

# **Comprehensive Strategy on Science, Technology and Innovation**

## Chapter 2

Issues to Be Addressed by Science, Technology and Innovation

## **Roadmap**





## (2) Realizing highly efficient and clean innovative technologies for power generation and combustion

**[Vision]** Society that achieves both economic growth and environmental burden reduction through advanced power generation technologies

**[Target]** Implementation of innovative highly efficient power generation/combustion systems and application of CO<sub>2</sub> collection/storage technologies

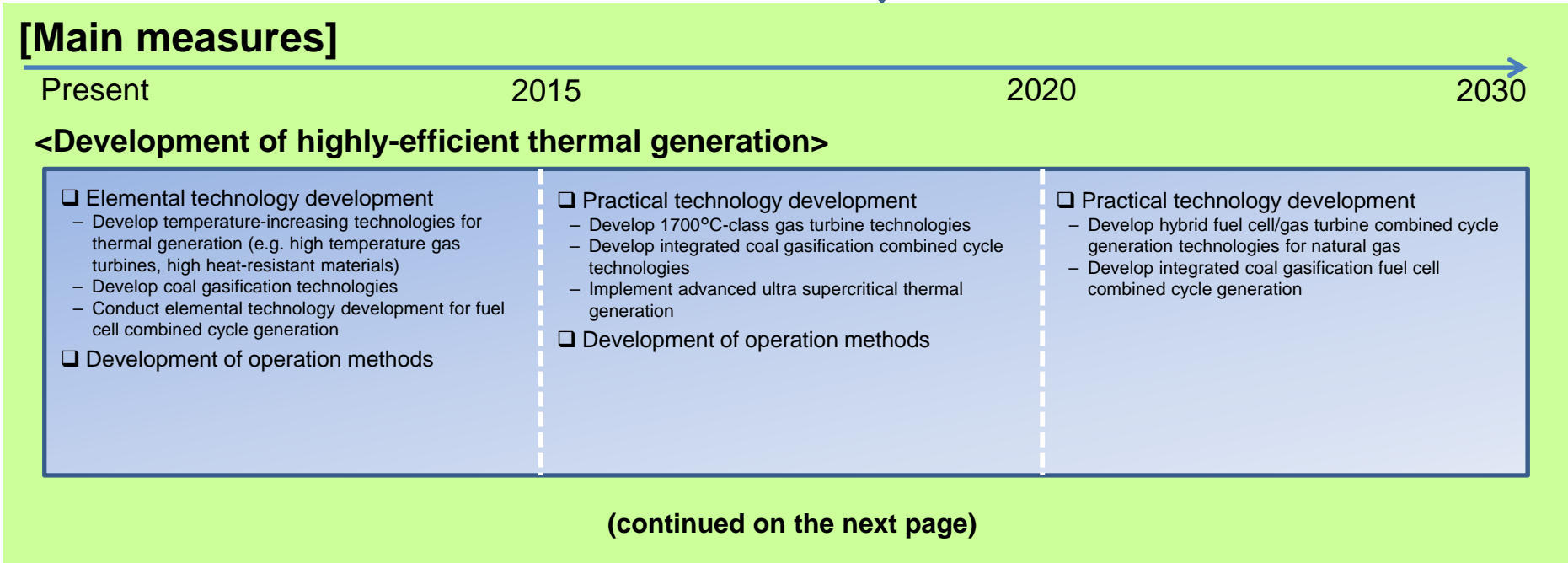
- Improvements in efficiency and durability of stationary fuel cells
- Implementation of CO<sub>2</sub> separation/collection/storage technologies

**[Measures toward social implementation]**

- Establishment of legal systems (e.g., promoting, licensing) for practical application
- Promotion of international standardization of technical standards, authentication systems, etc., pertaining to strengthening of international competitiveness

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Thermal power generation
  - Practical application of 1700°C-class gas turbine and advanced ultra supercritical thermal power generation
- Fuel cells
  - Functional improvements
- CO<sub>2</sub> collection/storage technologies
  - Practical application of integrated systems



## (2) Realizing highly efficient and clean innovative technologies for power generation and combustion

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### [Main measures]

Present

2015

2020

2030

#### <Development of fuel cells>

##### □ Elemental technology development

- Develop solid polymer fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)
- Develop solid oxide fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)

##### □ Practical technology development

- Develop solid polymer fuel cell vehicles
- Develop solid oxide fuel cell industrial technologies (e.g., combination with gas turbine generation)

##### □ Elemental technology development

- Develop solid polymer fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)
- Develop solid oxide fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)

##### □ Practical technology development

- Develop solid oxide fuel cell industrial technologies (e.g., combination with gas turbine generation)

##### □ Elemental technology development

- Develop solid polymer fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)
- Develop solid oxide fuel cell component and manufacturing technologies (e.g., cost reduction, durability improvement)

#### <Development of CO<sub>2</sub> separation, collection, and storage technologies>

##### □ Elemental technology development

- Develop existing and new CO<sub>2</sub> separation and collection technologies
- Develop construction technologies

##### □ Practical technology development

- Commence demonstration fields for integrated systems

##### □ Technology development of operation methods

- Consider environmental impact assessment, etc., techniques
- Develop monitoring/maintenance technologies

##### □ Elemental technology development

- Conduct technology development for cost reduction

##### □ Practical technology development

- Conduct large-scale demonstration (underground storage)

##### □ Technology development of operation methods

- Establish environment impact assessment, etc., methods
- Develop monitoring/maintenance technologies

##### □ Elemental technology development

- Conduct technology development for cost reduction

##### □ Practical technology development

- Implement CO<sub>2</sub> separation, collection, and storage technologies



### Related indicators

- Implementation of 1700°C-class gas turbine and advanced ultra supercritical thermal generation (by around 2020)
- Improvement of efficiency and durability of fuel cells
- Implementation of CO<sub>2</sub> separation, collection, and storage technologies (by around 2020)

### (3) Diversifying sources and resources of energy

**[Vision]** Society with improving energy self-sufficiency rate and ensured energy security

**[Target]** Contribution to energy source diversification

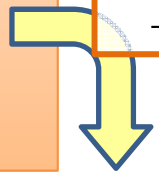
- Technology development for methane hydrate, while monitoring international situations, aiming at starting commercialization projects led by the private sector in the latter half of FY 2018
- Establishment of next-generation marine resources development technologies
- Reduction in oil usage through innovative catalyst technologies

**[Measures toward social implementation]**

- Evaluation of impacts on the seafloor environment
- Environmental arrangement to support marine resources development (e.g., establishment of activity bases, securing marine interests)

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Methane hydrate
  - Technology development for realizing commercialization targeting by FY2018
- Innovative catalyst technologies
  - Establishment of elemental technologies



