Asia-Pacific
Economic Cooperation

APEC SME Green Innovation Conference (SME 09/2010A)

August 25 – 28, 2011, Seoul, Korea

SME Working Group
May, 2011

SME09/2010A

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APEC SME Innovation Center SMBA SBC Small & medium Business Corporation ABAC APEC BUSINESS ADVISORY COUNCIL

sub

No.	Title	File
April 19 (Tue.)		
1	**Canada : Development of a Clean Lithium Ion Battery Business** (Raj Shekar Das Gupta, Director of Research, Electrovaya)	
2	**Japan : Success Story from the Pallet Stove Manufacturer** (Kohachi Maga, Technical General Manager, Sunpot)	
3	**Korea : Success Story from the Solar Cell Equipment Manufacturer** (Yeong Gon Lee, Executive Vice President , Ju Sung Engineering)	
4	**Philippines : Chemrez, Bio Petroleum Specialties** (Rolando Reyes, Consultant of Chemrez Technologies, Inc.,)	
5	**Singapore : Anti-stick Coating System for all Urban Areas Beset with** (Yukio Yanase, COO, Haruna Paint Pte Ltd)	
6	**Chinese Taipei : Rain Water Management** (Erh Chien Tsai, CEO of NanYang Chemical Company Ltd)	
April 20 (Wed.)		
1	**Chile : Green Innovation Policies and Experiences** (Conrad Von Igel, Head of Innovation Division, Ministry of Economy)	
2	**Philippines : Greening SMEs in the Philippines - Initial Steps** (Gladina Aquino, Chief Trade and Industry Development Specialist, Department of Trade and Industry)	
3	**Papua New Guinea : SME Support Policies concerning Green Financing and Green Workforce** (Willie Reia, Principal SME Development Officer, Development of Commerce & Industry)	
4	**Malaysia : Green Industry Development in Malaysia** (Nik Mohd Fahim Muhaimin, Principal Assistant Director, Ministry of International Trade & Industry)	
5	**China : Green SME Supoort Policies in China** (Li Lian, Deputy Division Director, Ministry of Industry and Information Technology)	
6	**Viet Nam : Supporting SMEs in the Application of the Advanced Management System according to the National and Other International Standards** (Quyet Chien Nguyen, Official, Ministry of Science and Technology)	
7	**Korea : Green SME Support Policies in Korea** (Sang-Tae Kim, Deputy Director, Small and Medium Business Administration)	
8	**Indonesia : Development of Green Business Center in Indonesia** (Meliadi Sembiring, Senior Advisor to Minister, Ministry of Cooperatives and SMEs)	
9	**Indonesia : Microbial Technology for Sustainable Agriculture** (I Nyoman Aryantha, Head of Intellectual Property Right Division, Institute Teknologi Bandung)	
10	**Thailand : SME Support Policies concerning Green Technology Innovation** (Vinuchada Talangsri, Policy and Planning Analyst, Department of Alternative Energy Development and Efficiency)	
11	**Mexico : SME Policies to Support Green Technology Innovation** (Ivan Ornelas, Director, Ministry of Economy)	
12	**Peru : Clean Process and Technologies to Support Small Industries** (Adriana Rios, Executive Director, Ministry of Production)	
13	**Chinese Taipei : Governmental Strategy of Promoting Green Trade for SMEs** (Chun Hsu Lin, Executive Secretary, Green Trade Promotion Office, Ministry of Economic Affairs)	
14	**Presentation on Green Initiative Framework** (Ji-Seok Kim, Commissioned Researcher, APEC SME Green Innovation Center)	

Agenda

Date	Time	Schedule
Apr. 19 (Tue.)	09:30-10:00	Registration
	10:00-10:10	Opening Remarks Jongho Song, President, SBC (Small & medium Business Corporation)
		Session I. Keynote Presentation
	10:10-10:40	Ambassador Muhamad Noor, Executive Director, APEC Secretariat Faizulah Ezat Talib, Lead Co-Chair of SMME & Entrepreneurship Working Group in ABAC (APEC Business Advisory Council)
		Session II. Creating Green Business Opportunities
	10:40-12:00	Canada : Development of Clean Lithium for Battery Businesses [illegible]
		Japan : Success Story from the Pellet Stove Manufacturer [illegible]
		Korea : Success Story from the Solar Cell Equipment Manufacturer [illegible]
		Q&A and Discussion
	12:00-13:30	Lunch
		Session III. Environmental Improvement through Green Growth
	13:30-14:45	Philippines : Chemrez, Bio Petroleum Specialists [illegible]
		Singapore : Anti-skid Coating System for all Urban Areas [illegible]
		Chinese Taipei : Rain Water Management [illegible]
		Q&A and Discussion
	14:45-15:00	Coffee Break
		Session IV. APEC SME Matchmaking Event
	15:00-17:00	Matchmaking Meetings
Apr. 20 (Wed.)		**Session V. SME Support Policies concerning Green Financing and Green Workforce**
	10:00-11:00	Chile : Green Innovation Policies and Experiences [illegible]
		Philippines : Greening SMEs in the Philippines : Initial Steps [illegible]
		Papua New Guinea : SME Support Policies concerning Green Financing and Green Workforce [illegible]
		Q&A and Discussion
	11:00-11:15	Coffee Break
	11:00-12:15	Malaysia : Green Industry Development in Malaysia [illegible]
		China : Green SME Support Policies in China [illegible]
		Viet Nam : Supporting SMEs in the Application of the Advanced Management System according to the National and Other International Standards [illegible]
		Q&A and Discussion
	12:15-13:30	Lunch
		Session VI. SME Support Policies concerning Green Technology Innovation
	13:30-14:30	Korea : Green SME Support Policies in Korea [illegible]
		Indonesia : Development of Green Business Center in Indonesia [illegible]
		Indonesia : Microbial Technology for Sustainable Agriculture [illegible]
		Thailand : SME Support Policies concerning Green Technology Innovation [illegible]
		Q&A and Discussion
	14:30-14:45	Break
	14:45-15:45	Mexico : SME Policies to Support Green Technology Innovation [illegible]
		Peru : Clean Process and Technologies to Support Small Industries [illegible]
		Chinese Taipei : Governmental Strategy of Promoting Green Trade for SMEs [illegible]
		Q&A and Discussion
	15:45-16:00	Coffee Break
		Session VII. Green Initiative Framework
	16:00-17:30	Presentation on Green Initiative Framework [illegible]
		Q&A and Discussion

19 April Presentations

1 Canada : Development of a Clean Lithium Ion Battery Business
(Raj Shekar Das Gupta, Director of Research, Electrovaya)

2 Japan : Success Story from the Pallet Stove Manufacturer
(Kohachi Maga, Technical General Manager, Sunpot)

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(Yukio Yanase, COO, Haruna Paint Pte Ltd)

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(Erh Chien Tsai, CEO of NanYang Chemical Company Ltd)

Electrovaya's Low Cost, High Performance, Clean Manufacturing Approach for Lithium Ion Batteries

Dr. Rajshekar DasGupta
Director, Research

electrovaya

2011 APEC SME Green Innovation Conference
Seoul, Korea

Electrovaya at a Glance

- Founded in 1996;
- TSX: EFL : Public Company, Toronto Stock Exchange
- Highly Differentiated Battery Technology
  - Pioneer of Lithium Ion Battery & Battery Systems for Clean Transportation/Smart Grid/Mobile Computing
  - Proprietary Lithium SuperPolymer®: Platform Technology: 150+ Patents; High Energy Density; Low Cost
- Clean and Low-Cost Manufacturing Worldwide
  - *NMP-free* process: NMP identified as a reproductive toxicant (generates birth defects)
  - Significantly lower CapEx & OpEx: Faster build up of manufacturing capacity at fraction of capital cost
- Canadian and US manufacturing expansion

Our History

1996 — Founded in Ontario Canada

1998 — Breakthrough in Nanotechnology developed

2000 — Company goes public under ticker EFL

2002 — PowerPads®, Electrovaya's external laptop battery product, first commercially launched

2004 — Receives NASA Prime Contract for large-format batteries for aerospace

Electrovaya, in partnership with GM / Suzuki JV, creates its first electric car

2006 — Sold Phostech Lithium shares shortly launches MN-Series chemistry

Delivers first Ford Escape PHEV conversion demonstrator

2008 — Partners with subsidiary of Tata Motors in Europe

2010 — CHRYSLER Announced as Chrysler Ram PHEV Battery Supplier

Electrovaya unveils Maya Electric, Test program with ExxonMobil: Lithium ion Powered city car

Founders

Dr. Sankar Das Gupta

Chairman & Chief Executive Officer

- Co-founded company in 1996 as well as its predecessor
- Chairman since 1999
- Holds a PhD in Electrochemistry from Imperial College, University of London and is an adjunct professor at the University of Toronto.

Dr. James K. Jacobs

retired from Electrovaya

- Co-founded company in 1996
- CTO until 2003
- Holds a PhD in solid-state physics from the University of Toronto

Experienced Management Team

Dr. Sankar Das Gupta
Chairman &
Chief Executive Officer

- Founded company in 1996 with Dr. James Jacobs
- Extensive business experience in the technology sector at Electrovaya and HSA Reactors Limited
- Holds a PhD in Electrochemistry from Imperial College, University of London and is an adjunct professor at the University of Toronto. He also serves as a corporate Ambassador for the Province of Ontario and is a Charter Founder Member of TIE-Toronto.

Tom LaSorda
Special Advisor to the CEO &
Member of the Board of Directors

- Former CEO, Chrysler
- Distinguished 23-year career with GM including President of Opel, Eisenbach
- Recently was Advisor to Penske Automotive Group in their bid to purchase Saturn

Paul L. Hart
Chief Financial Officer

- Previously CFO of Public/Privately Held Companies, including Bid.com (dual listed TSX/NASDAQ) and ADP Canada
- M&A experience for key acquisitions in the financial services and venture capital industries
- Previously also at PriceWaterhouse-Coopers, Bank of Montreal, holds an MBA, CA and C.Dir

Bruce Coventry
Vice President of Operations

- Former CEO, GEM Motors
- Former President of the Global Engine Manufacturing Alliance (GEMA)
- Distinguished 25 years in operations management at Chrysler, Ford, GM.
- Most recently President of the Power & Compression Group of Dresser Inc.

Board of Directors

- **Clarence J. Chandran**
- **Bejoy DasGupta, Ph.D**
- **Bernard Fleet, Ph.D**
- **Michael L. Gopikanth, Ph.D**
- **Tom LaSorda, MBA**
- **Alexander McLean, Ph.D**

PART 1: Electrovaya's Business Strategy


"One million plug-in hybrid cars by 2015"
President Barack Obama
Automotive:

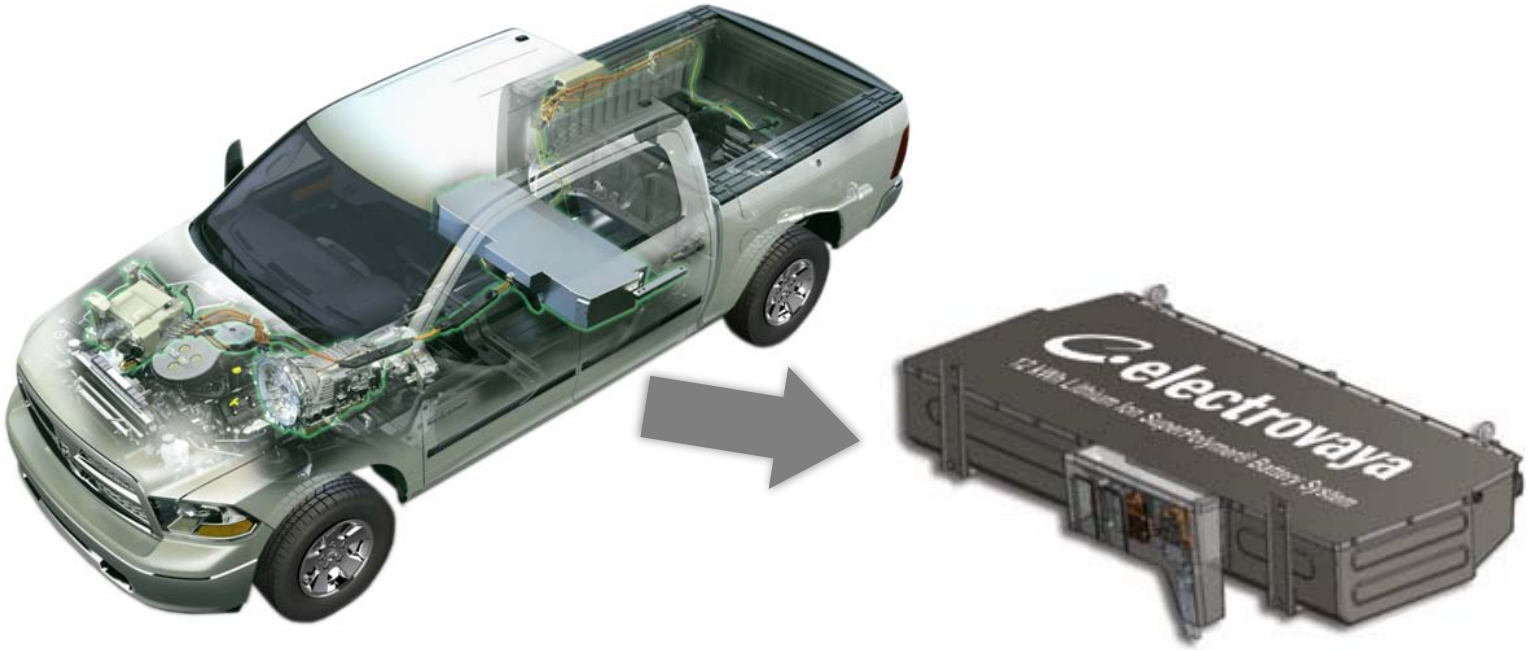
Electrovaya is Partnered with Chrysler Group LLC in a Department of Energy (DOE) Ram Truck Plug-in Hybrid Electric Vehicle Test Fleet Program

CHRYSLER

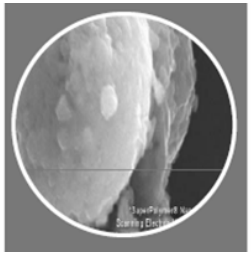
- Battery pack size: 12 kWh Electrovaya responsible for both cells and complete integrated battery system
- Sole provider of battery systems to Chrysler Group's test fleet of Ram PHEV's

