Yamaguchi* Green Materials Cluster(YGC) Profile
* located in westernmost part of main island

Open session on
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Biography

Dr.Eng. Mitsuhiro Kurashige

• 1942 Born
• 1965 Graduated from Kyusyu university,(1984 PhD degree, Engineering)
• 1965~1999; NHK(Japan broadcasting corporation), mainly engaged in researches on HDTV at the technical labs. After serving as Director of Material Science and Devices div., Director of Image Devices div., in 1994, moved to NHK Engineering service Co. as the secretary-general., HDTV-consortium. 1999 Executive Research Engineer, NHK Labs.
• 2000~2007, Panasonic as an adviser
• From 2009 April, present post
  2000 Co-established Entrepreneur Engineering Research Group and after secretary-general and chairperson, now advisor. Currently he serves as a visiting professor, Kochi University of Technology & Osaka Electric-Communication University
• Major publication: 「Shock! Plasma TV can change society(Jitsugyo-no Nihon)<2008>」, 「After market strategy(Hakuto-Syobo)<2012>」
• Award: Journal Paper Award. J. IEICE, SMPTE Journal Award, Achievement Award IEICE etc. Member of IEICE, ITE(Fellow), and SID.
### Outline

1. Introduction
2. Brief Overview of Yamaguchi Prefecture
3. The Vision to Conform Yamaguchi Green Materials Cluster (YGC)*1
4. YGC’s R&D Themes and Innovation Creation Scenario
5. YGC’s Innovation Management
6. Brief Overviews of The Interim Achievements
7. Conclusion

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*1 Driven by one of MEXT’s*2 publicly offered programs to promote strategic regional innovations

*2 MEXT: Ministry of Education, Culture, Sports, Science and Technology
1. Introduction

Why now the green technologies

Society growth should be limited by various and intertwined complicate factors such as population, food supply, pollution, finite natural resources, and industrial output, which should impose a limit to the growth of society including regional developments as well.

Green technologies must be one of important solutions to this limitation.

The Rome Club founded in 1970s gives us thought-provoking arguments even nowadays.
A Simulation for Global Growth Model

Feedback Mechanism to Affect Population Growth and Industrial Capital Growth


- **Population** (Total population)
  - Annual births (+)
  - Annual deaths (-)
- **Industrial capital** (factory, machine)
  - Investment (Annually invested new capital) (+)
  - Capital consumption (Annual obsolescence or consumed capital) (-)
- **Investment income ratio**
- **Electronic feedback circuit to stabilize the output**

Input: Amplifier
Output:

Amplifier: 

- Annual births
- Birth rate
- Expected life
2. Brief Overview of Yamaguchi Prefecture

- 1.43 million Population
- Inland mild climate
- Three sides surrounded by the seas
- Birth place of the Meiji Restoration to trigger Japanese modernization

- Previously, rich resources such as salt, rice and paper, so-called “three whites”
- Rich natural resources such as coal, limestone, and soda induced modernization of industries in the 20th century
- Recently, the chemicals and petrochemical complexes prospers
Schematic illustration of Yamaguchi Pref. Industries

- **Prefecture GDP**
- **Company Size Breakdown**
- **Industrial Sector Breakdown**

- Primary Ind. Sector
- Secondary Ind. Sector
- Tertiary Ind. Sector
- Small/Mid-sized Enterprises
- Large-sized Enterprises
- Fab/Assembler Industries
- Base Material Industries

- Industry-Based Province
- Global Expansion led by Large-sized Enterprises
- Base Material Industry Leading

- Ube/Onoda Region Complex
- Shunan Region Complex
- Iwakuni/Ohtake Region Complex

Shimonoseki Region Complex

2012/11/14 EU Green Material Cluster Mission Open Session
Prefectural GDP Change
Source: “Yamaguchi Prefecture's Industry” (2012)
Particularly Notable Features of Yamaguchi Prefecture’s Industry

Source: “Yamaguchi Prefecture's Industry” (2012)

- Basic material industries support Yamaguchi prefecture
  In Taisho Era (1912-1926), various factories such as shipbuilding, chemicals, machinery, and metal engineering etc. moved aggressively into Yamaguchi one by one along Seto inland sea. After the world-war, petrochemical complexes were formed, and they contributed to evolve Yamaguchi to a leading industrial prefecture.
  In the western part, the previous coal mining industries reformed timely to chemicals, petroleum, ceramics etc industries, while in the eastern part, chemical companies for sodas were accumulated around petroleum refinery complexes.