Present	2015	2020	2030
<b>&lt;Methane hydrate&gt;</b>			
<ul style="list-style-type: none"> <li><input type="checkbox"/> Demonstration of production technology, etc., through offshore production tests</li> <li><input type="checkbox"/> Detailed evaluation of reserve amount/area</li> <li><input type="checkbox"/> Evaluation of impacts on environment (e.g., ecosystem)</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Technology development for realizing commercialization (targeting FY2018)</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Continuing technology development for starting commercialization projects led by private sector, while monitoring international situations</li> </ul>	
<b>&lt;Next-generation marine resources development technologies (e.g., sea-floor hydrothermal deposits)&gt;</b>			
<ul style="list-style-type: none"> <li><input type="checkbox"/> Elemental technology development                             <ul style="list-style-type: none"> <li>– Develop investigation technology (e.g., acoustics, un-/manned probe)</li> <li>– Develop production technology (e.g., scaling-up, cost reduction)</li> <li>– Demonstrate I/P/T systems* on site</li> <li>– Analyze of production results of field tests</li> </ul> </li> <li><input type="checkbox"/> Development of activity bases                             <ul style="list-style-type: none"> <li>– Establish of special-condition port construction technology</li> </ul> </li> <li><input type="checkbox"/> Technology development of operation methods                             <ul style="list-style-type: none"> <li>– Establish methods for environmental impact evaluation and resources evaluation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Elemental technology development                             <ul style="list-style-type: none"> <li>– Develop investigation technology (e.g., acoustics, un-/manned probe)</li> <li>– Develop production technology (e.g., scaling-up, cost reduction)</li> <li>– Demonstrate I/P/T systems* on site</li> <li>– Analyze of production results of field tests</li> </ul> </li> <li><input type="checkbox"/> Development of activity bases                             <ul style="list-style-type: none"> <li>– Establish/utilize entire system for residue processing, etc.</li> </ul> </li> <li><input type="checkbox"/> Technology development of operation methods                             <ul style="list-style-type: none"> <li>– Establish methods for environmental impact evaluation and resources evaluation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Elemental technology development                             <ul style="list-style-type: none"> <li>– Develop investigation technology (e.g., acoustics, un-/manned probe)</li> <li>– Develop production technology (e.g., scaling-up, cost reduction)</li> <li>– Demonstrate I/P/T systems* on site</li> <li>– Analyze of production results of field tests</li> </ul> </li> <li><input type="checkbox"/> Development of activity bases                             <ul style="list-style-type: none"> <li>– Establish/utilize entire system for residue processing, etc.</li> </ul> </li> <li><input type="checkbox"/> Technology development of operation methods                             <ul style="list-style-type: none"> <li>– Establish methods for environmental impact evaluation and resources evaluation</li> </ul> </li> </ul>	

\*I/P/T systems: investigation, production, and transport systems

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# (3) Diversifying sources and resources of energy

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## [Main measures]

Present

2015

2020

2030

### <Innovative catalyst technologies>

- Elemental technology development
  - Develop photo-catalysts
  - Develop hydrogen separation membranes
  - Develop CO<sub>2</sub> re-use catalysts
  - Develop advanced processing technologies for heavy oils, etc.

- Elemental technology development
  - Achieve 3% energy conversion efficiency for photo-catalysts
  - Modularize hydrogen separation membranes
  - Achieve 80% olefin conversion rate of introduced hydrogen or CO<sub>2</sub> (carbon)
  - Develop advanced processing technologies for heavy oils, etc.

- Practical technology development
  - Develop artificial photosynthesis process

- Elemental technology development
- Practical technology development
  - Implement these technologies

### <Bio-fuel>

- Elemental technology development
  - Conduct technology development for microalgae-based fuel production
  - Conduct technology development for cellulose-based fuel production

- Practical technology development
  - Develop production systems for cellulose-based fuel

- Elemental technology development
  - Conduct technology development for microalgae-based fuel production
  - Reduce production cost of cellulose-based fuel

- Practical technology development
  - Expand and improve bio-ethanol production facilities

- Elemental technology development
  - Conduct technology development for microalgae-based fuel production
  - Reduce production cost of cellulose-based fuel

- Practical technology development
  - Expand production scale of bio-ethanol





# (4) Efficient energy utilization through development of innovative devices

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## [Main measures]

Present

2015

2020

2030

### <Information devices>

<ul style="list-style-type: none"> <li><input type="checkbox"/> Basic technology development of ultra-low power consumption devices                     <ul style="list-style-type: none"> <li>- Develop miniaturization and ultra-low power consumption technologies using extreme ultraviolet light</li> <li>- Develop non-volatile devices, etc.</li> <li>- Develop software and hardware utilizing non-volatile devices, etc.</li> <li>- Develop 3D application technologies for semiconductor chips</li> </ul> </li> <li><input type="checkbox"/> Basic technology development of ultra-low power consumption optical communication devices                     <ul style="list-style-type: none"> <li>- Develop optoelectronic hybrid circuit integration technologies</li> <li>- Develop practical technologies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of ultra-low power consumption devices                     <ul style="list-style-type: none"> <li>- Achieve 10% or less power consumption by semiconductors</li> <li>- Realize ultra-low voltage devices</li> <li>- Realize 3D application technologies for semiconductor chips</li> </ul> </li> <li><input type="checkbox"/> Development of ultra-low power consumption optical communication devices</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Development and practical application of products using these technologies</li> </ul>
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### <Lightings and displays>

<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of ultra-low power consumption sheet displays                     <ul style="list-style-type: none"> <li>- Establish plastic substrate display elemental technologies</li> <li>- Develop energy-saving organic electroluminescent (EL) displays</li> </ul> </li> <li><input type="checkbox"/> Development of highly-efficient next-generation lightings                     <ul style="list-style-type: none"> <li>- Develop new base materials</li> <li>- Develop practical technologies for organic EL lightings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Establishment of ultra-low power consumption sheet display technologies</li> <li><input type="checkbox"/> Development of highly-efficient next-generation lightings                     <ul style="list-style-type: none"> <li>- Implement organic EL lightings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Practical application of ultra-low power consumption sheet displays</li> <li><input type="checkbox"/> Achievement of 100% stock for highly-efficient next-generation lightings</li> </ul>
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### Related indicators

- Market growth of power electronics devices to 20 trillion yen (2030)
- Reduction and improvement of rare earth use rate in motors

# (5) Efficient energy utilization through development of innovative structural materials

**[Vision]** Society where energies are utilized efficiently and whose advanced technologies are expanding internationally

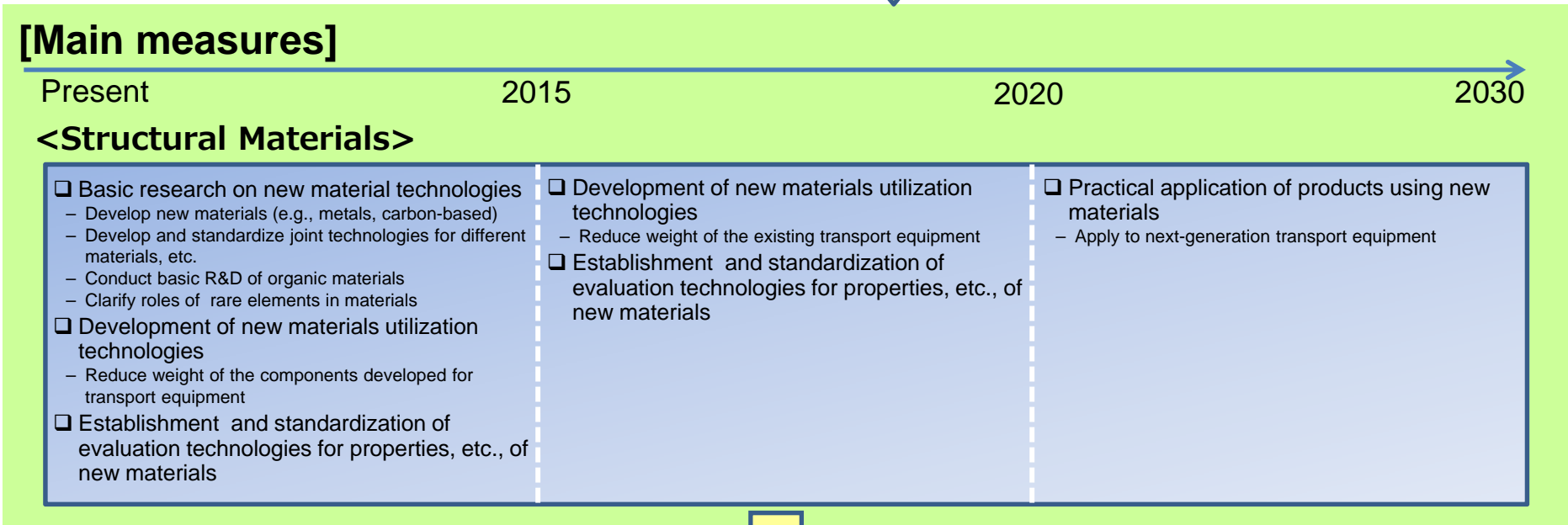
**[Target]** Improvement in energy efficiency and reduction in energy consumption by innovative structural materials

**[Measures toward social implementation]**

- Promotion of international standardization, normalization, and authentication systems from the technology development stages in order to assist international expansion
- Promotion of the Top Runner Program

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Structural materials
  - Application to structural components of transport equipment
  - Establishment and standardization of evaluation technologies for properties, etc., of new materials



**Related indicators**

- Contribution to structural weight reduction of cars, planes, etc. by utilizing Innovative materials
- Reduction of rare earth use rate in structural materials

# (6) Sophisticating technologies for energy utilization on the demand side

**[Vision]** Society with autonomous and stable energy supply and demand

**[Target]**

- Establishment of energy management technologies in housing, buildings, and communities
- Expansion of the use of energy management system in private sector

**[Measures toward social implementation]**

- Promotion of international standardization, normalization, and authentication systems from the technology development stages in order to assist international expansion
- Promotion and expansion of energy management international standards, the international standard for environmental protection, etc.