Integrated12.1kWh battery pack solution

20 mile all electric range, up to 65% fuel savings



Electronic Management

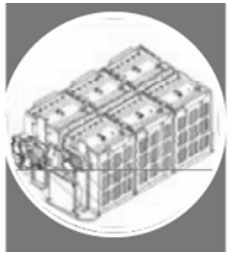


Thermal Subsyste

Electrical Subsystem

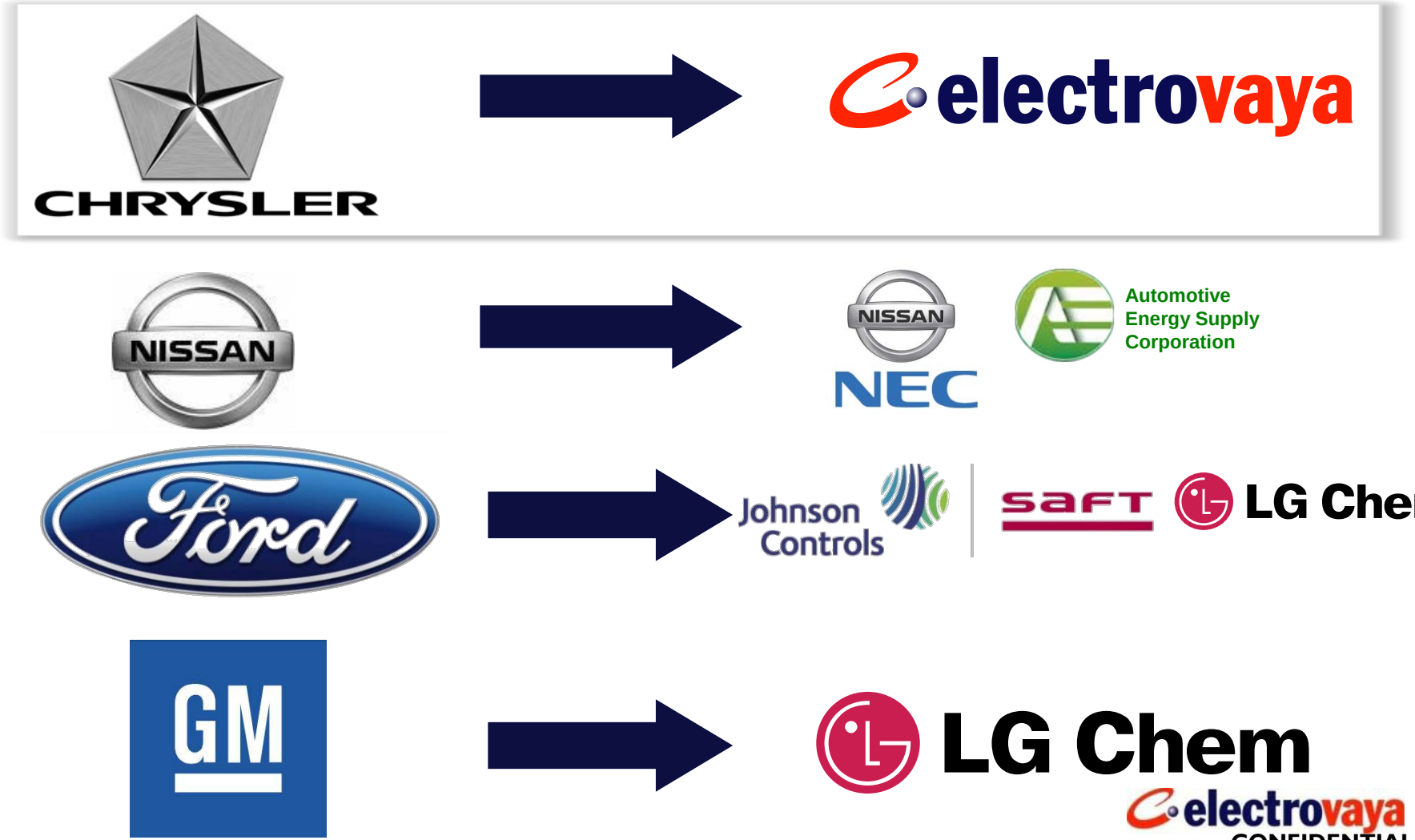
Mechanical Subsystem

Safety Subsystem



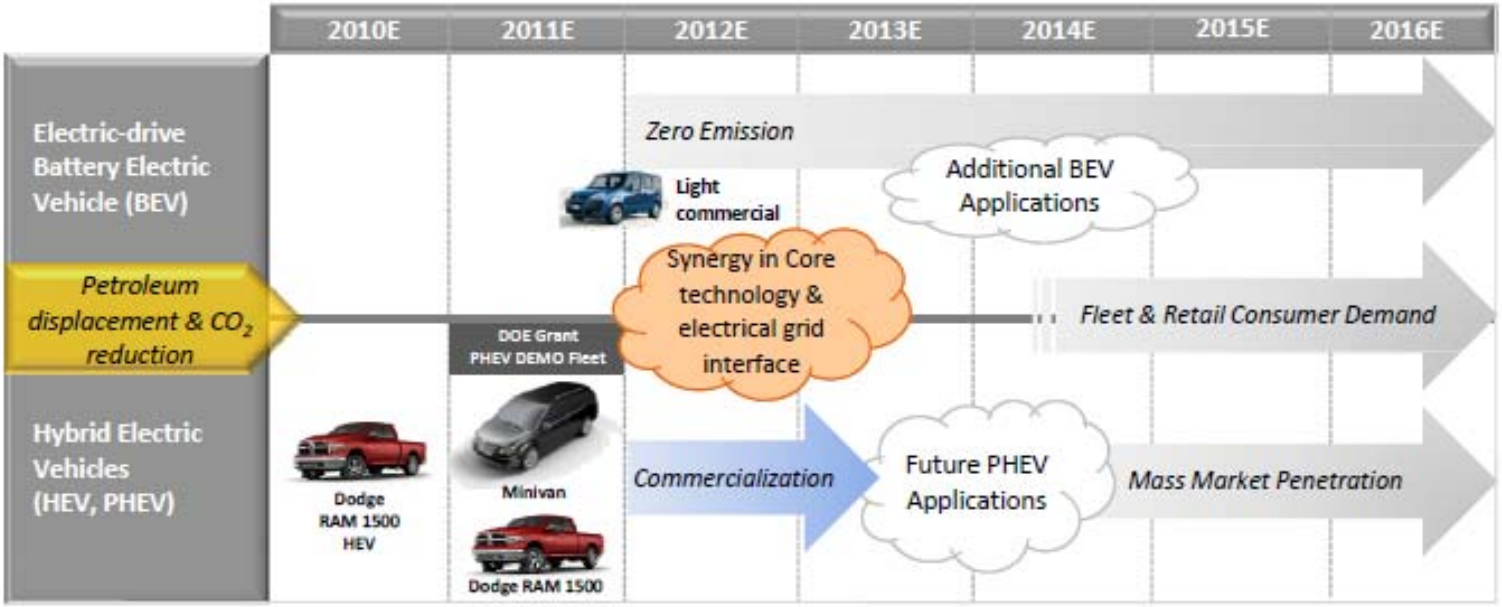
One Million Plug in Vehicles: N.American Auto Partnerships

4 Chosen Tier-1 Suppliers for this Emerging $22-bilion global market by 2015. Electrovaya is the only public pure-play battery company selected to supply batteries for an approved DOE project by a major North American automobile manufacturer.



Source: Equity Research

Chrysler Group's electrification plan



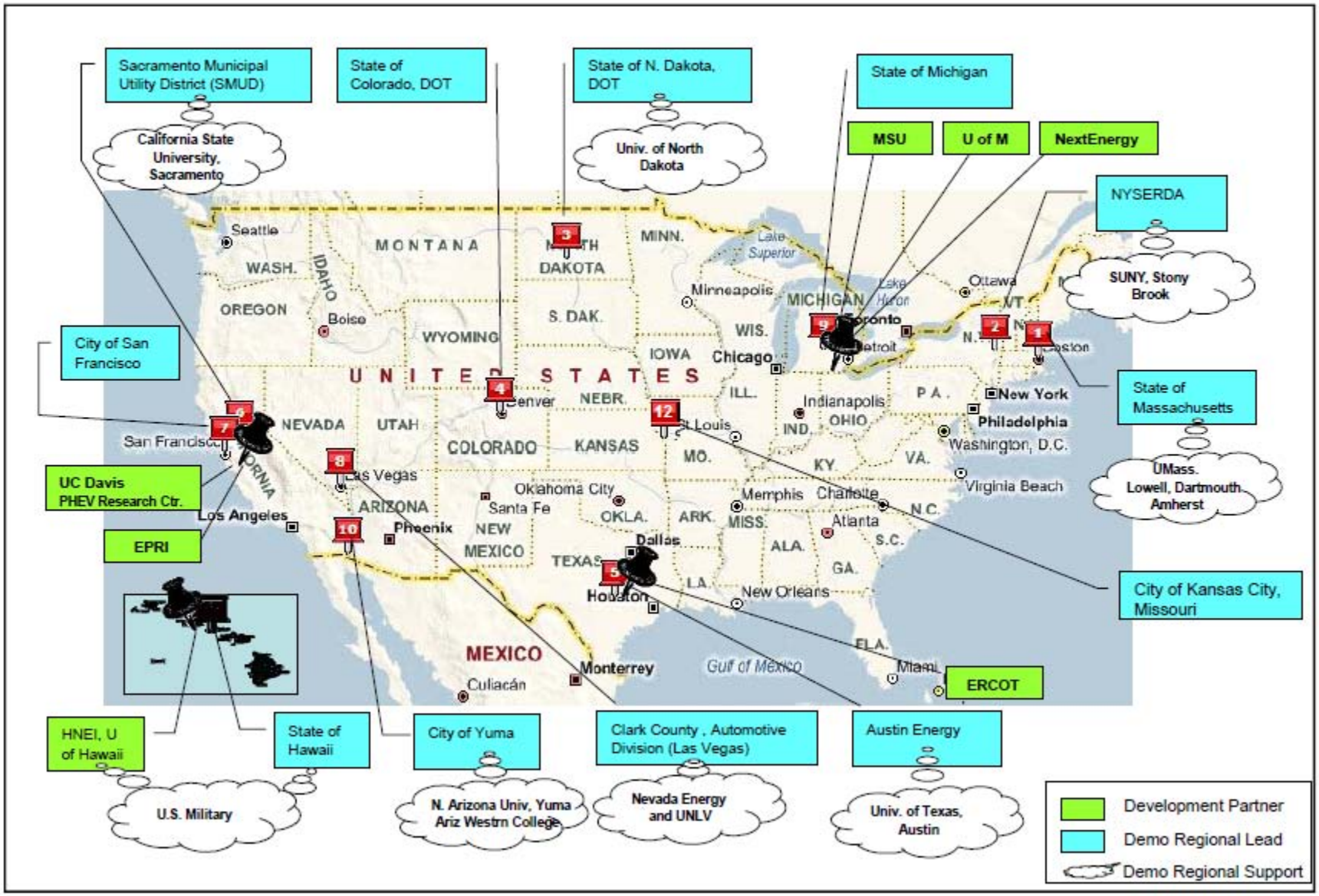
Chrysler's Electrification Plan

- Support Alternate propulsion technology for energy independence: Petroleum displacement & GHG reduction
- Develop several key technologies for commercialization
- Implement PHEV & BEV tehnologies
- Prepare for potential shift from regulatory push to consumer demand
- Partner with Government and suppliers as a key to managing cost and creating consumer demand

Chrysler Group is lead engineering center for hybrid /electrification for Chrysler & Fiat Group

Partner and Vehicle Allocation

CHRYSLER



Battery of Choice for Difficult Applications

Electrovaya has always been technically focused on large-format cells and battery systems for some of the world's most demanding applications.

Criticality-1 Application for Astronaut Life Support

Sole supplier to Kongsberg Maritime a global leader in Underwate Autonomous Vehicles

EXCELLENCE AWARD FROM NASA

...Extremely impressed with the abilityand innovativeness of Electrovaya and the superior technical support brought by Dr. Jacobs and the Electrovaya team." Mr. Lutz continued "the high degree of expertise has made a significant difference in the relationship and project progress to date.... Glenn Lutz, Deputy Manager Extravehicular Activities (EVA) Office. June 02, 2004

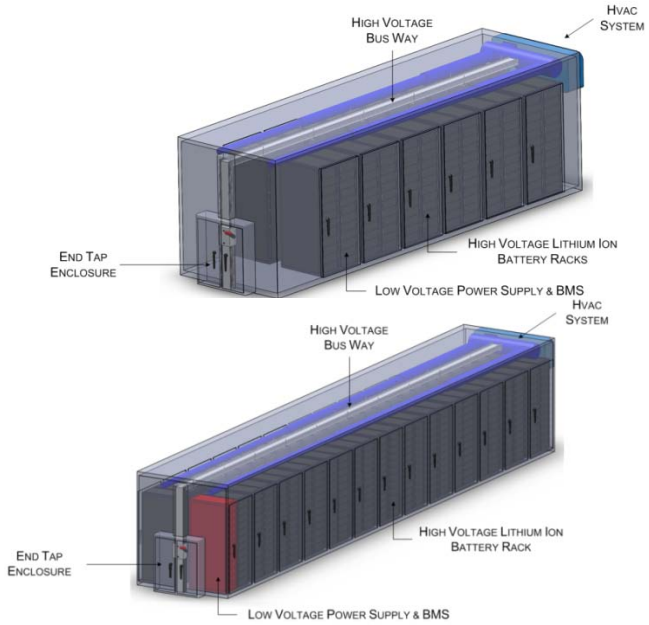
electrovaya

Grid Applications & Product Line

Renewable Energy: requires storage to become reliable domestic energy option

Urbanization: demand growth challenges all parts of the infrastructure

- Utility Scale Systems designed to provide Energy Firming and Off-peak Storage
- Electrovaya's solutions have the most flexibility in performance and ultimately lowest cost
- Current demonstration in Ontario, Japan, several large installations under review



Utility/Grid Partners

Electrovaya is in discussions with many parties across the spectrum of the applicable utility storage market as detailed below. While we develop those relationships, we've also announced some partners also shown below.

Spectrum of Utility Applications :: advanced partner discussions

- **Announced Partners:**

CEATI INTERNATIONAL

Members including hydro one

$7.5-million total project (Feb-10)

- Intermittent (renewable) generation
- High-density urban solutions for new electric loads
- Repurposed electric vehicle batteries

NKE

Japan Partnership (Nov-09)

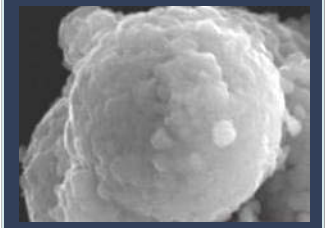
NKE is the only company in Japan that provides distribution equipment to all of the major 10 electric power utilities in Japan.

PART II: Unique Technology and Approach to Lithium Ion Battery Manufacturing

Key Technology Differentiators

Four key areas of core technology/product advantages

Technology



Nanostructure Innovation

Large Format Prismatic Cell Specialist

Integrated Pack / Systems

Unique Clean Low-cost Manufacturing Process

Benefit

- Lower cost curve due to superior energy density
- Enables continuous improvements

Preferred for Large Battery Systems (auto, grid)

Higher Value-added, Non-commoditized Business

- Low CAPEX
- Low OPEX
- Faster capacity build
- No Future Liabilities
- No Negative PR

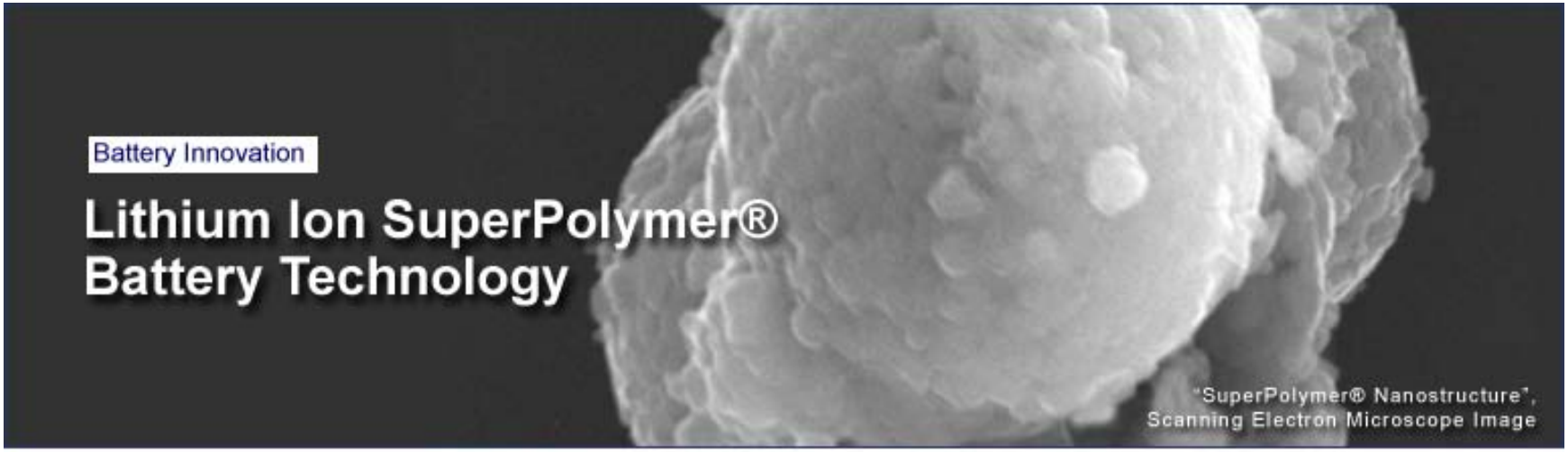
Intellectual Property

We have the critical technology (Battery, BMSD, Systems, Thermal Interfaces to Automotive) to provide end-to-end solutions for our customers

- We have over >150 patents or patents pending
  - 90 issued national patents
  - 88 pending patents
  - 20 issued US patents
- Our patent coverage focuses on areas where potential markets / manufacturing activities make patent protection desirable and economically justifiable, specifically the U.S., Canada, Europe, India, China, Japan
- Our Patents address the following areas:
  - Structural technology innovations (platform)
  - System-level designs
  - iBMS® - Intelligent Battery Management System
  - Nanomaterials
  - Processes

Nanostructured Innovation

Electrovaya's principal innovation to the battery industry is a fundamental innovation in a structure of a cell.

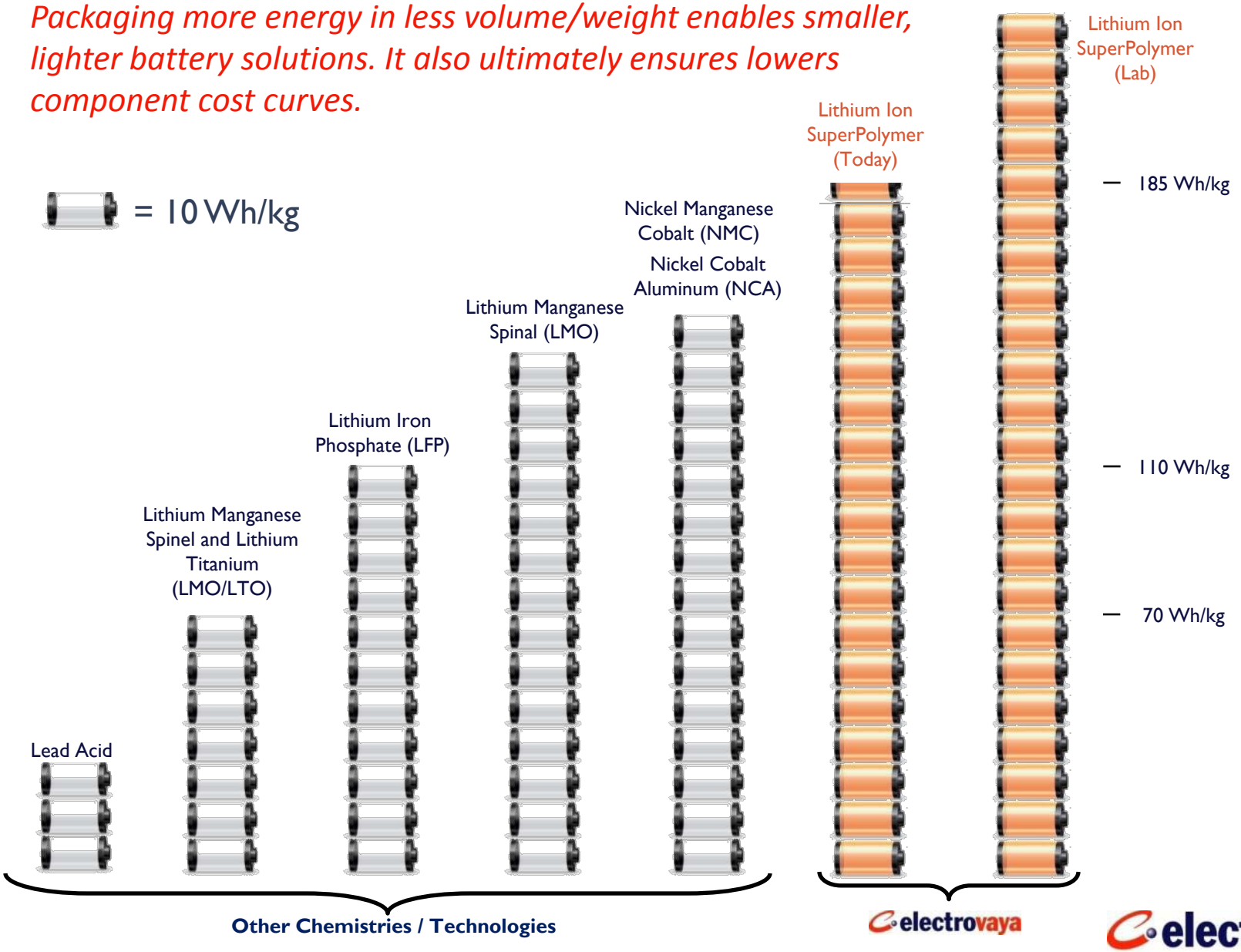


Fundamental Innovation → Continual Evolution

Superior Energy Density → Smaller, Lighter → Lower cost

Superior Energy Density & Roadmap

Packaging more energy in less volume/weight enables smaller, lighter battery solutions. It also ultimately ensures lowers component cost curves.