- Industries for transport machineries, electronic components, and drug medicines accumulated
  In Yamaguchi, transport machinery industries prospered as well in addition to the basic materials, and big companies such as vehicle maker [MAZDA], railway car maker [Hitachi], shipbuilder [Mitsubishi heavy industries] got around, and the related industries also accumulated. Furthermore, mechatronics, electronic component industries prospered and recently, the medicinal chemicals and environmental industries prospered remarkably together with related SMEs, thereby their annual production values have reached the top-class in Japan.

- Energetic SMEs accumulated
  Yamaguchi has a lot of energetic SMEs possessing technical skills high enough to compete world widely. For example, Yamashita-kogyo Co. proud of sheet metal hammering process applied to the Shinkansen, Hiromoku-Giken Co. proud of super interior decorating technologies.
  Hibiki-Seiki Co. proud of cutting edge technologies producing the precise parts, e.g. for smart phones and hybrid cars. Geo Power System Co. puts ventilation systems into market, utilizing earth thermal which were employed in pavilions at the Aichi-Expo (2005).
Yamaguchi Prefecture’s Foreign Trade Outlook
~merchandise item break down~
Source: “Yamaguchi Prefecture's Industry” (2012)

Yamaguchi Pref.'s Export/Import Transition

2012/11/14
EU Green Material Cluster Mission Open Session

Regional break down(%)

Trade articles break down(%)
3. The Vision to Conform Yamaguchi Green Materials Cluster (YGC)

**Drivers of Industrial Cluster Formation**

- **Globally competitive group of core corporations**
  - Tokuyama Corporation, UBE INDUSTRIES, Ltd., Choshu Industry CO., LTD., Japan Fine Steel Co., Ltd, TODA KOGYO CORP., Ube Material Industries, Ltd., etc.

- **Group of local, small and medium-sized enterprises with growing business**

- **New start-ups/new corporate sites**

**Core universities**
- Graduate school of Science and Engineering Yamaguchi University
- Tokyo University of Science Yamaguchi
- National Fisheries University

**Cooperation among industry/academia/public sector**

**Nonlocal/Overseas Universities and research institutes**

**Yamaguchi Industrial Promotion Foundation** (Industrialization / management support)

**Yamaguchi pref. Industrial Technology Institute** (Technical assistance)

**Yamaguchi Prefecture** (Promotion headquarters for accumulating industries with advanced technologies in Yamaguchi)

**Creating a Hub of Global Knowledge**
- Developing advanced technologies
- Forming an international hub of shared research
- Establishing research infrastructure
- Promoting international cooperation
- Conducting HR development targeting youth

**Creating a resource and energy-saving production base for high-performance materials**
- Developing venture business
- Developing new business
- Providing funding
- Providing industrial sites

**Yamaguchi Green Materials Cluster (YGC)**
- Solar cell (PV) silicon
- LED applied products
- Recycling waste silicon
- Organic EL
- Secondary battery materials
- Nanoparticle applied products
- Semiconductor manufacturing/processing equipment
- High efficiency light-emitting materials (LED, etc.)

**Semiconductor manufacturing/processing equipment**
- Recycled waste silicon
- LED applied products

**Recycling waste silicon**
Participating Organizations of Yamaguchi Green Materials Cluster

- National Fisheries University
- DIC Corporation
- HDT INC.
- Hosiden Co.
- KANEKA CORPORATION
- Nippon Atomized Metal Powders Corporation
- Sharp Co.
- Companies outside Yamaguchi
  - UBEKOHKI Co., Ltd.
  - Japan Fine Steel Co., Ltd.
  - Choshu Industry Co., Ltd.
  - TODA COGYO CORP.
  - Nippon Chemi-Con Corporation
  - Shintec Inc.
  - Shin Nihon Iyaku Corporation
  - Shintec Inc.
  - Choshu Industry Co., Ltd.

- Yamaguchi Prefectural Fisheries Research Center
- Yamaguchi Prefecture
- Yamaguchi Industrial Promotion Foundation
- Yamaguchi Prefectural Agriculture & Forestry General Technology Center
- Tokuyama Corporation
- Shin Nihon Iyaku Corporation
- Shintec Inc.

- National Fisheries University
- Mizuguchi-densou Co., Ltd.
- Nagayama Electric Industrial Co., Ltd.