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Housing/buildings (HEMS\*1, BEMS\*2)
  - Standardize ZEH\*3 for constructing new houses
  - Realization of ZEB\*4 for new public buildings, etc.
- Communities (CEMS\*5)
  - Establishment of regional demand response operation methods
- Production process technologies
  - Establishment of innovative energy-saving process technologies

**[Main measures]**

Present	2015	2020	2030
<b>&lt;Housing/buildings (HEMS, BEMS)&gt;</b>			
<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of ZEH/ZEB technologies                             <ul style="list-style-type: none"> <li>- Develop insulation technologies</li> <li>- Develop cost-reduction technologies</li> </ul> </li> <li><input type="checkbox"/> Development of highly-efficient/smart household electric appliances                             <ul style="list-style-type: none"> <li>- Develop energy-saving items, consider control methods</li> </ul> </li> <li><input type="checkbox"/> Development/demonstration of demand response                             <ul style="list-style-type: none"> <li>- Develop demand response systems and operation technologies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Standardize ZEH for constructing new house                             <ul style="list-style-type: none"> <li>- Realize ZEB for new public buildings, etc.</li> </ul> </li> <li><input type="checkbox"/> Diffusion of highly-efficient/smart household electric appliances</li> <li><input type="checkbox"/> Development of services toward practical application of demand response</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Realization of ZEH for new houses (average)</li> <li><input type="checkbox"/> Realization of ZEB for new buildings (average)</li> <li><input type="checkbox"/> Empirical and progressive diffusion of demand response</li> </ul>	

\*1 HEMS: Home Energy Management System  
 \*2 BEMS: Building Energy Management System  
 \*3 ZEH: net Zero Energy House  
 \*4 ZEB: net Zero Energy Building  
 \*5 CEMS: Community Energy Management System

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# (6) Sophisticating technologies for energy utilization on the demand side

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## [Main measures]

Present 2015 2020 2030

### <Communities (CEMS)>

<ul style="list-style-type: none"> <li>❑ Development and demonstration of regional energy management systems                     <ul style="list-style-type: none"> <li>– Develop regional energy information and communication networks</li> <li>– Develop and demonstrate toward practical application of regional demand response systems</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❑ Establishment and diffusion of regional energy management systems</li> </ul>	<ul style="list-style-type: none"> <li>❑ Diffusion of regional energy management systems</li> </ul>
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### <Production process technologies>

<ul style="list-style-type: none"> <li>❑ Technology development of innovative energy-saving processes                     <ul style="list-style-type: none"> <li>– Conduct elemental technology development of innovative energy-saving chemical processes</li> <li>– Conduct basic technology development of environmentally-harmonized iron manufacturing processes</li> <li>– Integrate basic technologies and elemental technologies of next-generation printed electronics</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❑ Technology development of innovative energy-saving processes                     <ul style="list-style-type: none"> <li>– Conduct elemental technology development of innovative energy-saving chemical processes</li> <li>– Conduct basic technology development of environmentally-harmonized iron manufacturing processes</li> <li>– Integrate basic technologies and elemental technologies of next-generation printed electronics</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❑ Practical application of innovative energy-saving process technologies                     <ul style="list-style-type: none"> <li>– Develop and demonstrate innovative energy-saving chemical processes</li> <li>– Develop and demonstrate innovative iron manufacturing processes</li> <li>– Develop and demonstrate next-generation printed electronics technologies</li> </ul> </li> </ul>
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# (7) Establishing network systems to promote diverse energy utilization

**[Vision]** Society with energy network systems that promote various types of energy use

**[Target]**  Implementation of advancement technologies for backbone system interconnections

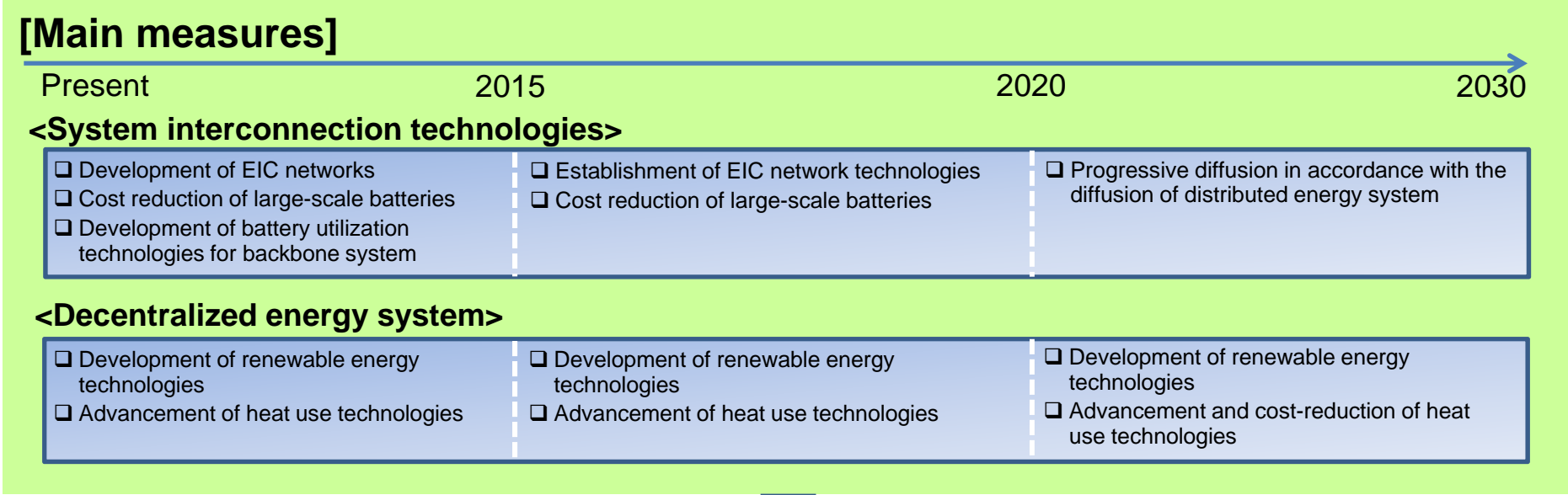
**[Measures toward social implementation]**

- Establishment and expansion of the framework for wide-area application including municipalities, etc.
- Promotion of international standardization for system components and system technologies
- Refinement of regulations and systems that become bottlenecks for integration or commercialization of the system

**Interim goals to be achieved at the intermediary stage(around 2020)**

- System interconnection technologies
  - Establishment of EIC\* networks
  - Cost reduction of large-scale batteries
- Distributed energy system
  - Promotion of diffusion of renewable energies, cogeneration, etc.

