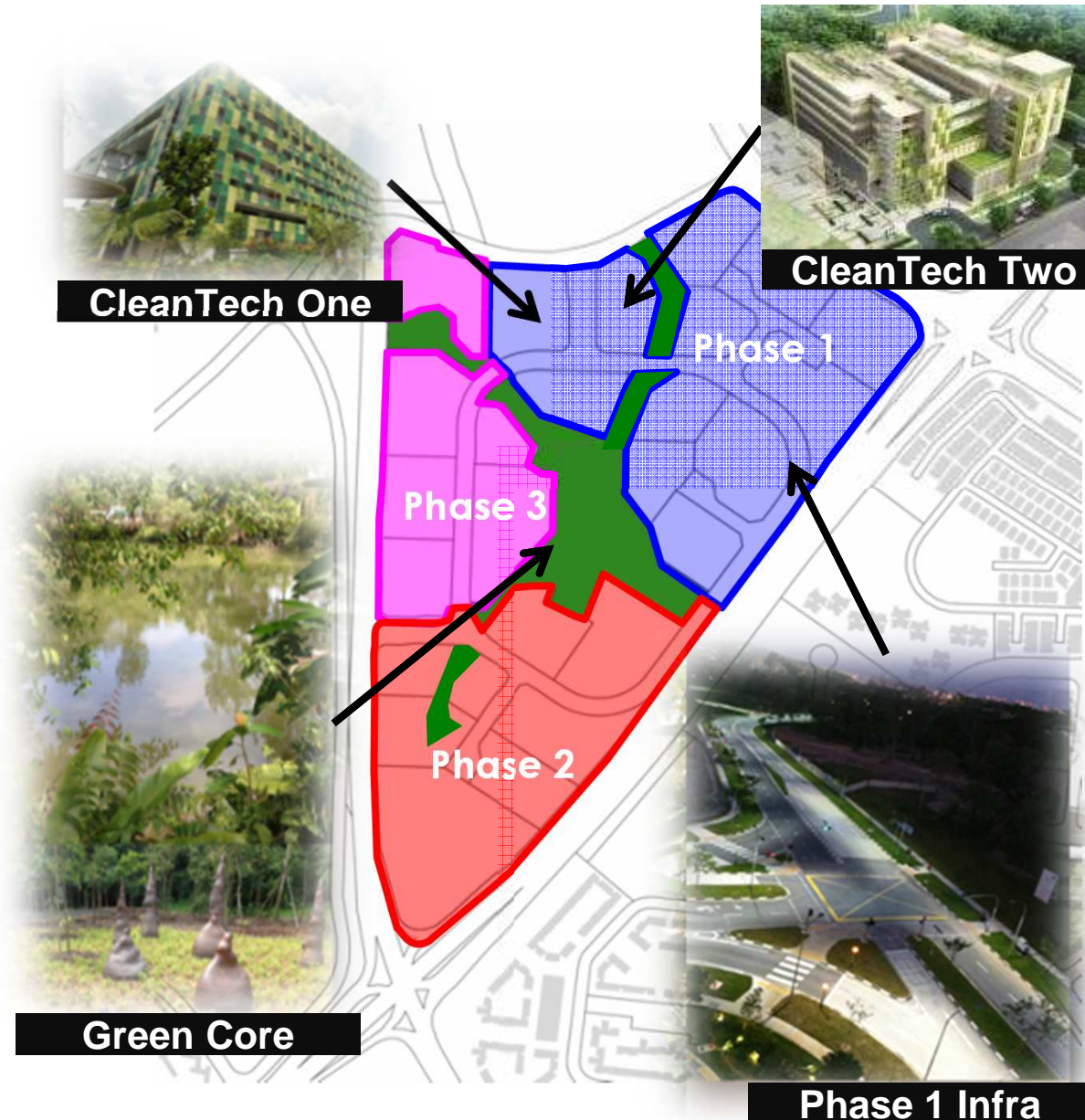


**CleanTech Business  
Acceleration Center**





# Showcase Your Solutions Regionally @ CleanTech Eco-Business Park

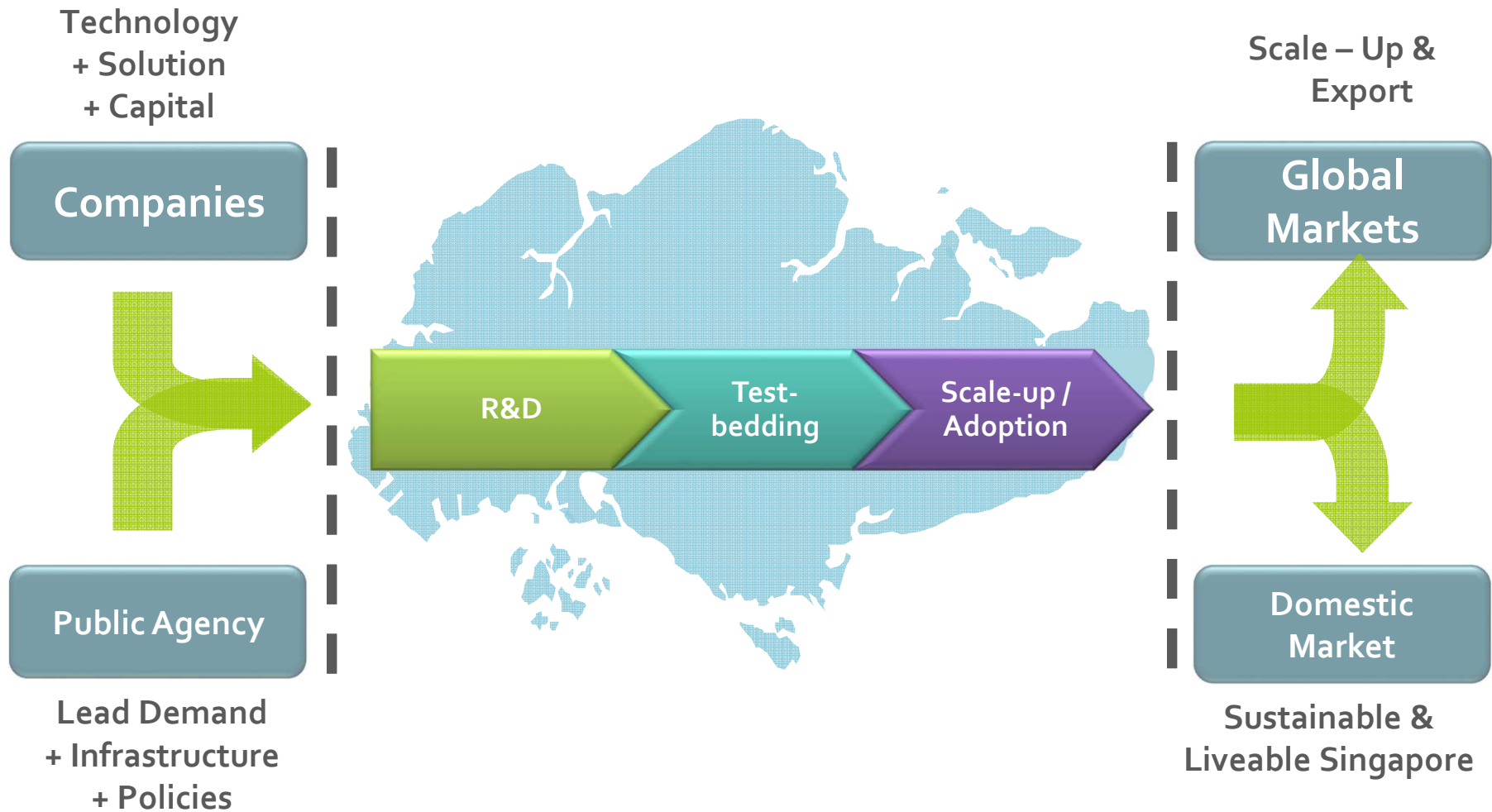


- 50 ha site to be developed in 3 phases, over 20 years
- Total 39 ha of allocable land
- Average land plot size of 1ha - 2ha
- 2 JTC Developments: *CleanTech One & CleanTech Two*