Source: Equity Research.

Electrovaya: The Only Complete Solution

No other competitor offers a solution that meets all critical battery solution attributes.

	electrovaya	Competitors
Nanostructure that lowers cost curve	☑	NONE
Large-format prismatic cells	☑	Some
Integrated pack/systems solutions	☑	Some
Clean manufacturing process	☑	NONE
Excellent Cycle Life	☑	Most
Superior Usable Energy Density	☑	Most
Good Safety	☑	Most
Low-cost North American Mfg.	☑	Few

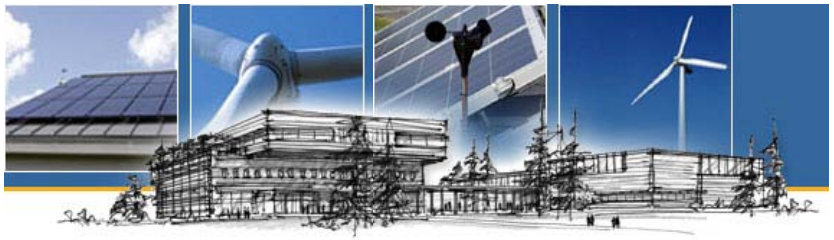
Unique Manufacturing Process

"zero-emission": non-toxic process *(NMP-free)*

Low-cost Manufacturing Capacity in High Cost Regions.

Images: *Top:* 15 acre Mississauga Plant
Bottom Left: Outside of dry room
Bottom Right: Modular mfg. production

- Mississauga, Ontario Canada
  - 2nd largest dry room in North America
  - 155,000 sq. foot facility on 15 acres
  - 2010: 100MWh / annum
  - 2012: 200 MWh / annum



- US Location:
  - 2011: 500 MWh/annum
  - Target 2014: 1000 MWh/annum
- Joint Venture – Europe
- Joint Venture – India
- Joint Venture – Japan

Unique, Clean Manufacturing Process

Electrovaya offers "Zero-Emission Manufacturing for Zero-Emission Vehicles"

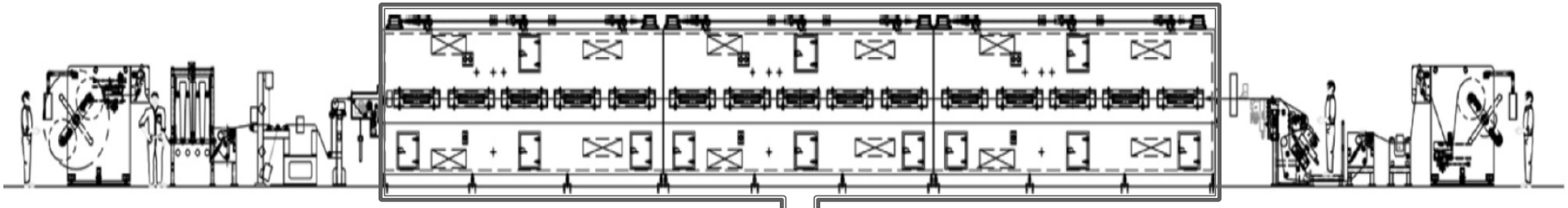
Typical Lithium Ion Battery Manufacturing

VS.

electrovaya

- No use of NMP (NMP FREE)
- Financial advantage relative to alternative – higher margins and lower capital costs
- Less risk of future liabilities
- Capable of manufacturing in urban areas
- Complements customer and partners' vision of green supply chain

Benefit: Eliminated Capital Infrastructure & Associated Operating Costs



NMP: Long Term Liability

- **Birth Defects:** NMP has been closely linked to the presence of birth defects. Many academic studies have recently highlighted its toxic effects.
- **Legislation:** Governments are increasing legislation of NMP. USA, Japan and the E.U have begun legislation which will only increase.
- **History of Liability** : NMP can easily follow the same history of other toxic substance like Asbestos. Asbestos liability led to enormous liability costs and bankruptcy of multi-billion dollar corporations.
- **Nature of the Liabilities:** Increasing US legislation as well as Tort based legal liabilities

Summary: Unique Electrovaya Process

- **Capital Cost Reduction:** Electrode production costs are approximately 75-85% lower than NMP based process
- **Operating Cost Reduction:** Electrode production costs are approximately 20-30% lower than NMP based process
- **Liability Reduction:** Avoidance of potentially significant liability costs
- **Clean Production:** Mirrors environmental intent of clean cars
- **Compatible with Existing Chemistry:** Electrovaya's process is compatible with all currently used chemistries including binders, electrolyte, cathode and anode materials.

Opportunities for Global Clean and Low Cost Lithium Ion Battery Production

- Lithium Ion Battery Manufacturing is becoming a strategic industry as they displace oil for transportation requirements and become a desirable asset for utilities.
- Current conventional manufacturing methods are very capital intensive (>$1B USD minimum for capacity), and are environmentally unfriendly (NMP usage)
- Electrovaya's NMP free manufacturing process allows for high performance and at significantly lower capital and operating cost.
- Electrovaya is in discussions regarding licensing opportunities.
- The lithium ion battery industry can go through a transformation by adopting the Electrovaya process as it will allow lower cost electric vehicles and allow for widespread/localized battery production.

Contact:

Dr. Rajshekar DasGupta
Director Research

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Canada L5J1K9

Success story from the pellet stove

2011 APEC SME Green Innovation Conference

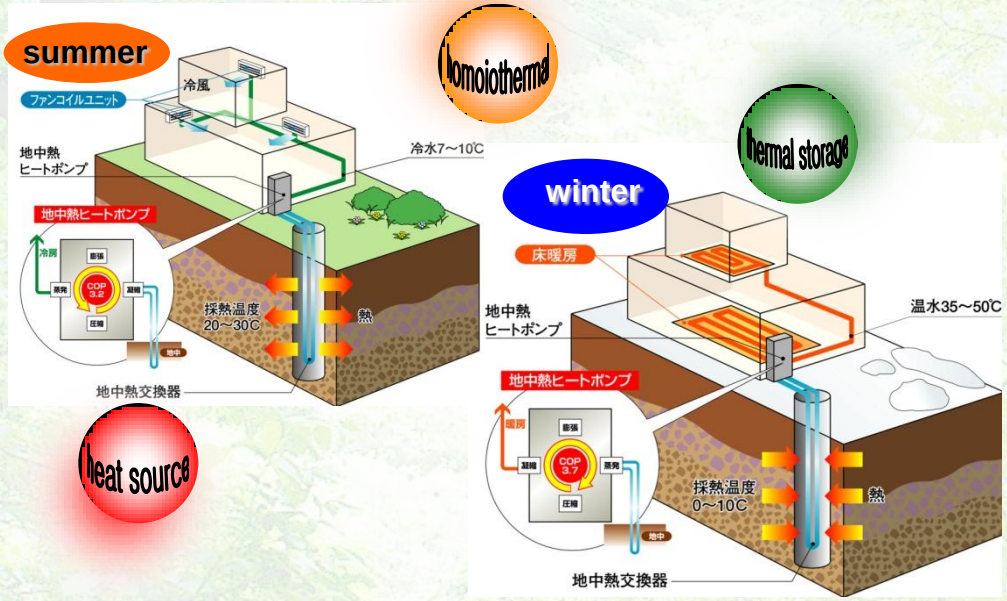
sunpot

Today's Program

1. Profile of Sunpot Corporation
2. Product Description
3. History of pellet stove Development
4. Conclusion

The Green industry at Sunpot

Feature of underground heat



Validity of GSHP

Pellet stove

Forest area occupies about 80%.

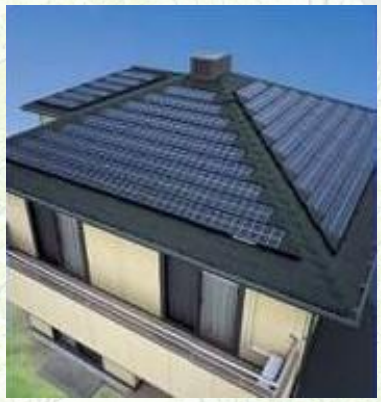
SUNPOT CO.,LTD.

Establishment: April 1, 1965
The capital: 962.2 million yen
Number of employees*: 276 people
(The contract employee is included).
Average age*: 40 years old four months
Length of service*: Ten years and five months
Sales: 9 billion 931 million (period on December, 2010)
Current profit : 756 million (period on December, 2010)
(*as of January 1, 2011.)

The prospective view of SUNPOT

Diversified energy source

1. The remarkable rise of the kerosene price
2. A highly-insulated and airtight house
3. Fuel automatic supply in the aging society



Product-1

Energy source：OIL

Operating floor heating
or space heating or both.

Oil burning space heater

oil heater

6 Product-2

Energy source：Electric

Water is warmed by Electric quickly

Electric boiler

Product-3

Energy source：OIL

Water is warmed by Effective utilization of Exhaust heat

Eco-feel

Product-4

Energy source：Gas

Operating floor heating or space heating or both.

Gas heater

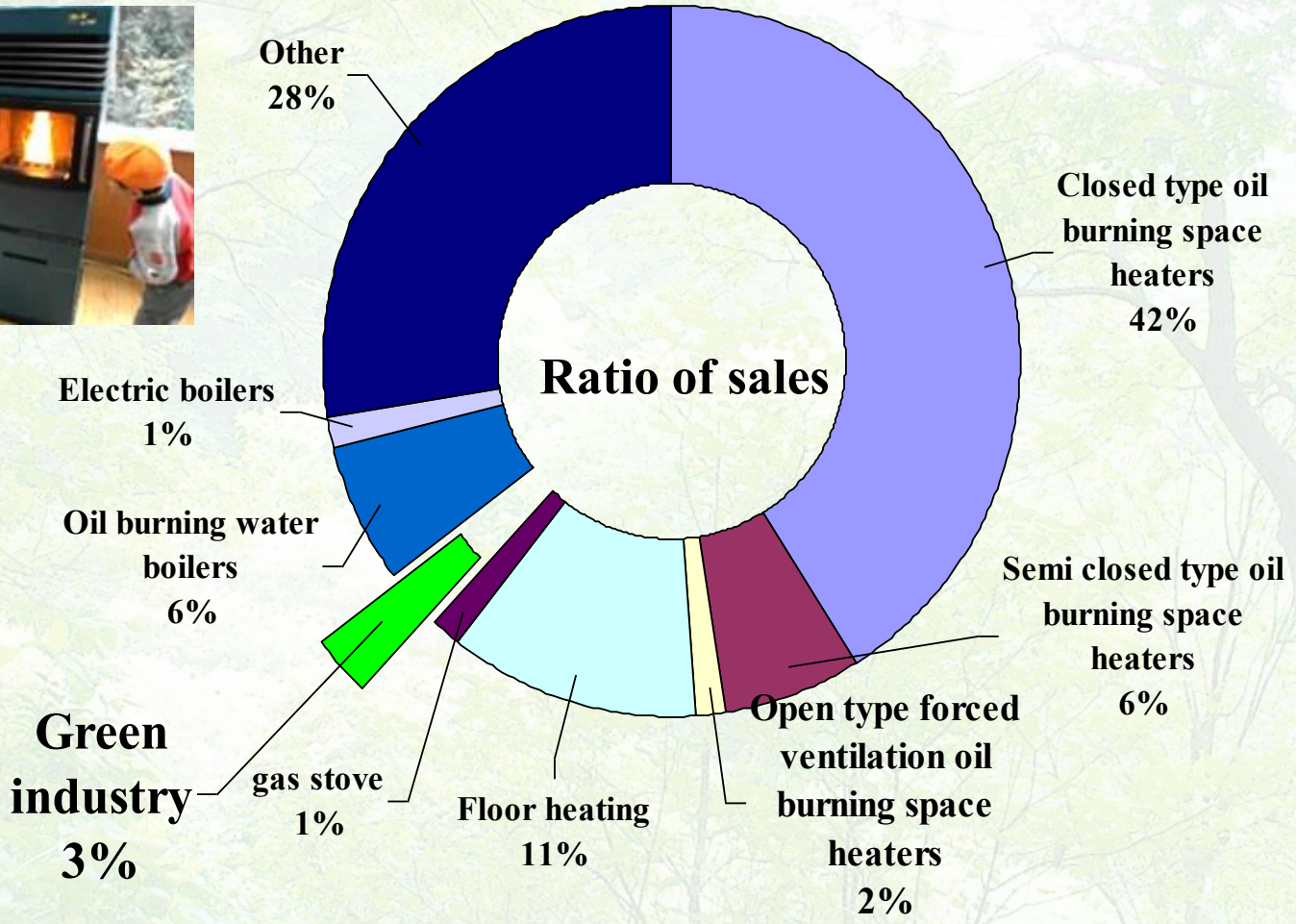
Product-5

Energy source：Electric

Japan’s first ground source Heat pump.
2 models on sale, one is All-in-one type,
the other is Connected conjunction type.
Output heater10kw/h cooler10kw/h

Ground source heat pump

Ratio of sales



The pellet stove business can't be said as a success case yet. It is on the way of that.

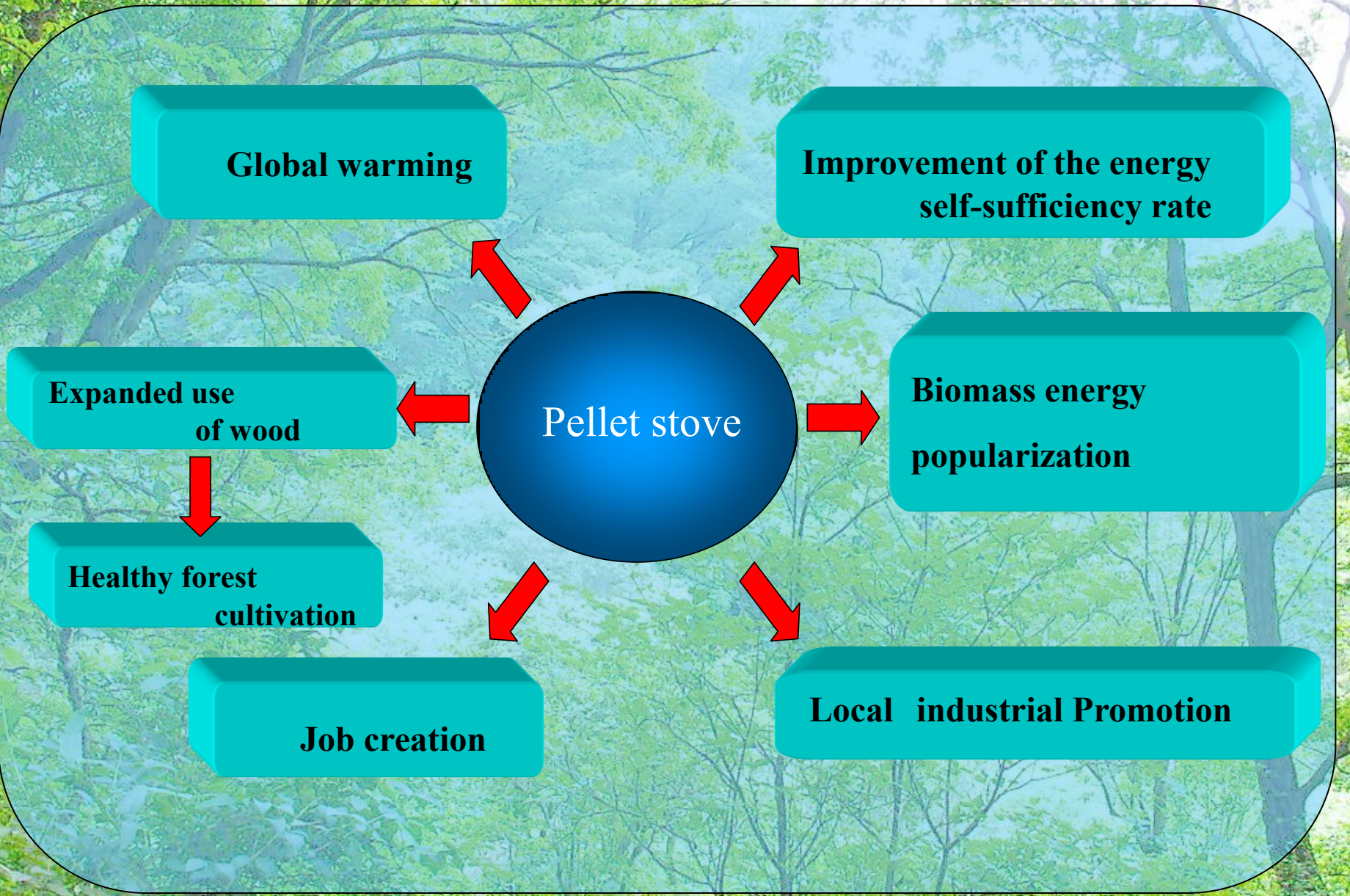
The trigger of the development

- Iwate Prefecture has aimed at the environmental capital.
- A company relocated to Iwate Prefecture from Saitama Prefecture.
- Sweden inspection with Iwate biomass study.
- Joint development with the Iwate engineering center.
- The application of support programs of the government

6 Support programs of the government

Support Program	Government
Pellet stove development work	Iwate prefecture
A pellet stove popularize promotion	Iwate prefecture
Experimental Study on Utilizing of Wood Pellets	NEDO New energy and industrial technology development organization
Research project for utilizing advanced technologies	MAFF Ministry of Agriculture, Forestry Fisheries
Study of Local innovation work	METI Ministry of Economy ,trade and industry

Development concept of pellet stove



Development concept of pellet stove

●2001 fiscal year
Iwate Prefecture advertised for the pellet stove development proposal.