\*EIC: energy information and communication



**Related indicator** ○ Gain of 50% of global battery market share (20 trillion yen) by relevant Japanese companies (2020)

# (8) Sophisticating innovative technologies for transformation, storage and transportation of energy

**[Vision]** Society where use of clean energies is promoted by advanced energy conversion, storage, and transport technologies

**[Target]**

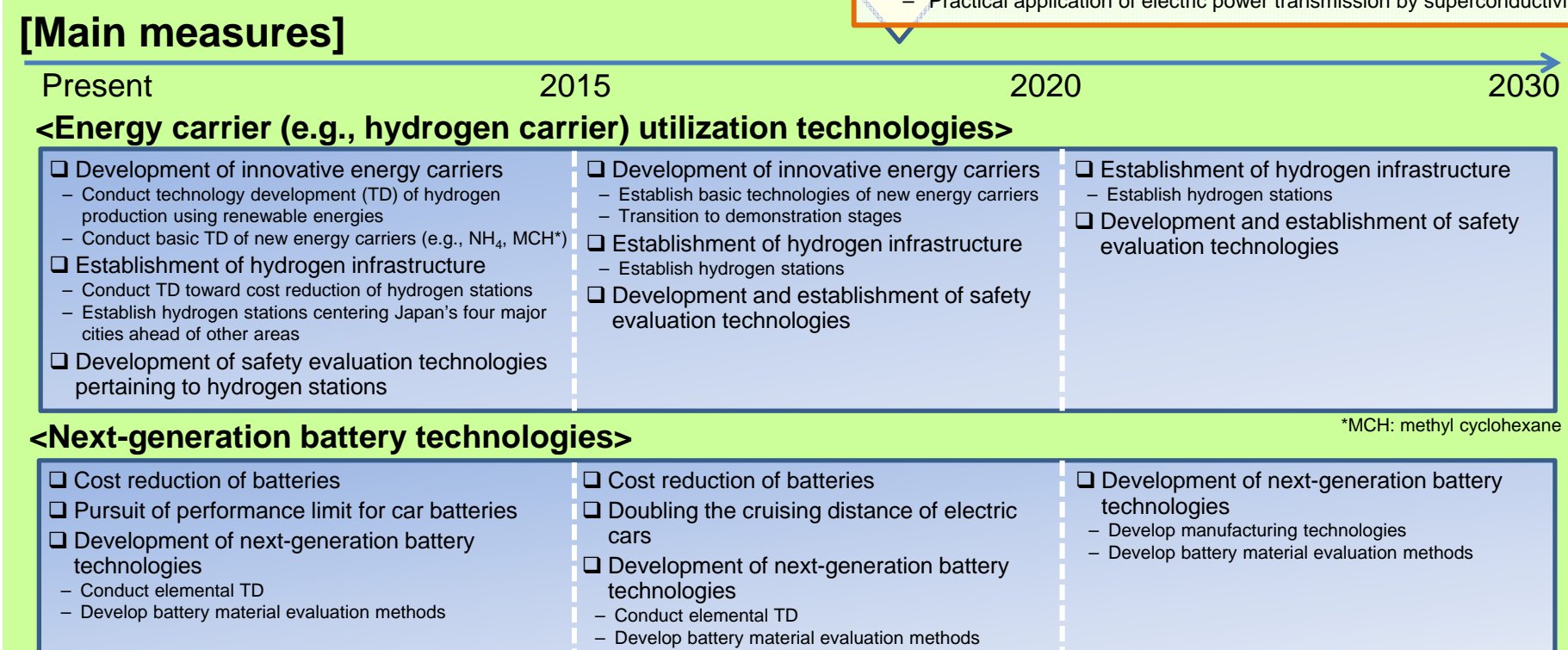
- Diffusion and development of hydrogen infrastructure
- Implementation of next-generation battery technologies
- Implementation of superconductive electricity transmission technologies

**[Measures toward social implementation]**

- Relaxation of regulations and inspection and review of safety standards which become bottlenecks of industrialization
- Promotion of international standardization, normalization, and authentication systems from the technology development stages in order to assist international expansion

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Energy carrier utilization technologies
  - Establishment of basic technologies for new energy carriers
  - Establishment of hydrogen infrastructure
  - Establishment of safety evaluation technologies
- Next-generation battery technologies
  - Establishment of battery material evaluation techniques
  - Elemental technology development (e.g., development of candidate materials for electrodes, electrolytes, and electrolytic solutions)
- Heat storage/insulation technologies
  - Practical application of high-performance heat storage/insulation materials and heat management technologies
- Superconductive power transmission technologies
  - Practical application of electric power transmission by superconductivity



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# (8) Sophisticating innovative technologies for transformation, storage and transportation of energy

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## [Main measures]

Present

2015

2020

2030

### <Technologies for heat storage, insulation, etc.>

<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of materials for heat storage, insulation, etc.             <ul style="list-style-type: none"> <li>- Develop high-performance heat storage/insulation materials</li> <li>- Develop high-performance thermoelectric conversion materials</li> </ul> </li> <li><input type="checkbox"/> Development of heat management technologies utilizing the above materials</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of heat storage systems that achieve both high heat density and high output</li> <li><input type="checkbox"/> Development of highly-efficient exhaust heat recover systems by utilizing these technologies</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Application of these technologies to civilians (buildings, housing) and industries (factories), and improvement of thermal efficiency</li> <li><input type="checkbox"/> Application and diffusion of these technologies to cars, etc.</li> </ul>
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### <Superconductive electricity transmission technologies>

<ul style="list-style-type: none"> <li><input type="checkbox"/> Development of transmission loss reduction technologies (e.g., electric power transmission by superconductivity)             <ul style="list-style-type: none"> <li>- Develop superconductive wire materials</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Practical application of electric power transmission by superconductivity</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Diffusion of transmission loss reduction technologies</li> </ul>
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### Related indicator

○ Gain of 50% of global battery market share (20 trillion yen) by relevant Japanese companies (2020)



## (2) Developing innovative methods of prevention, diagnosis, and treatment of high priority diseases (e.g., cancer)

### [Vision]

No-health-disparity society where people can fulfill healthy happy life. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

### [Target]

Extension of healthy life expectancy, reduction in difference between healthy life expectancy and life expectancy, extension of life expectancy, reduction in cancer age-adjusted mortality rate, relief of mental anguish from cancer patients and relatives, and sustenance and improvement in the quality of recuperation period

### [Measures toward social implementation]

- Implementation of policies related to “Health Japan 21,” Basic Plan to Promote Cancer Control Programs, and new cancer research strategies following the third-term Comprehensive 10-Year Strategy for Cancer Control

### Interim goals to be achieved at the intermediary stage(around 2020)

- 20% reduction in cancer age-adjusted mortality rate (for people below 75 years of age; 20% reduction in 2017 in comparison to the value in 2007)

### [Main measures]

Present

2015

2020

2030

#### <Development of prevention methods>

- Promotion of basic research and epidemiology research for materializing cancer prevention methods

- Promotion of basic research and epidemiology research for materializing cancer prevention methods

- Promotion of basic research and epidemiology research for materializing cancer prevention methods
- Elucidation of carcinogenic mechanisms
- Establishment of prevention method optimized for individual characteristics
- Edification and diffusion of prevention methods

#### <Development of diagnostic methods>

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer diagnostic methods

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer diagnostic methods

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer diagnostic methods
- Establishment of ultra-early diagnostic methods

#### <Development, etc., of treatment methods>

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer treatment methods
- Promotion of research on cancer treatment methods designed for elderly people

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer treatment methods
- Establishment of cancer treatment methods designed for elderly people
- Establishment of cancer supportive/palliative cares

- Performing and promotion of basic research, clinical research, and clinical trials for materializing next-generation cancer treatment methods
- Establishment of individualized cancer medicines

### Related indicators

- Reduction of cancer age-adjusted mortality rate
- Relief of mental anguish of cancer patients and relatives, and improvement/maintenance of the quality of recuperation period

### (3) Substitution and compensation for physical or organ functions

**[Vision]** No-health-disparity society where people can fulfill healthy happy lives. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