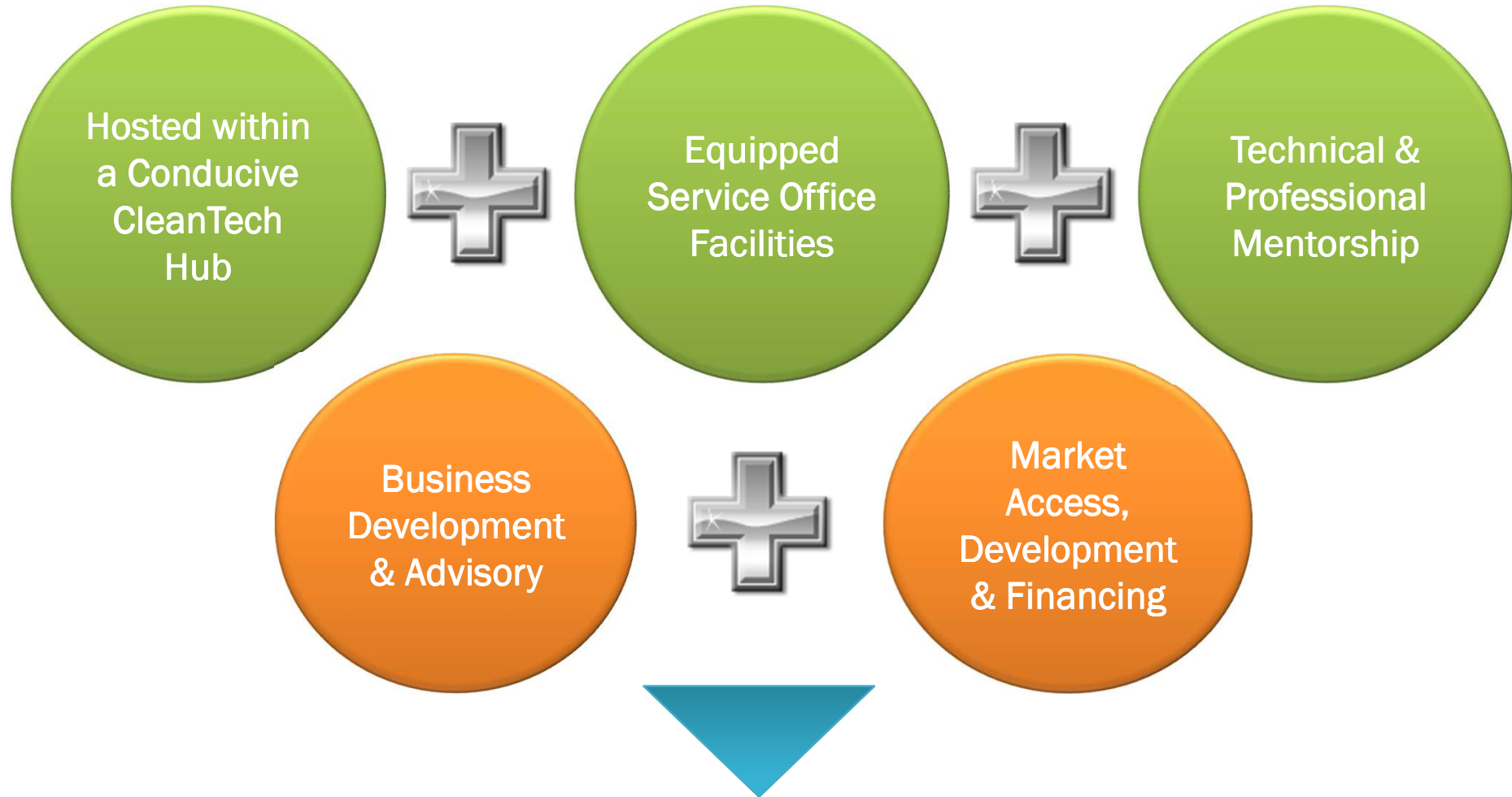
#### Winner of Numerous Green Awards

- *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 & Cos to *Grow Into the Region*



*Offered Through CleanTech Incubator/Accelerator*

Business Advisory

Technology Advisory

Capital & Markets

*“Support and Services to Assist Your Business Objectives...”*



*Packages Starting From S\$1,200 Per Month*

**Business  
Acceleration**

**Business  
Incubation**

*Facilities & Services Include*

*Desk &  
Utilities*

*Meeting  
Rooms*

*Internet*

*Mailbox @  
CleanTech  
Park*

*Printing  
Services*

*Business  
Plan  
Advisory*

*Technology  
Consulting*

*Business  
Mentorship*

*Joint Venture  
Opportunities*

*Market  
Feasibility  
Insight*

*Connection  
to R&D  
Funding*

*Grant  
Facilitation  
& Access*

*Regional  
Business  
Intelligence*

*Project  
Facilitation  
& Financing*

*Dedicated  
Business  
Advisory*

*Industry  
Networking  
Events*

# Business Acceleration Offering



Offerings	Business Acceleration
Office Facilities & Services	<ul style="list-style-type: none"><li>➤ Dedicated Desk Space</li><li>➤ Internet and Utilities</li><li>➤ 10 hrs of Conference / Meeting Room Use per month</li><li>➤ Printing Services</li><li>➤ Secretarial Service</li></ul>
Business Advisory	<ul style="list-style-type: none"><li>➤ Business Plan Review</li><li>➤ 2 Hrs Business Development Advisory From SEAS Secretariat / Month</li><li>➤ Market Feasibility Insight</li><li>➤ Access to Regional Intelligence</li><li>➤ Local and Regional Project Facilitation</li></ul>
Technology Advisory	<ul style="list-style-type: none"><li>➤ Mentorship Opportunities</li><li>➤ Connection to R&amp;D &amp; JV Partnerships</li><li>➤ Project Reference Development</li></ul>
Capital & Markets	<ul style="list-style-type: none"><li>➤ SEAS Individual Membership</li><li>➤ Networking Opportunities at SEAS Events &amp; Affiliated Industry Platforms</li></ul>