●April, 2002~
The Iwate Prefecture industrial technology center adopted the developmental proposal of sunpot Ltd. from among a lot of proposals and a joint research began.

・Result researched jointly
→ The “iwate type” business-use pellet stove was developed.

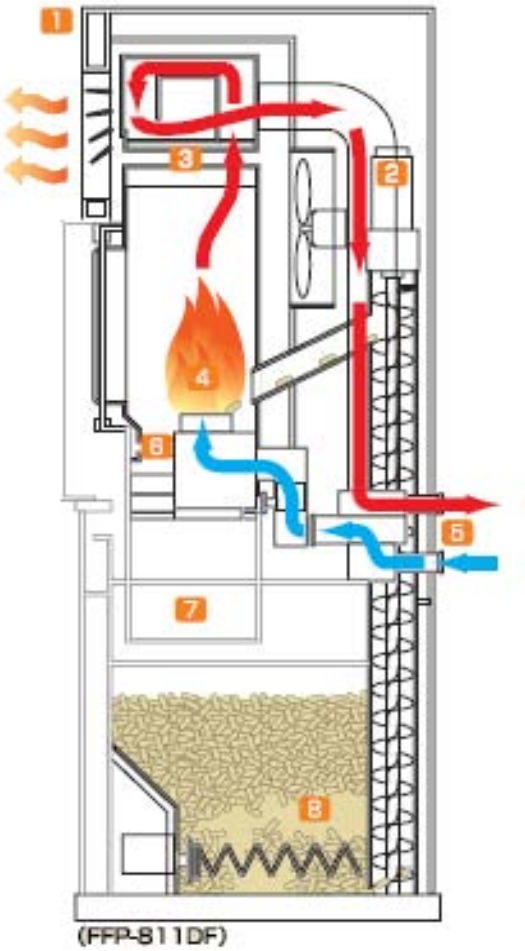
・The first FF type pellet stove in Japan using wood pellet

・The function was automated.
(ignition, extinction, temperature setting, safety device, and timer, etc.)

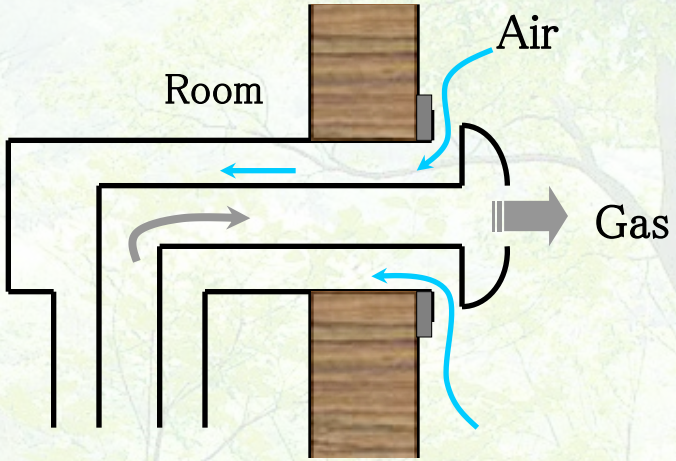
・It is possible to correspond to various pellet fuels.
(As for the pellet fuel, properties are different according to the producing company.)

・Especially, it corresponded to the pellet fuel manufactured from Berk alone who was not able to correspond with the stove made of the foreign country (ash processing mechanism).

Structure of pellet stove　　FF-Type



The heating method that doesn't pollute the indoor air.



Prototype of pellet stove

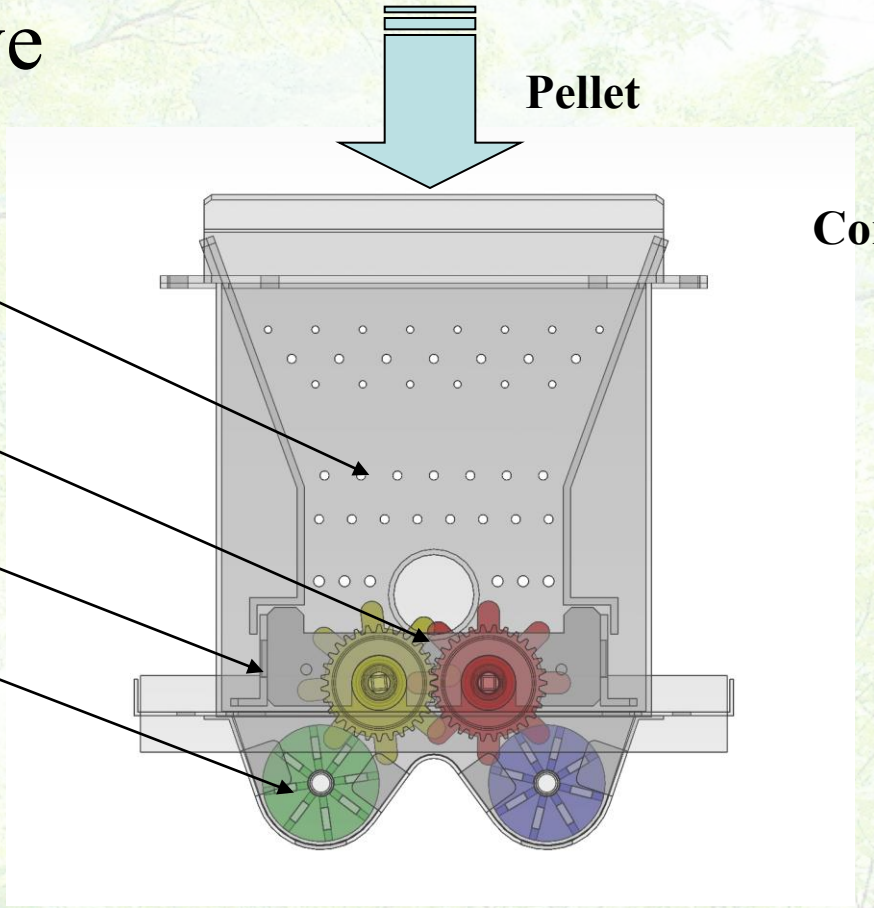
～Combustion test

Appearance of examination

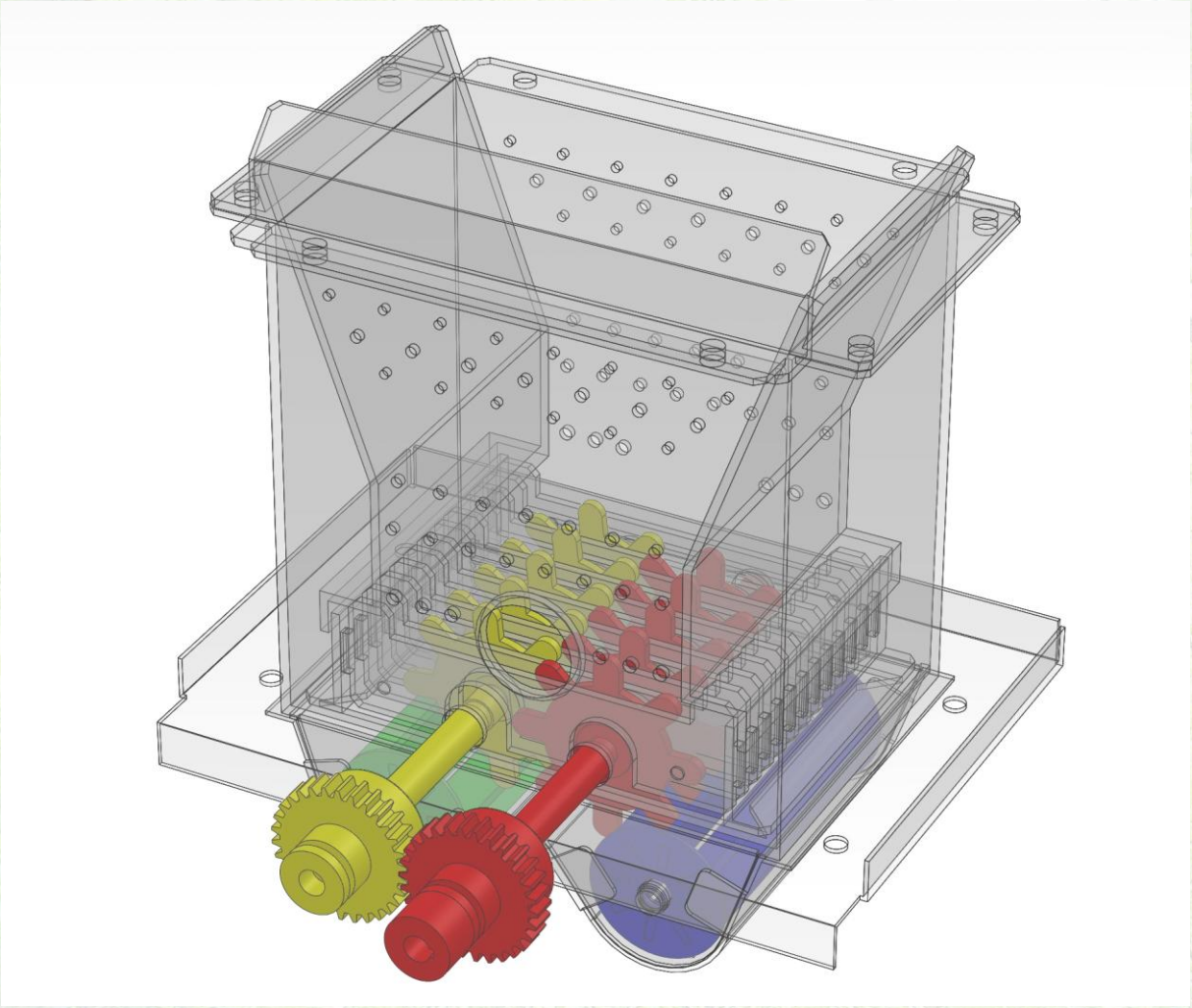
Pellet stove (initial type)

Ash processing mechanism

Pellet stove

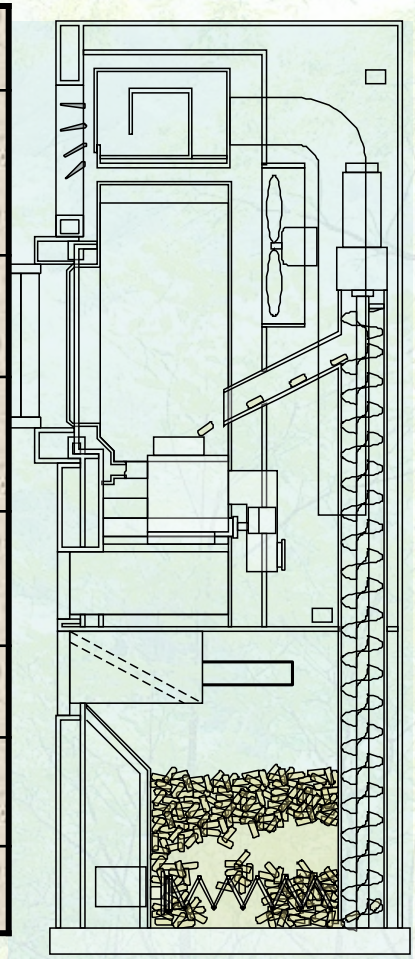


Combustion unit



Pellet stove monitor machine

Fuel	Berk pellet
Output	2.3kW/h～9.3kW/h (2000kcal/h～8000kcal/h)
Method	It is a charging air and an exhausted compulsorily method.
Feature	Automatic processing mechanism of ash
	Room temperature adjustment function
	Automatic ignition
	Device extinguished by automatic operation due to earthquake
	Nambeu Tekki ironware use



Business monitor machine

Iwate prefectural office
Pellet stove completion announcement

Problem

- The quality of the problem fuel varies.
- It is necessary to maintain it by the user.
  (removal of flyash)
- The product cost is high.
- High alkalinity is shown depending on properties of the ash.
  Metal corrosion

Metal corrosion

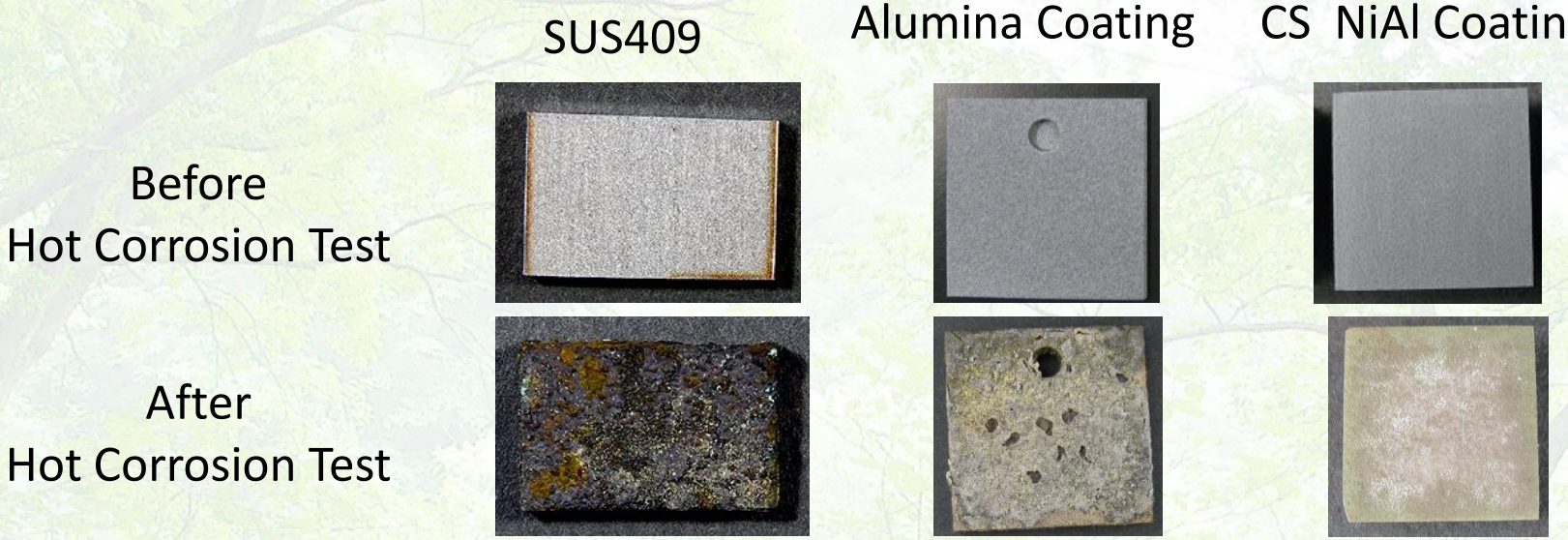


Fig Result of high temperature combustion ashes corrosion test of each materials.

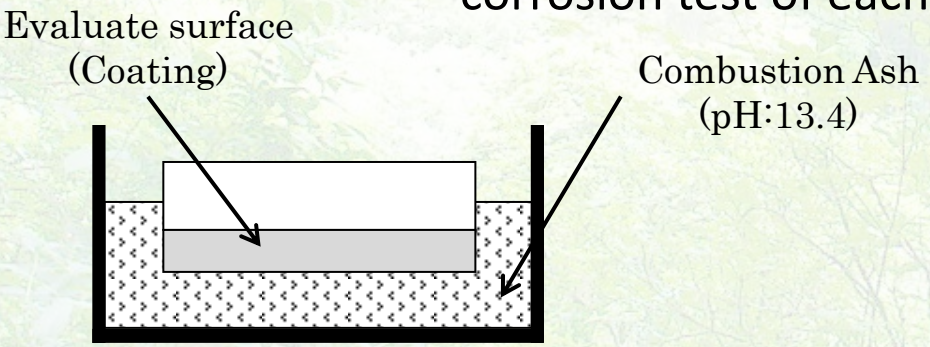


Fig. Schematic illustrations of high temperature combustion ashes corrosion test.