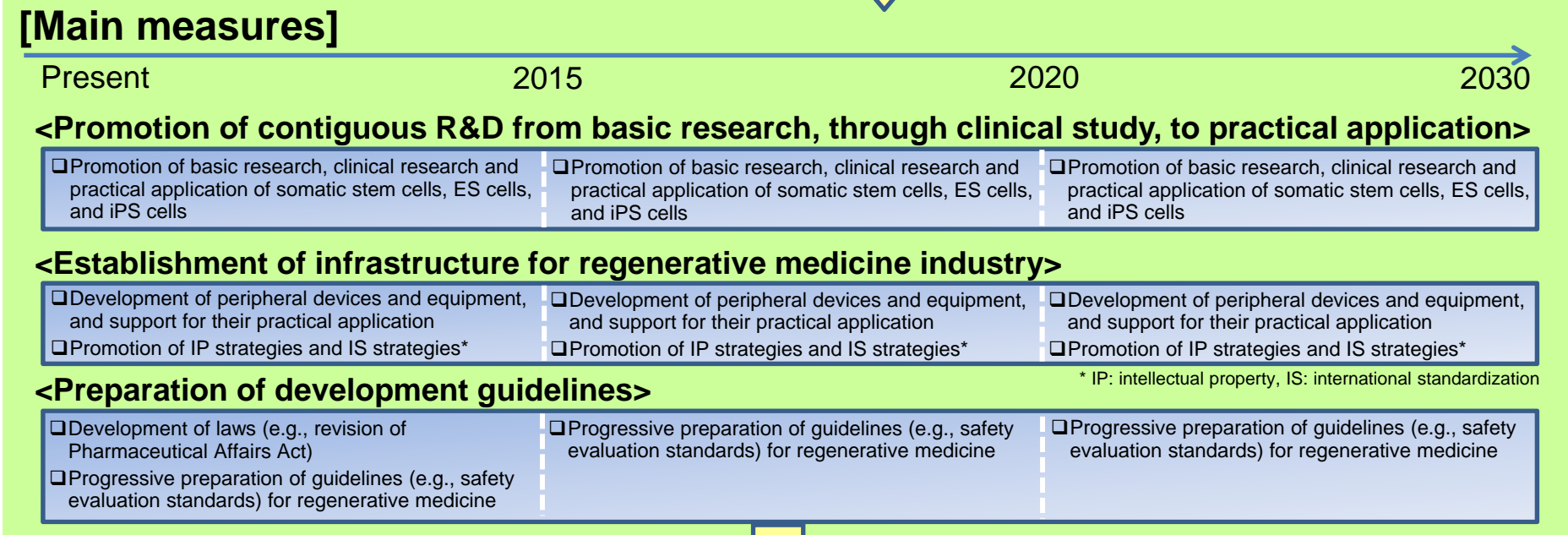
**[Target]** Increase in number of regulatory approvals on regenerative medicines and related products

**[Measures toward social implementation]**

- Improvement of regulations in accordance with the characteristics of regenerative medicines and related equipment
- Improvement of the legal systems to ensure safety of regenerative medicine
- Support for bio-ventures

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Increase in number of regulatory approval on regenerative medicine and related products
- Extension of disease and illness moving onto clinical research and trial stages (e.g., Parkinson's disease)
- Practical application of regenerative medicine peripheral devices and equipment



**Related indicators**

- Promotion of social participation of people with disabilities
- Increase of number of regulatory approvals on regenerative medicines and related products
- Expansion of regenerative medicine market from around 9 billion yen (2012) to 1 trillion yen (2030)
- Improvement of international competitiveness of regenerative medicine and related products

## (4) Reinforcing industrial competitiveness in the areas of pharmaceuticals and medical devices (including promotion of practical application studies of cutting-edge technologies)

Health and Longevity (4)

### [Vision]

No-health-disparity society where people can fulfill healthy happy lives. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

### [Target]

Increase in number of international clinical trials; increase in number of innovative “from Japan” medical supplies and equipment; formulation and utilization of guidelines for developing and inspecting innovative medical technologies

### [Measures toward social implementation]

- Establishment of evaluation methods for innovative medicine technologies; system improvement of an independent administrative agency, the Pharmaceuticals and Medical Devices Agency ; Five-year Clinical Research and Trial Activation Plan 2012, etc.

### Interim goals to be achieved at the intermediary stage(around 2020)

- Improvement of legal systems such as Pharmaceutical Affairs Act (around 2015)

### [Main measures]

Present

2015

2020

2030

#### <Promotion of R&D and practical application of innovative medical technologies; Establishment of evaluation methods>

- Promotion of R&D and practical application of innovative medical supplies and equipment
- Progressive preparation of development and inspection guidelines
- Appropriate evaluation of innovations

- Promotion of R&D and practical application of innovative medical supplies and equipment
- Progressive preparation of development and inspection guidelines
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- Promotion of R&D and practical application of innovative medical supplies and equipment
- Progressive preparation of development and inspection guidelines
- Appropriate evaluation of innovations

#### <Establishing/augmenting national support system for drug-development and medical equipment development; Environmental arrangement for clinical studies>

- Establishment/augmentation of drug-development support networks
- Arrangement of clinical research key hospitals, etc.
- Improvement of efficiency/ethics/quality of clinical research & trials
- Development/procurement of research and research supporters
- Promotion of international standardization
- Promotion of international joint clinical research & trials
- Support for medical equipment development through medicine-industry cooperation

- Augmentation of drug-development support networks
- Arrangement of clinical research key hospitals, etc.
- Improvement of efficiency/ethics/quality of clinical research & trials
- Development/procurement of research and research supporters
- Promotion of international standardization
- Promotion of international joint clinical research & trials
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- Augmentation of drug-development support networks
- Improvement of efficiency/ethics/quality of clinical research & trials
- Development/procurement of research and research supporters
- Promotion of international standardization
- Promotion of international joint clinical research & trials
- Support for medical equipment development through medicine-industry cooperation

#### <Improvement of systems for inspection and safety ensuring medical supplies and equipment>

- Improvement of legal systems such as Pharmaceutical Affairs Act
- System improvement of Pharmaceuticals and Medical Devices Agency
- Expansion of Pharmaceutical Affairs Consultation on R&D Strategy

- System improvement of Pharmaceuticals and Medical Devices Agency
- Expansion of Pharmaceutical Affairs Consultation on R&D Strategy

- System improvement of Pharmaceuticals and Medical Devices Agency
- Expansion of Pharmaceutical Affairs Consultation on R&D Strategy

#### <Promotion of international expansion of medical technology and service packages>

- Enhancement of networks with overseas medical institutions (e.g., those in emerging countries)

- Establishment of Japanese-style medical bases

- Establishment and expansion of Japanese-style medical bases

### Related indicators

- Increase of number of international joint clinical research and trials
- Increase of number of “From Japan” innovative medical supplies and equipment
- Formulation and utilization of development/inspection guidelines for innovative medical technologies







**(6) Development of future health care  
(e.g., genome cohort, bio-resources bank, promotion of cost–benefit analysis  
studies on medical technologies, bioethics studies)**

**[Vision]** No-health-disparity society where people can fulfill healthy happy lives. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