- Tokyo University of Science, Yamaguchi
- Yamaguchi University Faculty of Engineering
- Yamaguchi Prefectural Industrial Technology Institute
- Yamaguchi University Faculty of Agriculture

- Yamaguchi Prefecture
## 4. YGC’s R&D Themes and Innovation Creation Scenario

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<th>Project</th>
<th>Subject</th>
<th>Overview</th>
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<td><strong>LED Materials &amp; Applied LED Technologies</strong></td>
<td>R&amp;D for Light Emitting Diode(LED) Materials</td>
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<tr>
<td>R&amp;D for Primary Industrial Application by Using LED Lighting</td>
<td>R&amp;D for Pest Management System, and Crop Growth Control System by Using LED Lighting</td>
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<td>R&amp;D for New Fishery Technology by Using LED Lighting</td>
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<td><strong>Technologies for Reducing/Recycling Waste Silicon Slurry</strong></td>
<td>R&amp;D for Original Substrates Repelling Si Melt to Emit no Wasted Silicon</td>
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<tr>
<td>R&amp;D of Synthesis of Brominated Silanes from Waste Silicon Slurry and Recycling Technology to Solar Grade Silicon</td>
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<td><strong>Nanoparticle-doped Materials and Devices</strong></td>
<td>R&amp;D for Next-generation FSC(Field-sequential LCD) and Super Green LCD(STN &amp; PSV)</td>
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<tr>
<td>R&amp;D for Flexible Organic Thermo-electric Conversion Materials</td>
<td>R&amp;D for Hybrid Nanoparticle-doped Optical-films</td>
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### By-catch Reduction Fishing

- Substrate repelling Si melt
- Spherical Si
- Thin Plate Si
- Reusable Crucible

### Solar Grade Silicon

- Waste Silicon

### Flexible Thermo-electric Conversion Element

- Liquid Crystal Display
- Nanoparticles
- Silver Paste
- Optical Films

### GaN

- 5 µm

- High Luminance

- Patterned Sapphire Substrate

- Pest Management Crop Growth Control

- By-catch Reduction Fishing
5. YGC’s Innovation Management(1)
~Trinity Strategy of R&D, Intellectual Property, and Commercialization~

- **Research Promotion Committee**
  - Administration & Planning, etc.
  - Progress controlling

- **Various industry and academic research groups**

- **University/intellectual property sector**
  - Patent applications
  - Interaction with Patent Office

- **Intellectual Property Strategy Committee**
  - Planning/managing, etc. of intellectual property strategies

- **Commercialization**
  - Participating corporations
  - Venture companies
  - Commercialization scenarios
  - Analysis of competiveness

- **Intellectual Properties Survey**

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**Proposal discussions**

**R&D information**

**Research outcomes**

**Cooperation**

**Commercialization scenarios information**

**Reporting**
YGC’s Innovation Management(2)
~Japanese Hand-drum Shaped Semi-open Innovation Model~

Common concept: “globalization”

- Licensing
- Establishment of venture company
- Third parties
  - new market creation
- Existing companies
- Debut of new products & services
- In/out-sourcing & aggregation of technologies through industry-university-government cooperation

Domestic Base technology,

Overseas Base technology,

R

D

B
6. Brief Overviews of the interim achievements(1)

① LED Materials & Applied LED Technologies

- LED (Light emitting diode)
- PSS: Patterned sapphire substrate to improve LED luminous efficiency drastically
- Pest management system, and crop growth control system by LEDs
- New fishery technology by LED lighting

University-launched entrepreneurial venture company; Yamaguchi Opto Semiconductor, Inc., President Mr. Sugiura
Founded in Sep. 2010

② Developing technologies for reducing/recycling waste silicon slurry

- A substrate to repel Si melt
- Synthesis of brominated silanes from waste silicon slurry and recycling technology to solar grade

Experimental spherical micro silicon  Thin plate silicon  Waste silicon  Polycrystalline silicon
Developing nanoparticle-doped materials & devices

- Fast-response energy saving LCD
- High performance LCDs for car-applications
- Prolonged stability of nano-particle dispersion
- Flexible organic thermoelectric conversion materials
- Metal particles for fine-wiring
- Hybrid nanoparticle-doped optical film
7. Conclusion

• Reviewed why now green innovation
• Overviewed Yamaguchi prefecture’s history, geography and industries etc. including economic activities.
• Introduced our cluster innovation, including R&Ds, promotion management, and interim achievements.
• Yamaguchi is proud of its strong base material industries, competitive worldwide and thereby hope to contribute to the creation of new and worldwide clusters.