6 Design that considers self-maintenance by user

New lineup of pellet stove

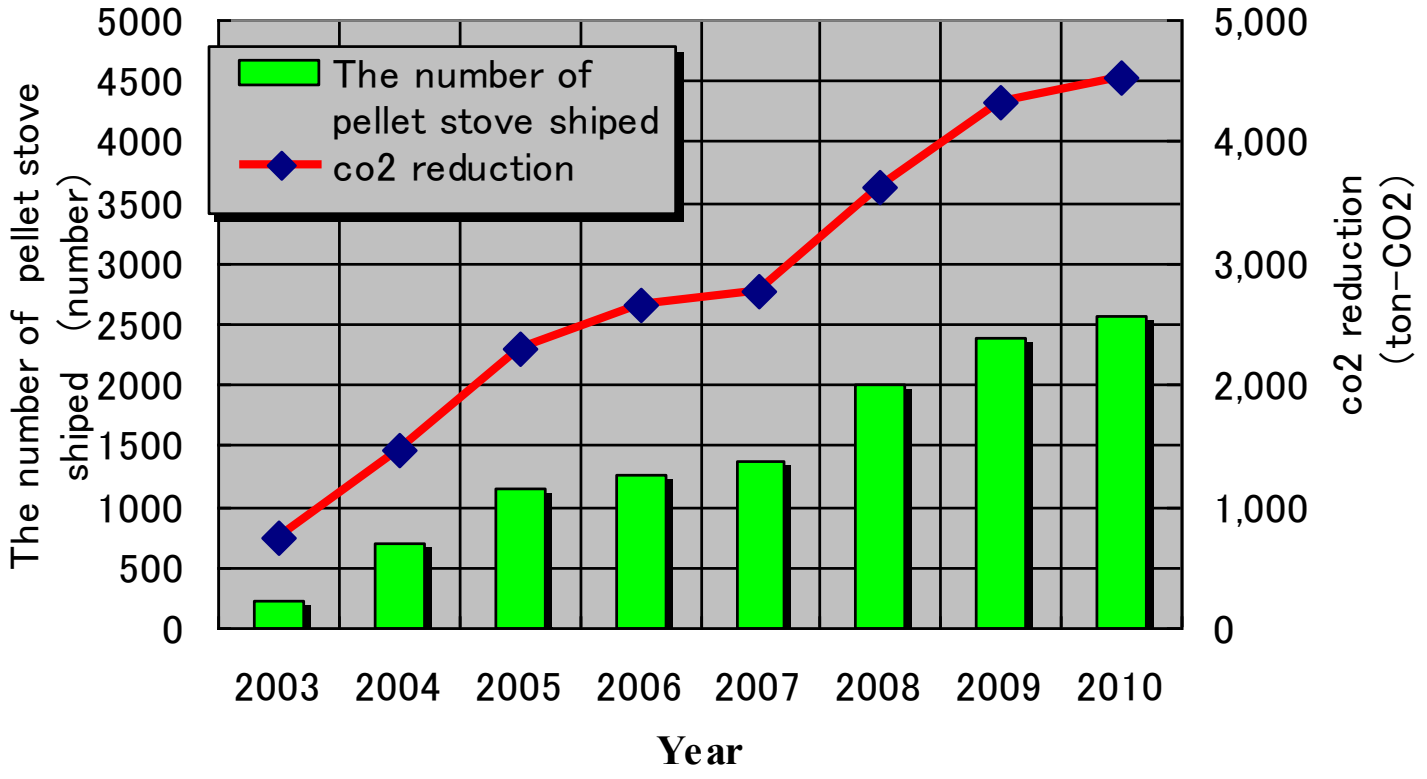
Manual ashes removal

Automatic ashes removal

Volume of shipments of pellet stove

Volume of shipments and amount of carbon dioxide reductin of pellet stove.

The cmount of the carbon dioxide reduction depends on our trial calculation.



Conclusion

The reasons for having succeeded in development

1. Good use of the support program
2. Use of the existing technical infrastructure
3. Cooperation with Iwate prefecture

Problems to be solved in future

1. Quality standard of pellet
2. Self-maintenance by user
3. Metal corrosion

Conclusion

Possibilities

1. Domestic abundant forest resources
2. The Biomass Use Promotion Fundamental Law
3. At 5.5% of the amount of biomass use (the plan by 2020), it is demand for 80,000 pellet stoves

We continue making an effort for environmental improvement.

World's Best People

World's Best Products

World's Best Company

JUSUNG ENGINEERING

APEC Green Innovation Conference

Korea Success Story

Y.G Lee, Executive Vice President

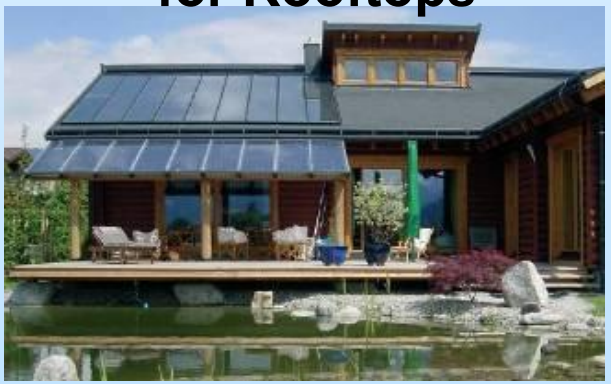
Presented at Seoul, Korea
April 19, 2011

JUSUNG Served Markets in Solar

Low Cost a-Si Thin Film
for Large Scale Utility

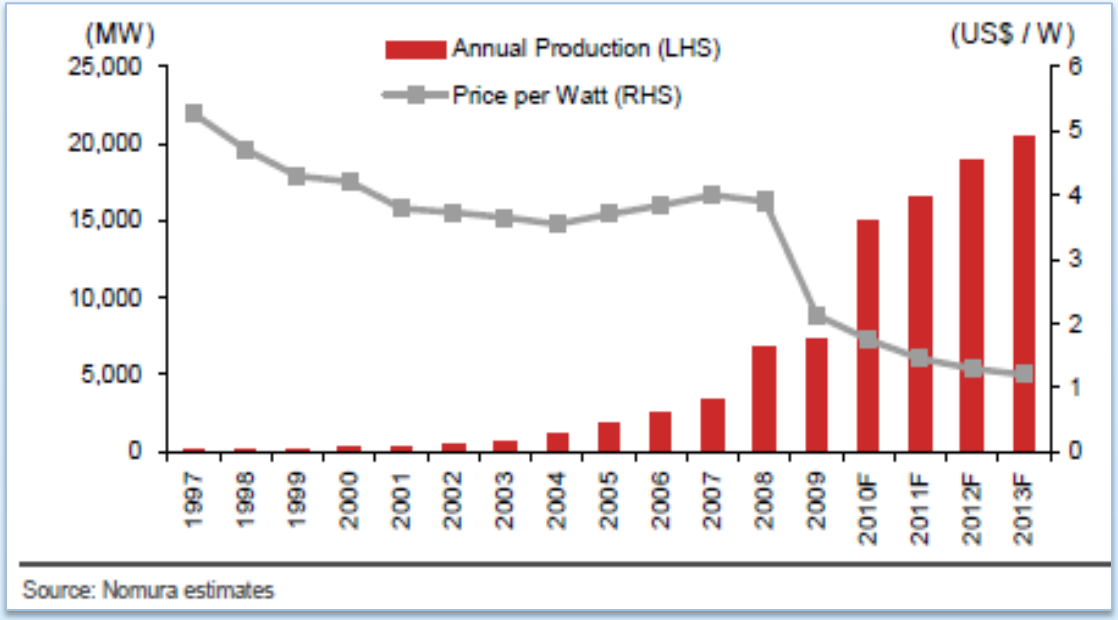
Transparent PV with Higher Output
for Building Integration

High Efficiency Crystalline Silicon
for Rooftops



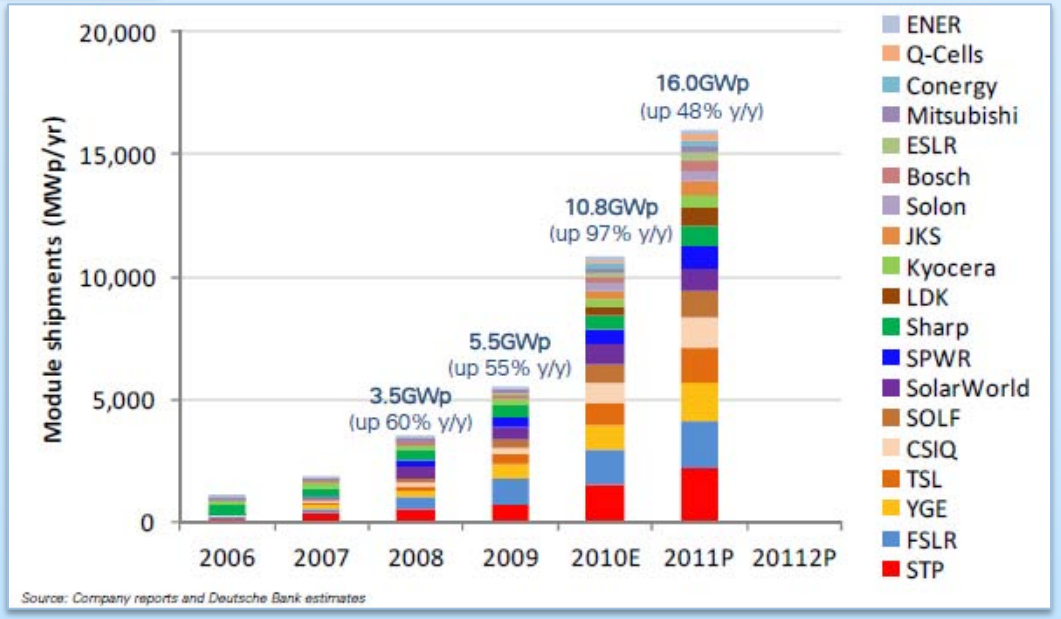
JUSUNG is a Leading Solar Technology and Production Equipment Solutions Partner

Solar Market Forecasts

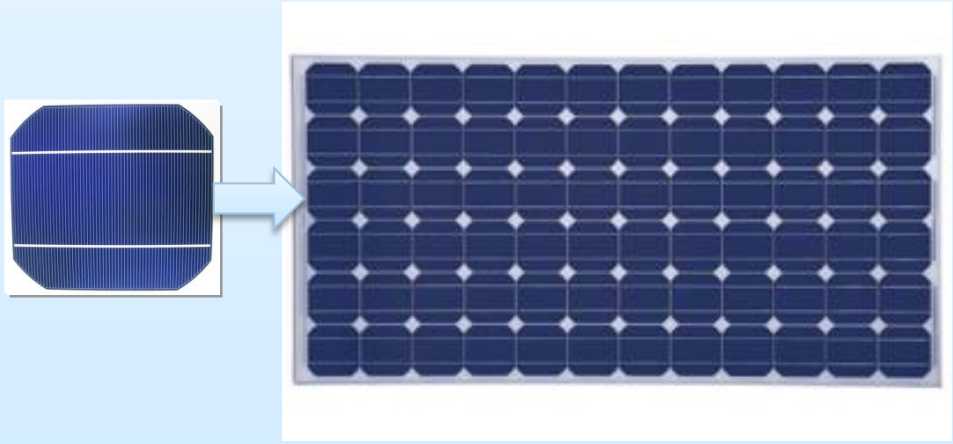


Analysts May Have Different Viewpoints on the Market – "Sunny Future for Solar" or "Cloudy Days"…

…Though All Forecasters Universally Agree that Solar Will Grow…

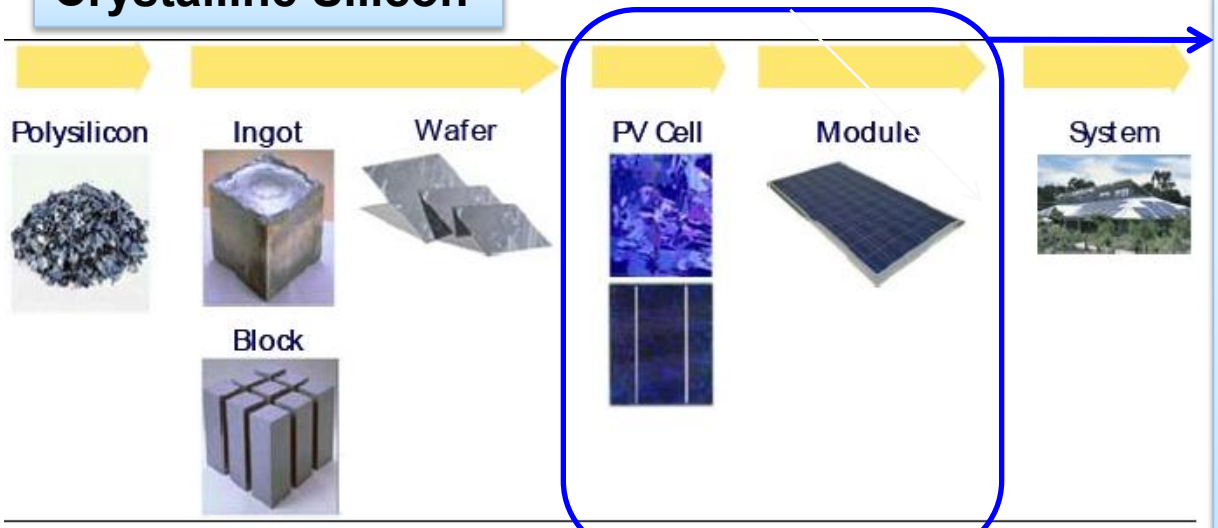


The Photovoltaic Landscape

	Crystalline Silicon	Thin Film
Technology	▪ Processing Silicon Wafers into Solar Cells ▪ Multi-, Mono-, Selective Emitter, Heterojunction	▪ Absorber & Conductive Materials Deposited on Glass Sheets ▪ α-Si (Single/Tandem), CdTe, CIGS, See-Thru BIPV
Cells/Modules		
Attributes	▪ Widely Used Conventional Technology ▪ High "Name Plate" Conversion Efficiency, 16%-22% ▪ Lighter Weight ▪ Lower Capital Expenditures, Higher Running Costs, i.e., Polysilicon ▪ Applications: Residential and Commercial Rooftops, Ground Mount Solar Farms	▪ "New" (But Old) Technology ▪ Lowest Production Costs, < US$0.80 ▪ Modest Conversion Efficiencies, 8%-12% ▪ Less Affected from Shading and Temperature Effects ▪ No Raw Materials Constraints ▪ Applications: Ground Mount Solar Farms, Commercial Rooftops, Building Glass

Solar Value Chain

Crystalline Silicon

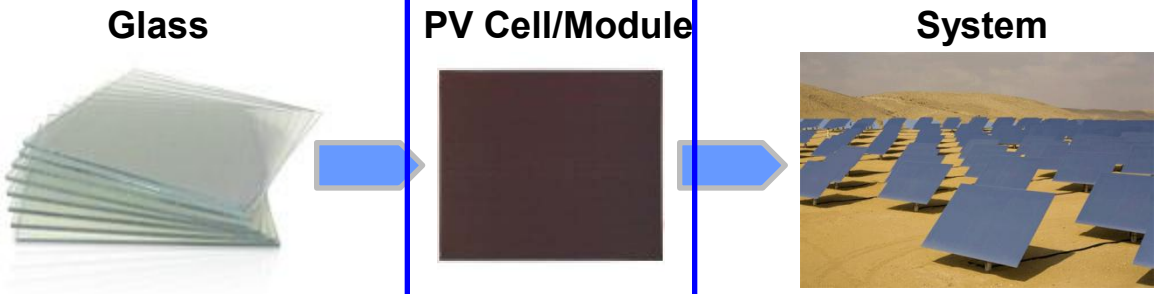


Source: European Photovoltaic Technology Platform, SEIA

JUSUNG Products

- Plasma Enhanced Chemical Vapor Deposition Systems for Passivation, Anti-Reflective and Absorber Layers
- Reactive Ion Etchers for Texturization
- Physical Vapor Deposition Systems Conductive Films
- Turnkey Factories for Heterojunction Technology

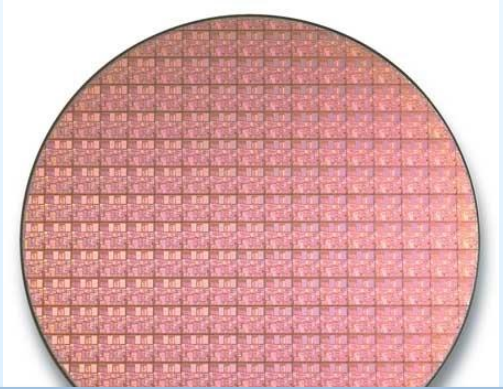
Thin Film



JUSUNG Products

- Plasma Enhanced Chemical Vapor Deposition Systems for Absorber Layers
- Metal Organic Chemical Vapor Deposition Systems for Transparent Conductive Coatings
- Physical Vapor Deposition Systems Conductive Films
- Turnkey Factories

JUSUNG Customer Value Proposition

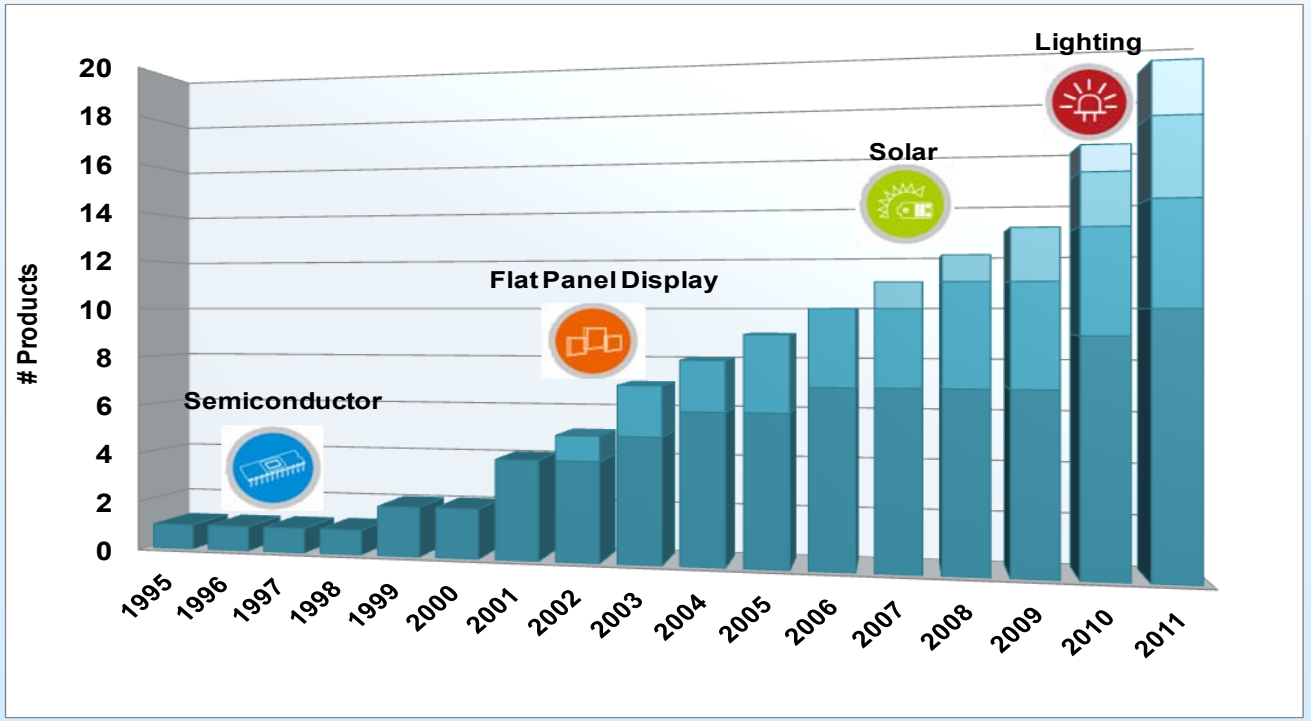


JUSUNG provides capital efficient, enabling technology solutions through World-Class innovation and partnership. Our products and services create value to our customers by helping them achieve market leadership as the World's #1 in cost, productivity, and profitability.