**Offering Include Mailbox @ SEAS CleanTech One Office**

*Terms & Conditions Apply To Select Offerings*

## 3<sup>rd</sup> Party Add-on Services



Legal  
Services

Accounting  
Series

Corporate  
Services

HR  
Outsourcing

Web  
Development

Marketing &  
Promotion

IP Services

Technology  
Design



# SEAS

Sustainable Energy Association of Singapore



*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

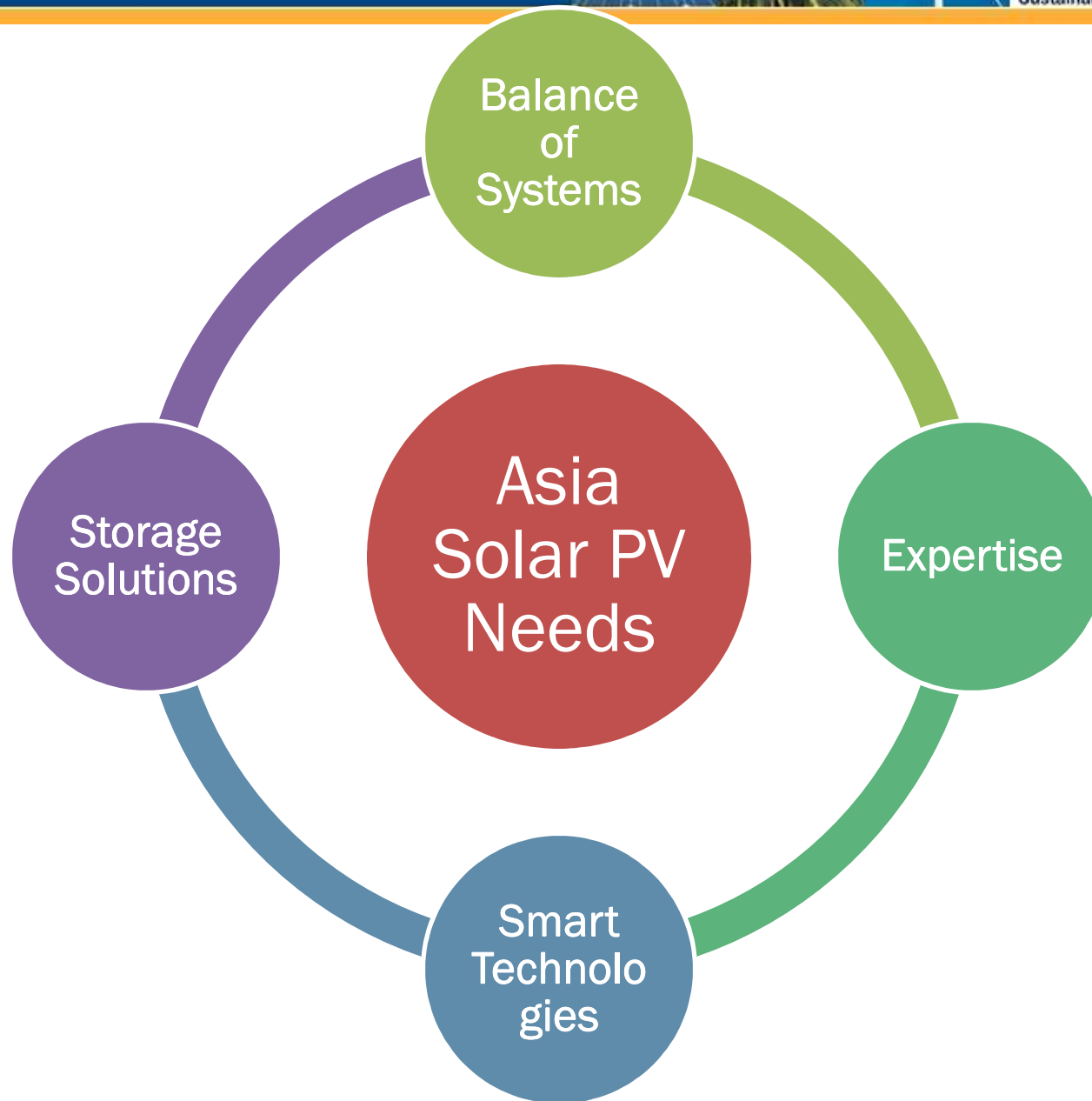
## Water



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

# Exporting Solutions from Singapore







# SEAS

Sustainable Energy Association of Singapore

**Thank You**

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

Join our Group on **LinkedIn**

**Headquarters**

1 Cleantech Loop #02-16 Cleantech One, Singapore 637141  
T +65-63388578 | F +65-66942178

**Training Centre :**

9 Penang Road, #08-02 Park Mall, Singapore 23845  
T +65-63379886 | F +65-63376658

[info@seas.org.sg](mailto:info@seas.org.sg)