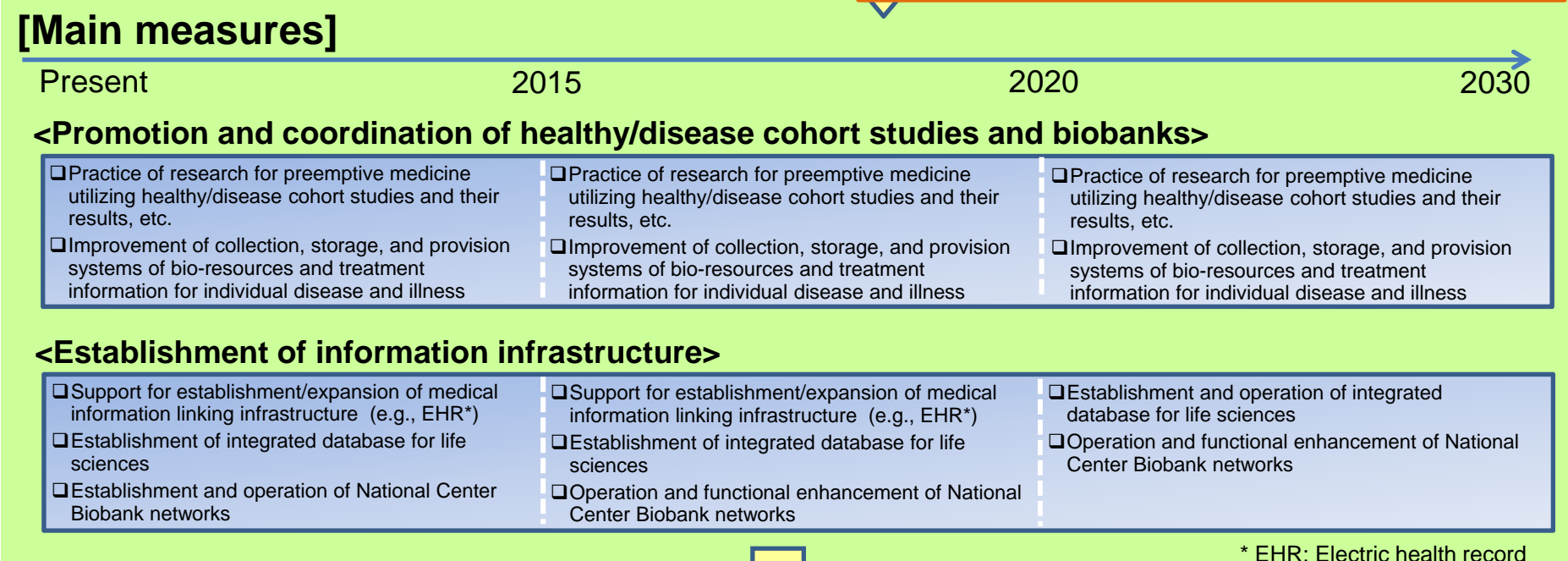
**[Target]** High-quality cohort studies; stable operation of bio-resources banks; expansion of preemptive medicine utilizing meta-analysis results, etc., of genome cohort research

**[Measures toward social implementation]**

- ❑ Tohoku Medical Megabank, Biobank Japan, National Center Biobank, etc.
- ❑ Establishment of integrated database and development of highly specialized human resources required

**Interim goals to be achieved at the intermediary stage(around 2020)**

- ❑ Establishment of fundamental information storing/sharing systems (e.g., biological information, health information)
- ❑ Establishment of biobanks and biological sample storing/sharing systems
- ❑ Identification of disease-related markers through cross-sectional analyses
- ❑ Identification of disease-related genetic/environmental factors and clarification of their interactions



**Related indicators**

- Reduction of difference between life expectancy and healthy life expectancy
- Extension of healthy life expectancy

# (7) Promoting comprehensive local healthcare through the utilization of IT in health, medical treatment and nursing

**[Vision]** No-health-disparity society where people can fulfill healthy happy lives. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

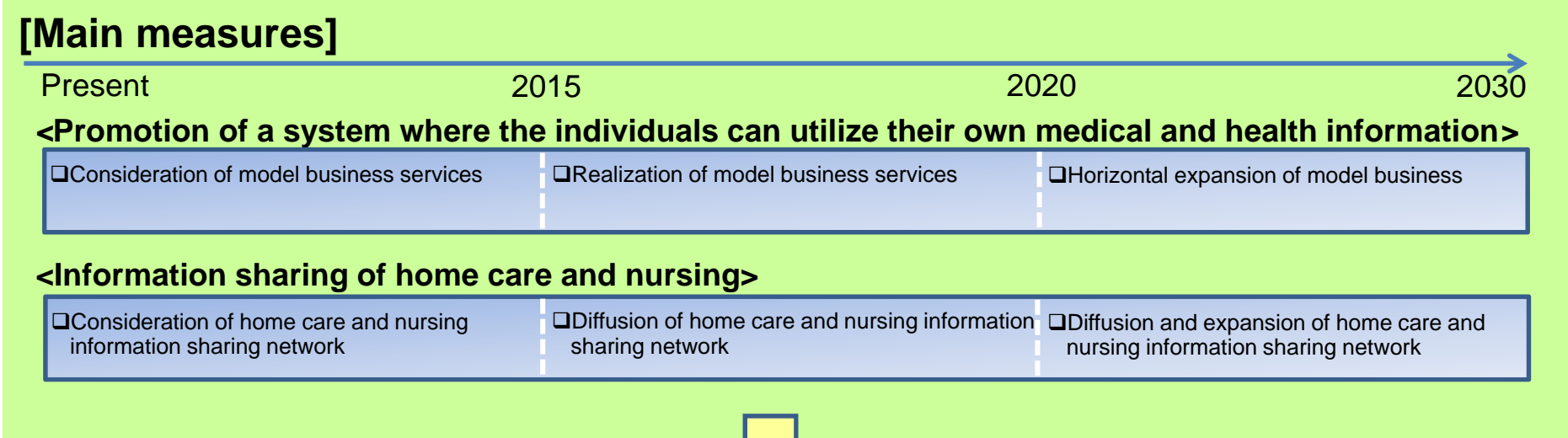
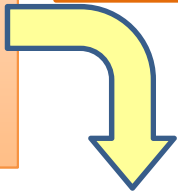
**[Target]** Expansion of areas that adopt comprehensive community healthcare systems utilizing IT

**[Measures toward social implementation]**

- Promotion of a system where the individuals can utilize their own medical and health information
- Information sharing of home care and nursing
- Promotion of visualization of nursing- and medicine-related information
- Improvement of safety measures for medical supplies, etc., by using standardized medical information database
- Consideration and inspection of monitoring services and health maintenance and management technologies for elderly people that fully utilize information technologies, from the point of view of establishing the next-generation housing and communities

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Spread of home care and nursing information sharing network



**Related indicators**

- Expansion of areas that engage in comprehensive community healthcare by utilizing IT



# (9) Improving children's health indicators and elucidating factors to influence upon children's health

**[Vision]** No-health-disparity society where people can fulfill healthy happy lives. Society that enables swift social rehabilitation after illness or injuries, where people can fully manage illness and feel secure.

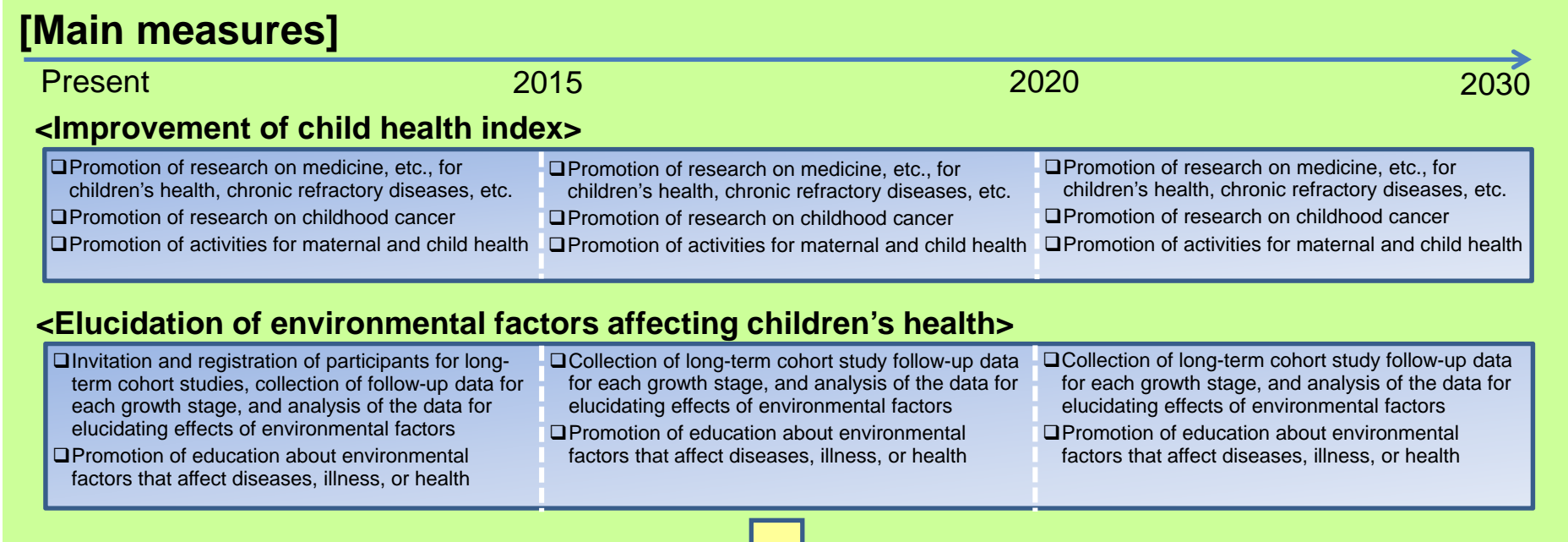
**[Target]** Reduction in the suicide rate of teens, improvement in the child health index such as the obesity rate of pupils

**[Measures toward social implementation]**

- Japan Environment and Children's Study, Healthy Parent and Child 21, Research into Treatment for Specific Child Chronic Diseases, various policies for school health, perinatal care measures, Basic Plan to Promote Cancer Control Programs

**Interim goals to be achieved at the intermediary stage(around 2020)**

- Reduction of the suicide rate of teens
- Some verification of hypotheses about environmental factors that affect diseases, illness, or health



**Related indicators** ○ Improvement of child health indices such as reduction of teen suicide rate, proportion of obese children, etc.