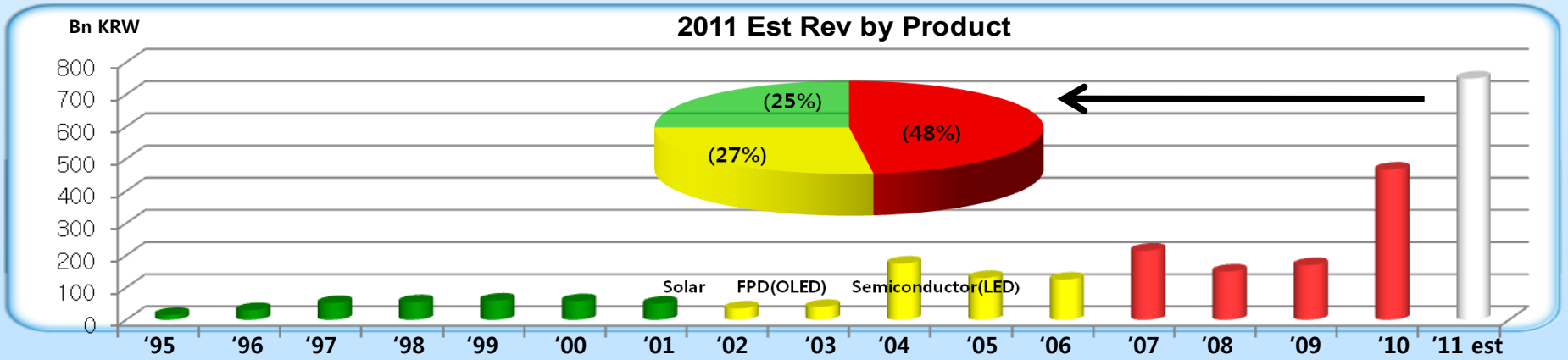
JUSUNG at a Glance

- Korea's Largest Manufacturer of Capital Equipment for Semiconductors, Solar, LED, and Flat Panel Displays
- Founded in 1995
- Headquarters: Gyeonggi-Do (Seoul Area), South Korea
- Listed on KOSDAQ in 1999, Ticker Symbol 036930
- Global Sales and Service Offices in United States, China, Chinese Taipei, Japan, and Eu
- Strong Track Record with Large Customers – Hynix, LG Display, Texas Instruments, IBM, TSMC, and more
- 2010 Revenues > KRW423bn, 150% YoY growth, extending into 2011
- Profitable and Growing

History of Product Innovation Leads to Growth



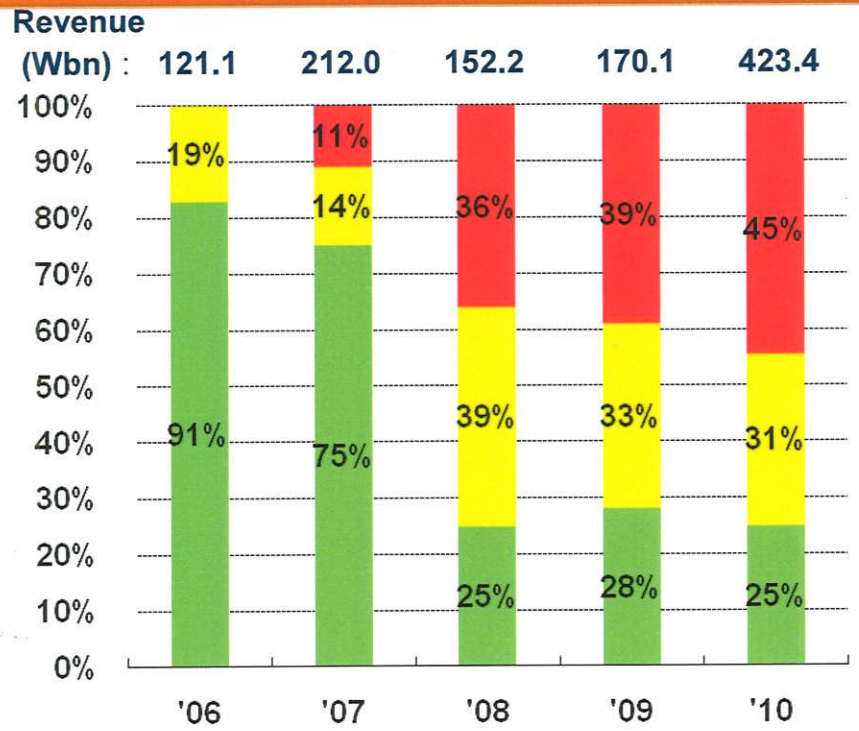
Increasing Products and Adjacent Served Markets Drive Company Growth



Jusung Business Segmentation 2006-2010

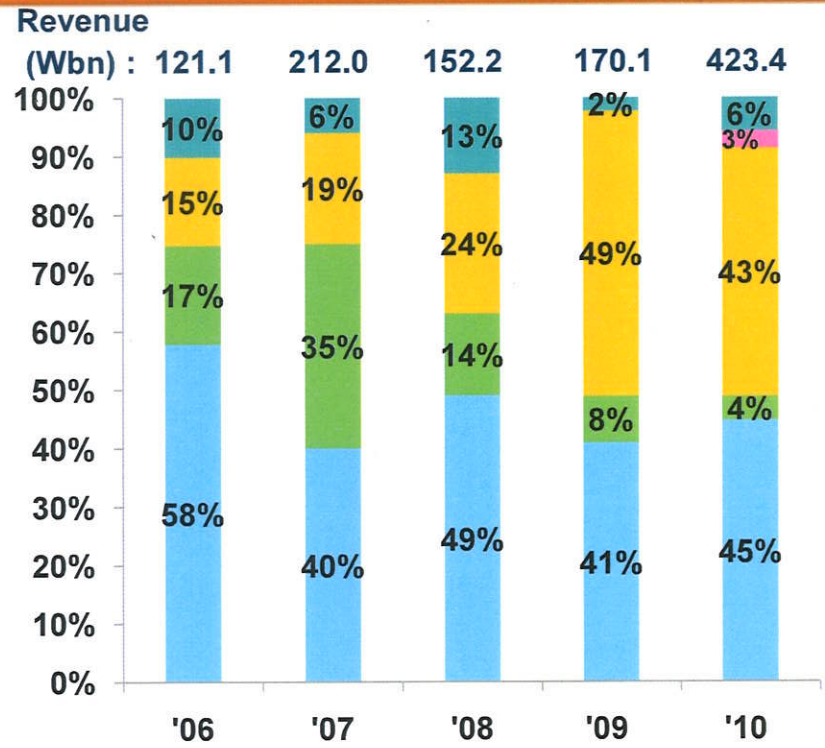
JUSUNG ENGINEERING

Products



■ Solar Cell ■ FPD/OLED ■ Semiconductor/LED

Regional

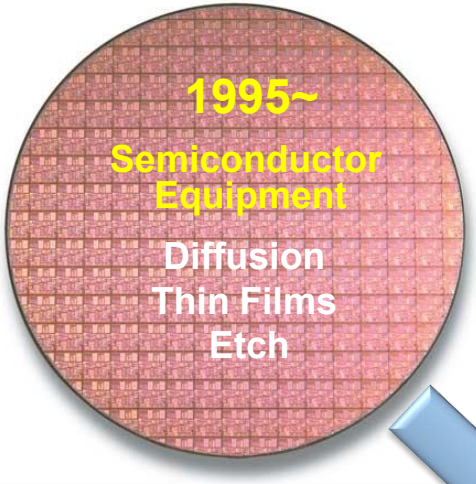


■ Korea ■ chinese taipei ■ China ■ EU ■ USA

Solar is the Largest Segment for Jusung Business >2010

JUSUNG's Technology DNA in Solar Products

Leveraging Production Proven Platforms



- Materials Science of Thin Film Deposition and Etch
- "Moore's Law" for Technology Innovation
- Vacuum and Plasma Physics for Precise Processing

- Large Area Processing Expertise
- Scaling Capability
- Low Cost Manufacturing Mentality

Providing Enabling, Cost Effective, and Manufacturable Solutions to Solar

Case Study of JUSUNG Product Development

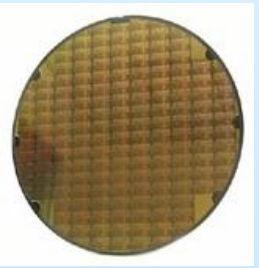
c-Si Solar

FPD Gen 6 (2001)

- Use Flat Panel Display Product as Backbone
- Production Proven with >300 Units Shipped Since 2001

+

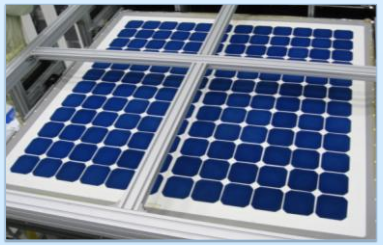
Semiconductor PECVD (2000)



- Add Know-How of Semiconductors
- Thin Film Process Control

=

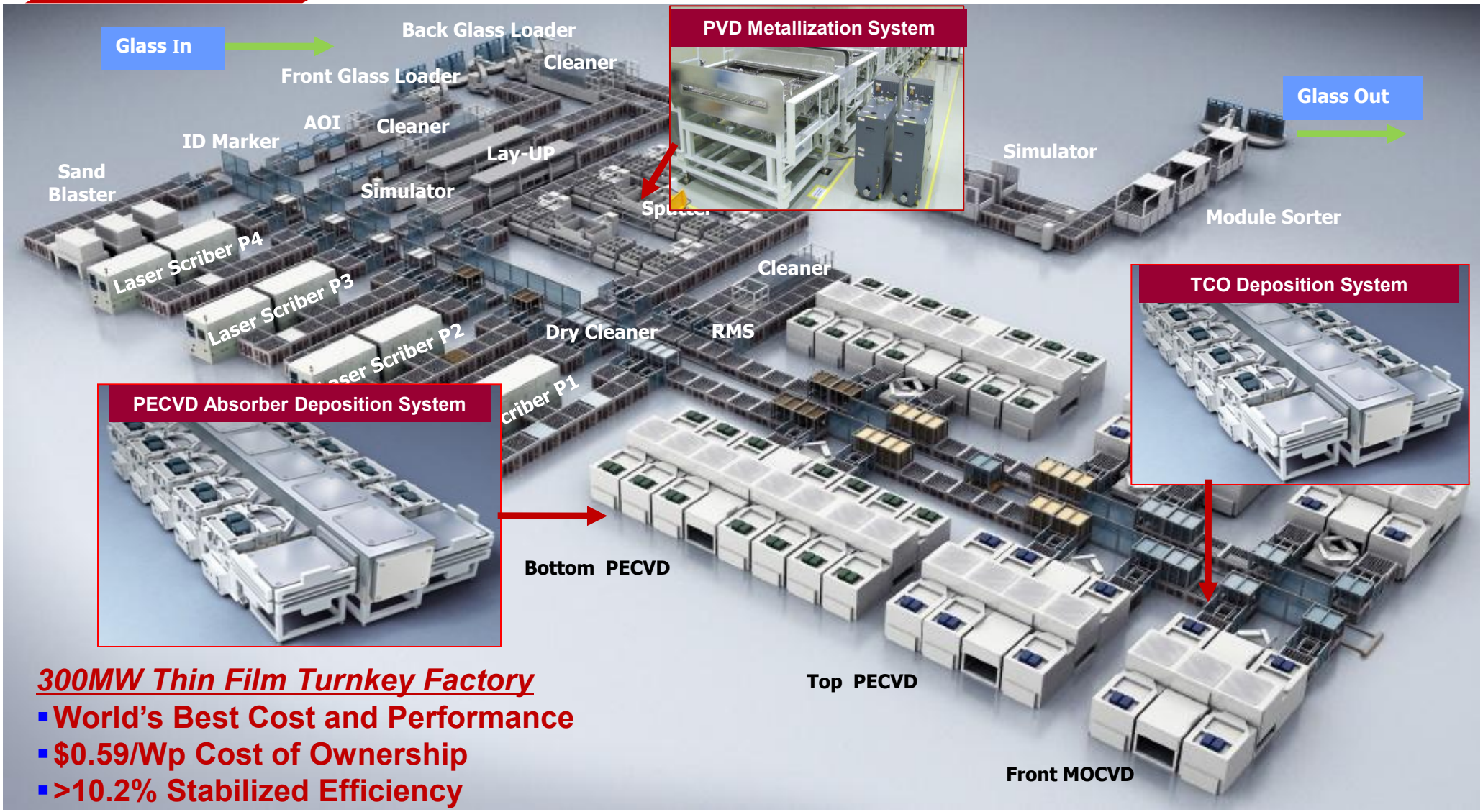
Solar Soultera PECVD Gen 6 (2008)



- Resulting in Industry Leading Productivity
- >2800 Wafers/Hour
- Improved Cell Efficiency, >0.5%
- Highest Uptime, >95%

Utilizing Common Platforms Shortens Time to Market, Decreases Execution Risk, and Increases Operational Leverage

Individual Systems to Turnkey Factories

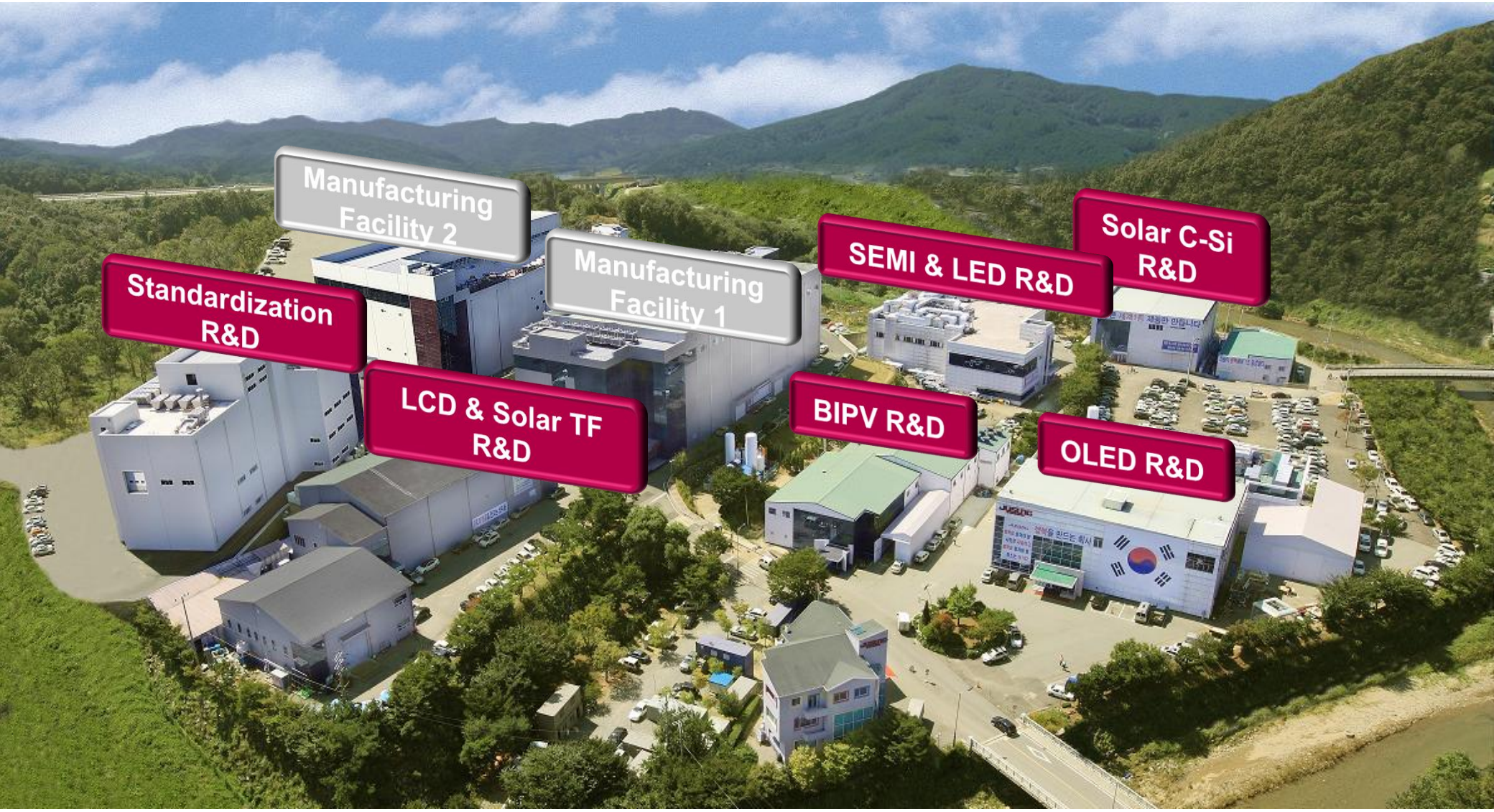


300MW Thin Film Turnkey Factory

- **World's Best Cost and Performance**
- **$0.59/Wp Cost of Ownership**
- **>10.2% Stabilized Efficiency**

Best of Breed Systems are Building Blocks to Turnkey Factories That Proliferates Capital Efficient Solar Manufacturing

JUSUNG Worldwide Headquarters in Korea

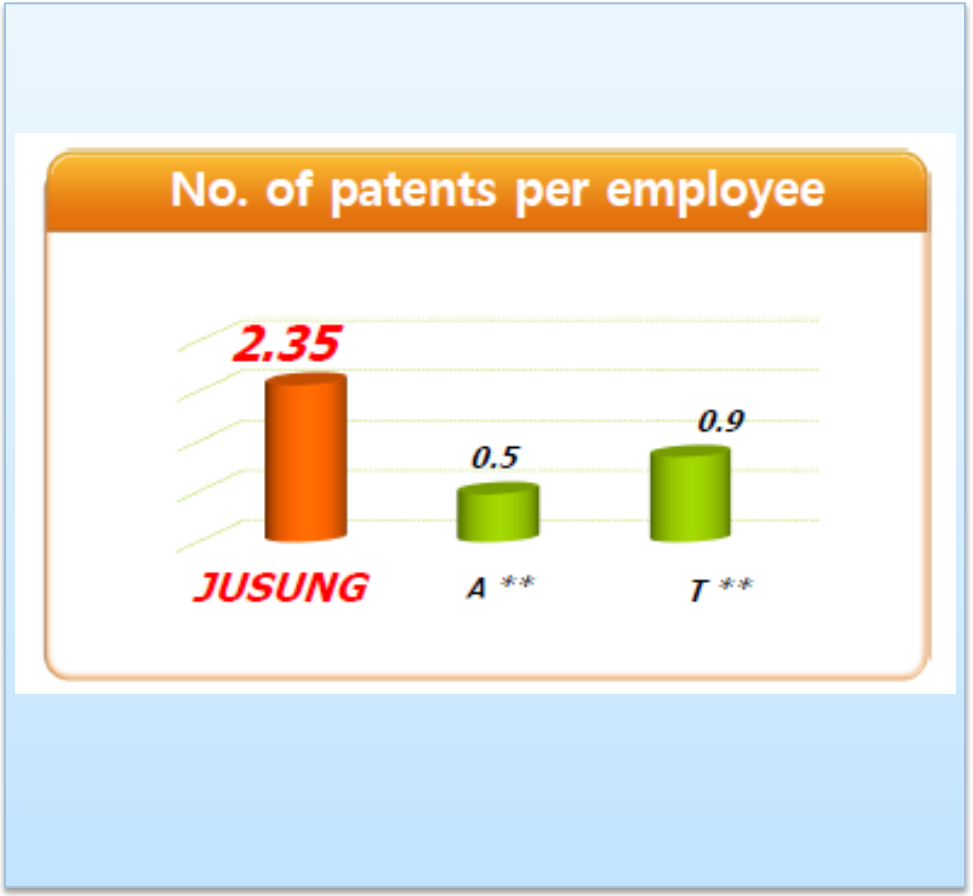


Investing in Capacity to Meet Increasing Market Opportunities

Investment in In-House Pilot Lines

Fully Equipped Pilot Lines for Thin Film and c-Si Device Integration

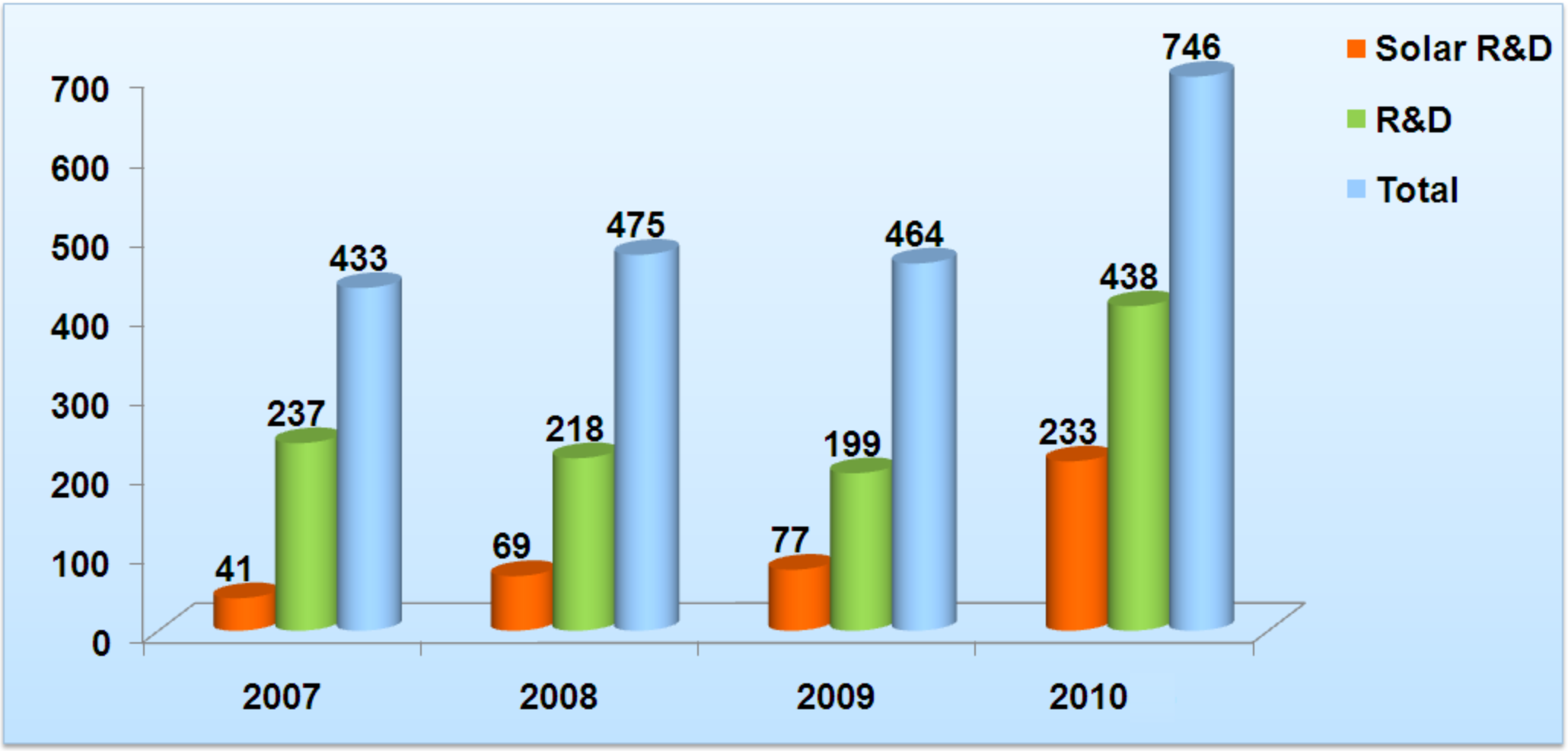
Intellectual Property is Our Priority



Highest Level of Intellectual Property Generates Unique & Innovative Technologies

JUSUNG IP includes Korea and international IPs listed globally. Sources: www.wips.co.kr, government patent offices, company webpages.

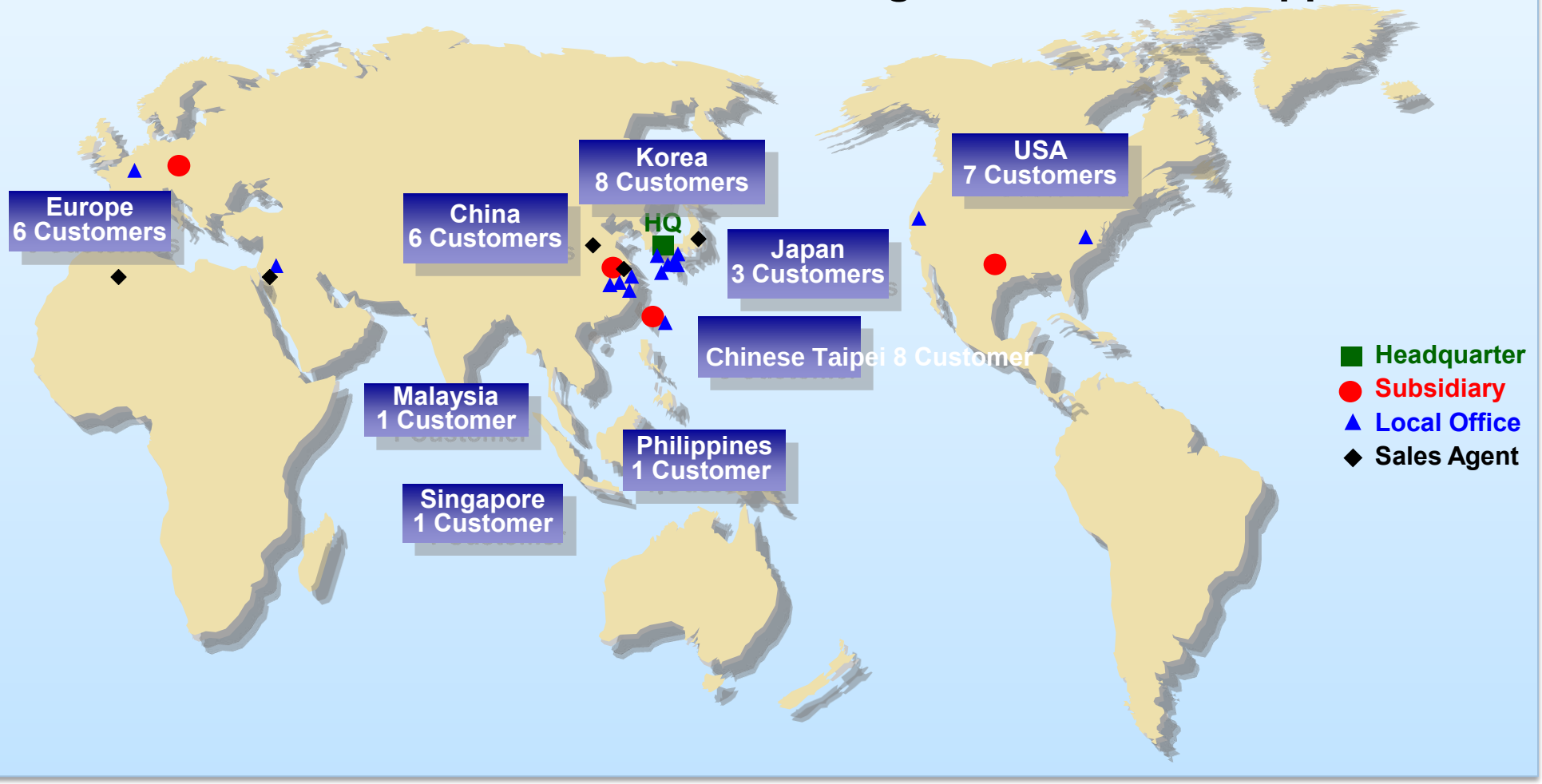
Human Resources are a Strategic Asset



Human Resources Stability Allows for Consistent High Performance…Regardless of Business Cycles

JUSUNG's Global Infrastructure

- 41 Customers in the World
- 4 Subsidiaries, 14 Offices, 5 Sales Agents for Global Support



Solar is Global…as is JUSUNG's Footprint

Solar Megatrends and JUSUNG's Preparation

- **Average Selling Prices Will Continue to Decline Until Grid Parity**
  - Feed-in Tariffs and Subsidies Reduction Forces Industry to Evolve into Self Sufficiency Through Cost Roadmaps
  - ➢ JUSUNG's Solutions: **Capital Efficient Technologies** – Higher Throughput, Uptime, and Conversion Efficiencies
- **Many Companies Have Reach Manufacturing Efficiencies of Scale for Cost Reduction**
  - Seeking Technology for Efficiency Gains to Further Cost Roadmap
  - ➢ JUSUNG's Solutions: **Uniquely Differentiated Products** in c-Si PECVD, Reactive Ion Etcher, Heterojunction, Thin Film
- **Manufacturing is Concentrating in Asia**
  - Favorable Government Partnerships and Lower Cost of Manufacturing
  - ➢ JUSUNG's Solutions: **Strategically Located in Asia**, with >100 Service Engineers for Mainland China, Malaysia, Philippines, Chinese Taipei, China, and Korea

Key Takeaways from the JUSUNG Story

Innovative Technologies, Unique Products

Production Proven in Semiconductors and Flat Panel Display

Investing in R&D, Production Capacity, Human Capital

Established HQ and Global Infrastructure for Customer Engagements

Thank You

Innovation beyond the limit.

JUSUNG ENGINEERING

Joe Feng
joe_feng@jseng.com

CHEMREZ
TECHNOLOGIES

"CHEMREZ BIOPETROLEUM SPECIALTIES"

Presented by Rolando A. Reyes

2011 APEC SME Green Innovation Conference

April 19-20, 2011

Seoul, Korea

CHEMREZ TECHNOLOGIES

- Manufacturer of chemical products
- Publicly listed
- 150 employees (40 technical staff)
- Website: www.chemrez.com

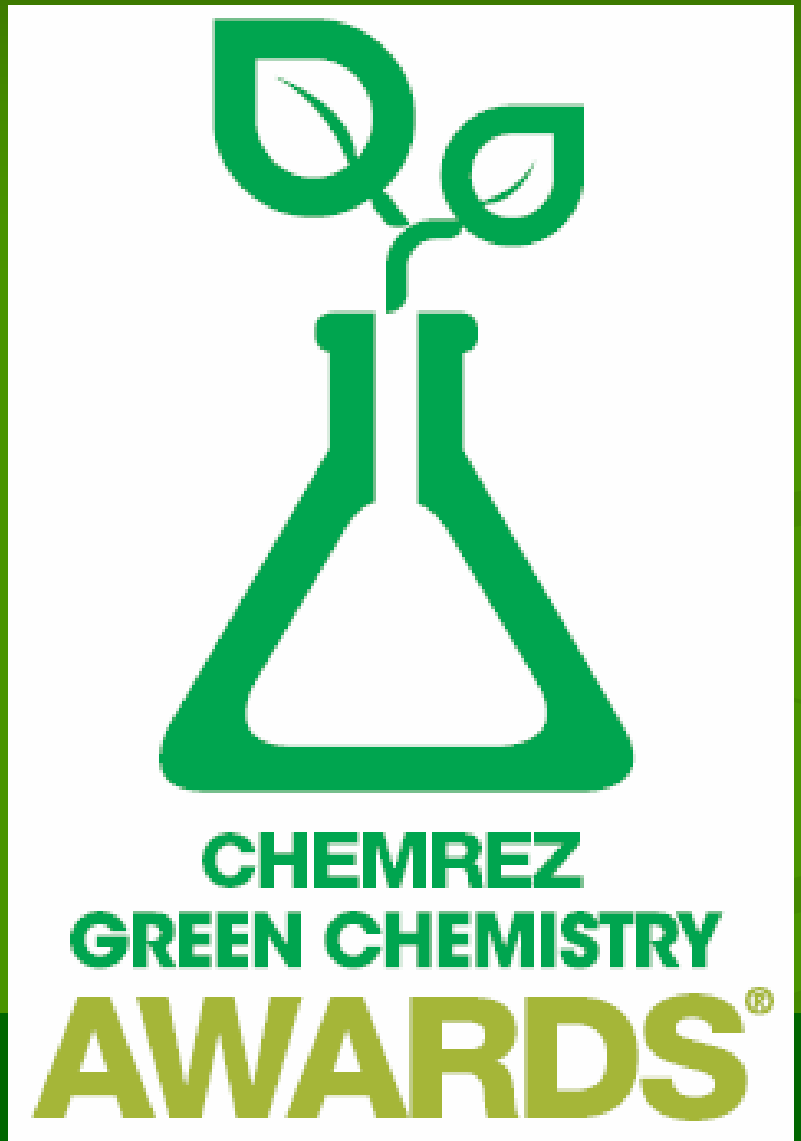
TECHNICAL RESOURCES





Comprehensive Research & Application Laboratories, Seasoned Technical Staff, and Industry Consultants

GREEN CHEMISTRY ADVOCATE



INDUSTRIES SERVED

- BioPetroleum
- Personal & Home Care
- Paint & Coating
- Building & Construction
- Composite
- Crop Science

INTEGRATED MANAGEMENT SYSTEM

ISO 9001:2001
Quality Management

ISO 14001:2000
Environmental Management

ISO 18001:1999
Occupational Health & Safety

ISO 17025:2009
Laboratory Management

PHILIPPINE BIOFUELS LAW

- First in Asia
- Passed January 2007
  - 1% coco-biodiesel in diesel
  - 5% bio-ethanol in gasoline
- Mandate increased in 2009
  - 2% coco-biodiesel
  - 10% bio-ethanol

WHAT IS COCO-BIODIESEL?