## (2) Developing highly-functional and highly-value added agricultural, forestry, and fishery products through the collaboration with medicine

Local Resources (2)

**[Vision]** Society where new industries are created by utilizing functions of agriculture, forestry, and fishery products

**[Target]** Creation of a new market centering on functional agriculture, forestry, and fishery products

### [Measures toward social implementation]

- Support for safety and effectiveness evaluation targeting approval by the Pharmaceutical Affairs Act
- Practice of large-scale epidemiological studies, such as cohort studies
- Establishment and industrialization of a supply system of foods, etc., in accordance with the individual's health conditions (tailor-made system), through collaboration with medicine

### Interim goals to be achieved at the intermediary stage(around 2020)

- Perspective for practical application of medical supplies and equipment utilizing agricultural products
- Establishment and industrialization of a supply system of foods, etc., in accordance with the individual's health conditions (tailor-made system)
- Establishment of database for functional ingredients of agriculture, forestry, and fishery products

### [Main measures]

Present

2015

2020

2030

#### <Medical supplies and new medical materials utilizing agricultural products>

Development of medical supplies and new medical materials utilizing agricultural products

Safety/effectiveness evaluation of medical supplies and new medical materials utilizing agricultural products, aiming at practical application (animal testing → human (clinical trials))

Practical application, implementation at the medical sites, and industrialization of medical supplies and new medical materials utilizing agricultural products

#### <Elucidation of functions of agriculture, forestry, and fishery products and tailor-made system>

Collection and accumulation of scientific evidence in collaboration with preventive medicine

- Conduct epidemiological studies (cohort studies)
- Collect data of agriculture, forestry, and fishery products with functional ingredients

Analysis/evaluation technologies of functional ingredients

Collection and accumulation of scientific evidence in collaboration with preventive medicine

- Specify individual intake conditions
- Identify new functional ingredients and elucidate their action mechanism
- Implement and diffuse analysis/evaluation technologies

Industrialization technologies (e.g., quality control, cost reduction)

Diffusion of a supply system of foods, etc., in accordance with the individual's health conditions (tailor-made system)

Creation and expansion of new markets for agriculture, forestry, and fishery products and food products (e.g., agro-medical foods) with functional ingredients

Establishment of highly precise and efficient production and transport systems for functional agriculture, forestry, and fishery products

### Related indicator

○ New markets creation based on functional agriculture, forestry, and fishery products



### (3) Sophisticating production system of agriculture, forestry and fishery products by IT and robotic technologies

**[Vision]** Society with easy-to-work sustainable agriculture, forestry, and fishery industries

**[Target]** Major reduction in labor costs and workload, and improvement in productivity

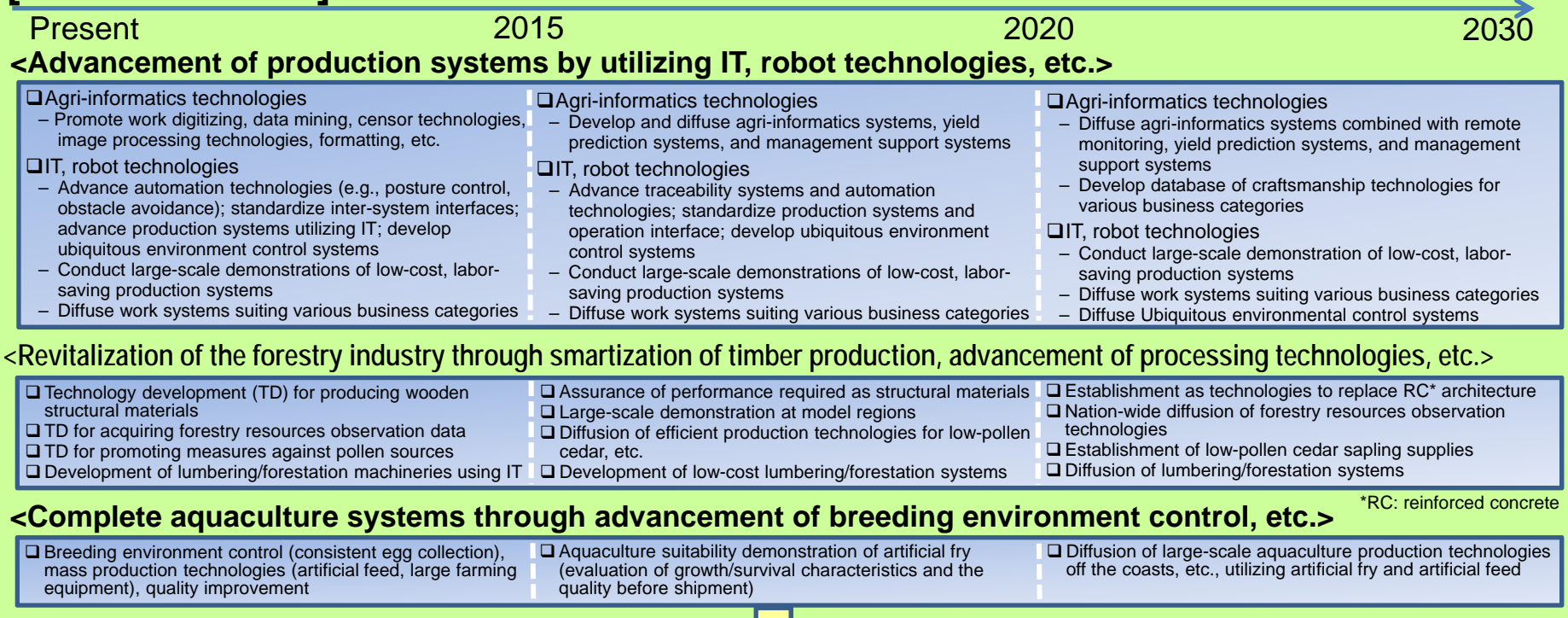
**[Measures toward social implementation]**

- ❑ Large-scale demonstration such as introduction of IT and robots
- ❑ Arrangement related to intellectual properties and consideration for international standardization pertaining to know-how
- ❑ Acceleration of EU HACCP approval process for Japan's fishery products' manufacture and processing facilities

**Interim goals to be achieved at the intermediary stage(around 2020)**

- ❑ Realization of high-yield, high-profit models through visualization of craftsmanship and know-how by utilizing agri-informatics and development of technologies to utilize such knowledge
- ❑ Major reduction of labor costs and workload by IT and robot technologies
- ❑ Full-scale supply of artificial fry using complete aquaculture technologies
- ❑ Effective utilization of timber resources through revitalization of the forestry industry

**[Main measures]**



\*RC: reinforced concrete

**Related indicators**

- Development of labor-saving and productivity-improving technologies (labor costs of land farming reduced by 50% (2018))
- Development of high-yielding, high-profit technologies (yields of protected horticulture increased by 100% (2015))
- Industrialization of complete aquaculture of eels, bluefin tuna, etc. (2020)
- Increase of supply of low-pollen cedar saplings to around 10 million (2017)







## (6) R&D and measures for activating local economy through industry-academia-government collaboration in the regions

Local Resources (6)

### [Vision]

Society where revitalization of local economies is realized through utilization of local strengths

### [Target]

Contribution to Japan's economic growth through realization of local innovations by the industry, academia, and government working in collaboration

### Interim goals to be achieved at the intermediary stage(around 2020)

- Expansion of new industry clusters among local communities
- Revitalization of local economies by utilizing individual local strengths

## [Main measures]

Present

2015

2020

2030

### <Cultivation, training, and appointment of highly-skilled talent in local communities>

Trial implementation of systems that dispatch postdoctoral, etc., to companies

Establishment of mutual talent exchange systems for company researchers and university research institutions

Establishment of systems pertaining to fluidization of highly-skilled talents  
 Creation of new industries/new business by highly-skilled talents and local corporations, etc.