- 100% natural green diesel fuel or diesel enhancer produced from coconut oil
- The only biodiesel with molecular structure very similar to fossil-based diesel

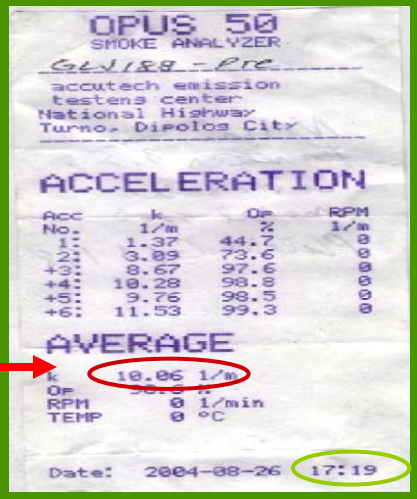
BENEFITS TO ENVIRONMENT

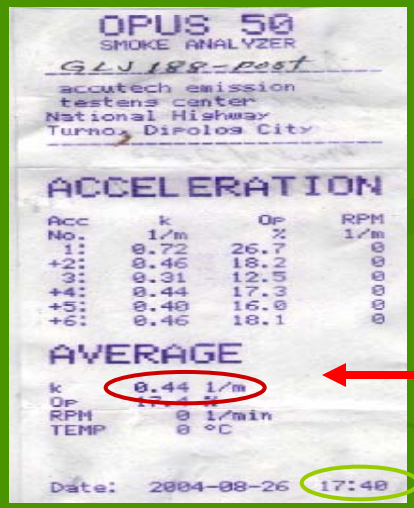
- Reduces air pollutant and harmful gases
- Reduces emission of greenhouse gases
- Promotes wellness of public health
- Practical, inexpensive, and immediately doable means to mitigate global warming

MEASURE OF BENEFIT TO ENVIRONMENT

I. Emission test of a smoke-belching vehicle before after blend of **BioActiv Cocobiodiesel**

Opacity 10.06


OPUS 50
SMOKE ANALYZER
GLJ188 - Pre
accutech emission
testens center
National Highway
Turno, Dipolog City
ACCELERATION
Acc No. | k 1/m | Op % | RPM 1/m
1: 1.37 44.7 0
2: 3.09 73.6 0
+3: 8.67 97.6 0
+4: 10.28 98.8 0
+5: 9.76 98.5 0
+6: 11.53 99.3 0
AVERAGE
k 10.06 1/m
RPM 0 1/min
TEMP 0 °C
Date: 2004-08-26 17:19


OPUS 50
SMOKE ANALYZER
GLJ188-Post
accutech emission
testens center
National Highway
Turno, Dipolog City
ACCELERATION
Acc No. | k 1/m | Op % | RPM 1/m
1: 0.72 26.7 0
+2: 0.46 18.2 0
3: 0.31 12.5 0
+4: 0.44 17.3 0
+5: 0.40 16.0 0
+6: 0.46 18.1 0
AVERAGE
k 0.44 1/m
RPM 0 1/min
TEMP 0 °C
Date: 2004-08-26 17:40

Opacity 0.44

Time 17:19

Time 17:40

MEASURE OF BENEFIT TO ENVIRONMENT

II. B2 (2%) Test Run on Emission of Particulate Matter

Plate No.	Type	Opacity on Pure Diesel (start of run)	Opacity on B2 Diesel (end of run)	% Increase/ (Decrease)	Remarks
WMX 158	Van	5.2 k	1.9 k	(63.5%)	(Decrease)
TBE 151	PUJ	7.6 k	1.6 k	(78.9%)	(Decrease)
PDE 443	PUJ	6.5 k	2.0 k	(69.3 %)	(Decrease)
TWT 558	PUJ	8.3 k	5.6 k	(32.5 %)	(Decrease)

BENEFITS TO PHILIPPINE ECONOMY

- Promotes wellness of coconut industry
- Saves on forex due to fuel import reduction
- Attracts new investments in agro-industry

GREEN CHAMPIUON TRANSFORMATION

PHILIPPINE CLEAN AIR ACT 1999

- Aims to mitigate effects of global warming
- Signals biopetroleum as future champion business

CHEMREZ

TECHNOLOGIES

A pioneer in coco-biodiesel

CHEMREZ BIODIESEL PLANT

Broke ground in 2005 and inaugurated in 2006

BioActiv®

Chemrez branded its coco-biodiesel as BioActiv® to differentiate and gain customer loyalty.

OBSTACLES

1. No technical data available to support coco- biodiesel effectiveness
2. Biofuel initiative strongly objected to by major oil companies

SUCCESS FACTOR

Chemrez allied with the technical experts specifically from the Asian Institute of Petroleum Studies, Inc. (AIPSI) in proving the effectiveness of coco-biodiesel.

WINNING MOVES

- First lubricity test done in 2001 at South West Research Institute, San Antonio, Texas, USA funded by AIPSI.
- Complete tests in reputable institutes funded by Chemrez:
  - Tokyo Metropolitan Research Institute
  - Daeduk Institute, South Korea
  - Toyota Motors, Japan
  - British Petroleum, New Zealand
  - SGS, Japan
  - BASF

Test results were outstanding!

WINNING MOVES

- Using the test results by Toyota Motors Japan, support of Chamber of Automotive Manufacturers in the Philippines was won.
- Chemrez funded press releases.
- Chemrez led advocacy, conducting over 200 briefings to key government and private organizations:
  - lawmakers
  - oil companies
  - bus & trucking companies
  - farmer associations
  - clean air NGOs & others

WINNING MOVES

- Technical papers were published in the web and print media
- Technical support was provided to the sponsoring Senator during senate debates which helped in passing the biofuels law

GOVERNMENT SUPPORT

- Philippine Department of Energy sought assistance from the U.S. National Renewable Energy Laboratory (USNREL) for complete tests of coco-biodiesel
- Organized technical working group
- Set up biofuel laboratory testing equipment in the Department of Energy and Department of Science & Technology
- Sponsored public forums
- Conducted roadshows to local government units
- Implemented information and education campaign

INDUSTRY OVERVIEW

- Sure market due to government mandate
- Low barrier to entry; manufacturing plants relatively inexpensive
- In a short time, market has become crowded; now 12 coco-biodiesel manufacturers
- The coco-biodiesel market has quickly turned from blue to red ocean; competition tight

FUTURE OUTLOOK

- Coco-biodiesel market will keep growing as government continues to increase blend rates over the years
- Competition among coco-biodiesel producers will be fiercer
- Coco-biodiesel producers will develop more profitable, high-value 'green' petroleum product substitutes

END

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www.chemrez.com

2011 APEC
SME Green Innovation Conference

Haruna's Journey and Transformation of Green Coatings

Anti Stick Paint the Ultimate Solution that all urban areas are beset with

Presenter : Yukio Yanase 柳瀬幸生(COO)
HARUNA PAINT PTE LTD

36 Tanjong Penjuru Singapore 609031
Tel: (65) 6270 0125 Fax: (65) 6270 1250
E-mail: enquiry@harunapaint.com

Presentation Overview

1. **Introduction of HARUNA PAINT**

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   b) An overview and future trends of its eco-friendly paint and chemical industry

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Introduction of HARUNA PAINT

HARUNA PAINT

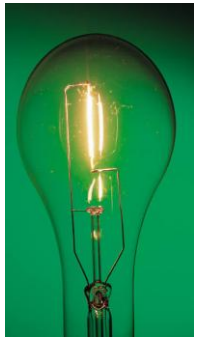
- Local SME, Incorporated in 2004
- SEEDS equity funded via EDB in 2005, now under portfolio of Spring Singapore
- Paid up capital of S$2.89 million
- Manufacture a full range of paints and architectural texture coatings certified to Singapore standards and Green Label Mark
- Registered with BCA (Building Authority of Singapore) under CR09 L4 for repairs and redecoration projects of up to S$10 Million contract value.
- Distribute our products locally as well as export them to Hong Kong, Brunei, Indonesia, Maldives, Thailand, Malaysia, the Philippines, Vietnam and China

Our Corporate Vision

To be an innovation driven, science and technology based world class manufacturer and distributor in building chemicals and other paint related products, through continual research and development, focusing particularly in Environmentally Friendly Systems.

We pledge to be a socially responsible company by
focusing our development efforts in
ecology friendly products thereby
contributing to the Improvement of Quality of Living.

Our Service



MANUFACTURING & DISTRIBUTION

- Haruna brand of paints and texture coatings

CONTRACT MANUFACTURING & DISTRIBUTION

- Niche technology coatings from US, Europe and Japan

SPECIALIST APPLICATION WORKS

- Textured coatings, floor coatings, intumescent coating, etc.

SYSTEM DESIGN & RECOMMENDATION

- Site investigation/System Proposal & Specs/Budgetary Quote

CONTRACT WORKS

- BCA Category:CR09 L3, Repairs & Redecoration Works via direct bidding

JOINT RESEARCH & DEVELOPMENT

- Actively engaged in development works with External Consultants, Institutional & Organizational Researchers to adopt new Green Technology in coatings.

Our Special Function Paints

Waterproof, anti-carbonation system

The Ultimate Structural Protection System **Shield Coat HB**

Flexible Silicone System

The New Millennium Coating - **HP M Silicone**

Friendly PU System

The Mild PU Coating - **HP E-Urethane**

All Weather Flooring

The Hardcourt Product - **HP NBA Cote**

Haruna's Journey and Basket of *Green Technology Coatings*

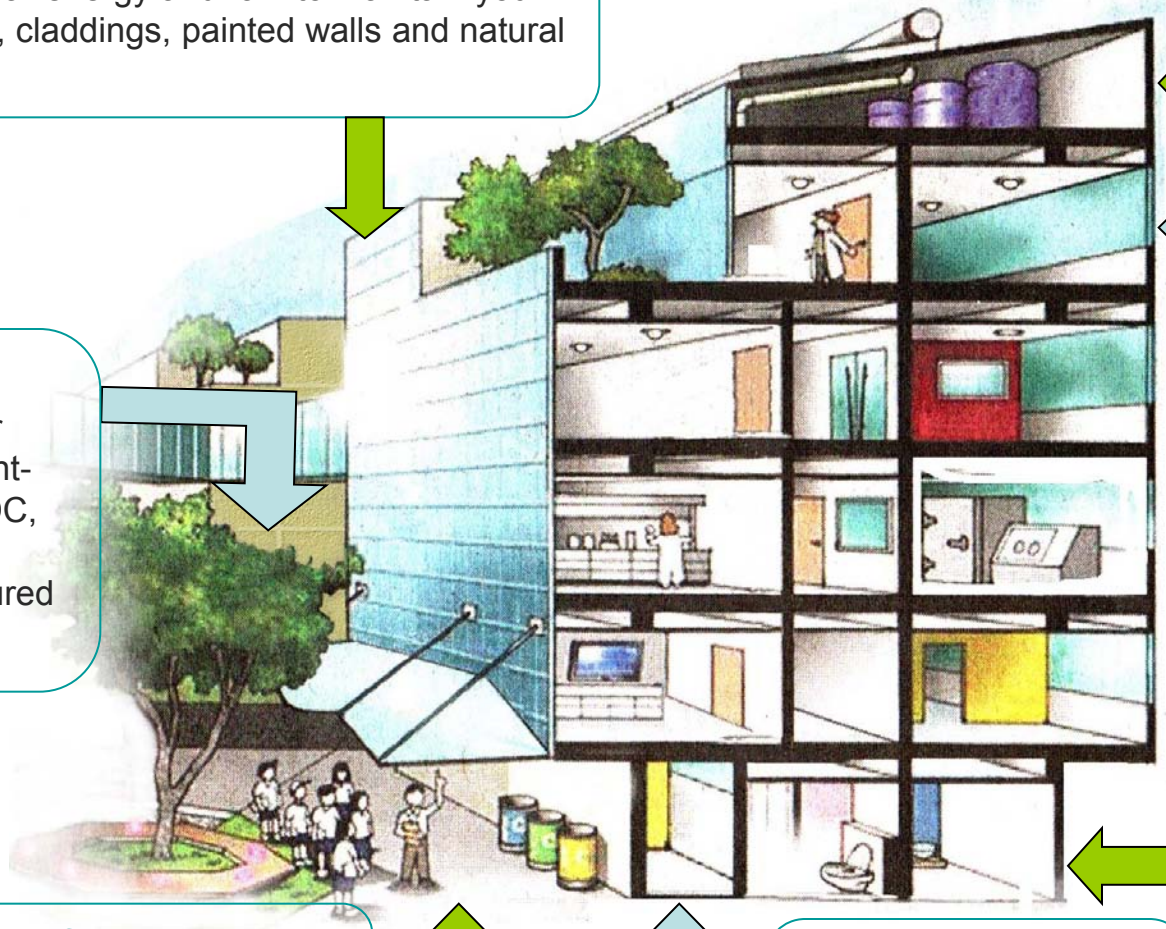
Illustration of Green Building Coating Design

Photocatalytic Nano TiO2 Coating

Uses free solar energy and rain to maintain your facade glass, claddings, painted walls and natural stones

Energy Efficiency Cool Paint

Cool your roof and walls with IR reflective, thermal insulating coatings



Aesthetics

Enhances your facade with light-weight, low VOC, self-cleaning stone-like textured finishes

Indoor Air Quality

Near zero VOC, anti-bacterial, anti-SARS, deodorizing emulsion for internal wall surfaces. Water-based paint for metal and timber

Thermal Comfort

Cool Pavement and running track for better comfort

Passive Fire Protection

Water-based non toxic intumescent

Green Flooring

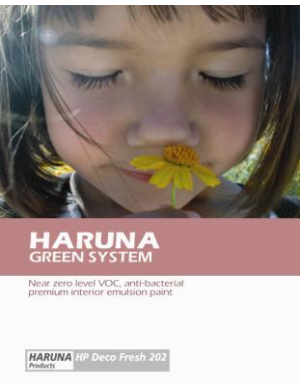
Near zero VOC, anti-bacterial epoxy floor coatings for corridors, kitchen, etc.

Green Product Series

Green label

HP DECO FRESH 202 has received
Official Endorsement from
SINGAPORE GREEN LABEL SCHEME

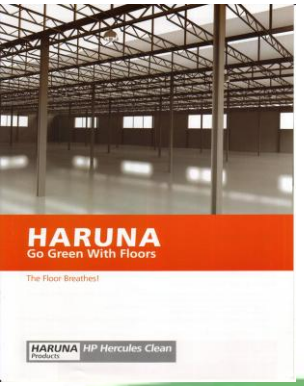
ECO PRODUCT



HP DECO FRESH 202

Certificate No: 032 009
Environmental friendly/
near zero VOC paint

Water-based technology with no emission of harmful formaldehyde and does not contain heavy metals for better indoor air quality and peppered with anti-bacterial properties



HP Hercules Floor Coatings

Certificate No: 032 016
Near zero VOC
Solvent-less Epoxy

Green Products update

- **HP TioFresh**
  - A non light activated photo catalytic clear coating
- **IR Heat Reflective, “COOL”Paint**
  - Energy efficiency • Energy saving product
- **No Fire Intumescent Coating**
  - Patented, water-based latex coating
- **HP Helioguard**
  - High IR reflectance of solar energy with ceramic balloon and special pigment.
- **TiO2 Self Cleansing Coat**
  - Super hydrophilic and decomposing (oxidizing) effect

New Launching

HP Graff Guard – The Anti Stick Paint-

Existing of illegal advertisements usually considered to be symbolize of corrupt public morals of area and local government.

Solutions of Current problem by HP Graff Guard

Graff guard is..

Special formulated coating system designed as an anti-adhesion on protection coating. It prevents illegal advertisements from being pasted and facilitates removed with its easy-to-clean surface.

Area of application..

Recommended on structures for aesthetic improvement such as Lamp post, Street Lights, Traffic Lights, Pedestrian walk ways, Interior columns of building and so on.

At the same time..

It also allows effective cost saving by reducing the cleaning process.

Cost Saving

LTA (Land and Transport Authority in Singapore)
have been spending significant amount of expense and effort to clean and remove the illegal advertisement in public.

About US$178,000 is recorded for maintenance fee (remove and clean) yearly under LTA jurisdiction.

Labor → **Cleaning** → **Repainting** → **Damage to surface** ⇒ **SAVE Maintenance Cost**

HARUNA's Transformation

a) Key enables of transformation into Green Industrial Sector

To enhance SME advantage

- Quick action for market demand
- Employees and relevant department to ensure company policy and directions
- Project with a flexibility respond to market and dig requirement changes.
- Management's emphasis on driving product development towards low VOC raw materials and formulation

For HARUNA case

- Local capital manufacturing Company
- Financial and human resource support from Public Agency
- Technology support from Research Institution as well as overseas company
- Collaboration work with Government Agency
- Industry awareness driven mainly by government via Green Mark Scheme for building developments.

HARUNA's Transformation

b) An overview and future trends of the eco-friendly paint and chemical industry

The product to be

- Contribute to saving of maintenance fee with higher cost
- Cost advantage
- Health perform, environment perform and comfortability on top of functional characteristics.
- Build the concept by not only paint manufacture but other end user, Architect as well as General Construction Company.

HARUNA's Transformation

c) Obstacles, Success factors and winning strategies behind the successful transformation

- Be one of the innovation in driving the transformation of Green Coating in Singapore enjoys vast support and recognition from institutional, governmental and private bodies in our transformation journey
- Relate obstacles faced in cost, sourcing of materials, etc. But our success was due to our innovation and first mover advantage.
- The launching of this Anti-Stick Paint is beyond our expectation.

HARUNA's Transformation

d) Government Support Programs Experienced

- Green Mark Scheme for building developments, setting up and listing of Green Label products, Governmental Support Schemes and Funding for Green technology and product developments.

- Investment from one of Government Agency
  EDB: Economic Development Board

- MND Research fund for the Built Environment from Building and Construction Authority.

- Capability Development Scheme (Technology Innovation) Project

We strive to be an eco friendly SME

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