### <Promotion of R&D and practical application in accordance with local characteristics>

Promotion of cluster formation and relevant activities utilizing world's best or one-of-a-kind technologies, in accordance with local characteristics  
 Promotion of various support systems, in accordance with local characteristics

Promotion of cluster formation and relevant activities utilizing world's best or one-of-a-kind technologies, in accordance with local characteristics  
 Promotion of various support systems, in accordance with local characteristics

Leading of local economies by clusters, in accordance with local characteristics

### <Promotion of industry-academia-government cooperation beyond regional boundaries>

Accumulation of skilled R&D talents, know-how, corporate information, etc., at each cluster  
 Promotion of industry-academia-government cooperation among clusters

Promotion of wide-area cooperation projects among clusters

Establishment of networks for wide-area utilization of local resources

### Related indicator

○ Contribution to Japan's economic growth through revitalization of local economies

# (1) Realizing a society where residents' health are protected from disasters and children and the elderly people are sound and healthy

## [Main measures]

Present

2014

2015

2018

### <Quick and appropriate provision of medical care to disaster victims and maintenance of their health>

Research on securing medical care at the time of large-scale disasters

Implementation

Research on the health conditions of the victims of the Great East Japan Earthquake and on health support at the time of large-scale disasters

Partial implementation  
(e.g., guidelines, etc., of supports, etc., for elderly people)

## (2) Establishing energy system resilient against disasters

### [Main measures]

Present

2014

2015

2018

#### <“Next-generation Energies for Tohoku Recovery Project”>

- R&D of marine renewable energies along the Sanriku coast
- R&D of microalgae to be utilized as energy sources
- R&D of energy mobility comprehensive management systems that enable utilization of local renewable energies

Partial  
implementation

#### <Augmentation of functions for preventing secondary disasters such as fires at industrial facilities>

- Research on safety improvement of petroleum tanks against quakes/tsunami and on sediment fire extinguishing technologies

Implementation

- Ensuring security against diversifying fire accidents

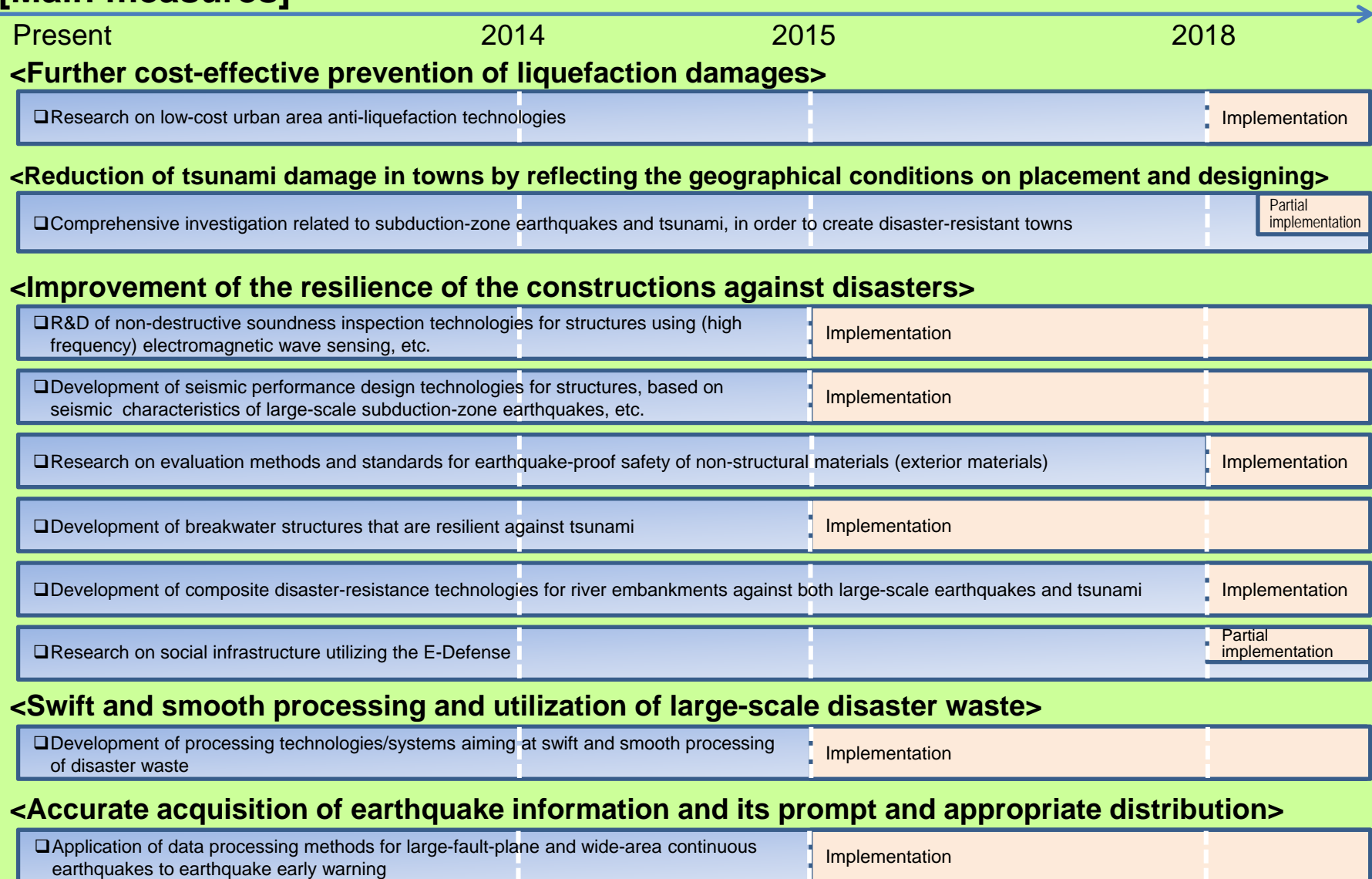
Implementation





# (4) Establishing next generation infrastructures resilient against disasters

## [Main measures]



(continued on the next page)

# (4) Establishing next generation infrastructures resilient against disasters

## [Main measures]

(continued from the previous page)

Present	2014	2015	2018
<b>&lt;Swift and accurate acquisition of tsunami information&gt;</b> <span style="float: right;">*GNSS: global navigation satellite system, GPS: global positioning system</span>			
<input type="checkbox"/> Development of earthquake scale estimation methods based on distribution of seismic intensity <input type="checkbox"/> Development of methods to utilize GNSS* data and GPS* wave gauge data		Implementation	
<input type="checkbox"/> Development of earthquake and tsunami monitors and research on technologies to promptly predict tsunami, for realizing "Emergency tsunami prediction technology & tsunami disaster response and support system"			Partial implementation
<b>&lt;Preparation and information provision for conducting evacuations swiftly and appropriately&gt;</b>			
<input type="checkbox"/> Collection of geological samples from predicted epicenter areas of potential eastern Nankai earthquake; measurement of density/pressure below the seafloor; analysis, etc., of geological data and measurement data			Implementation
<input type="checkbox"/> Establishment of evacuation planning systems for safety improvement against tsunami outside breakwaters			Implementation
<b>&lt;Swift and reliable lifesaving activities at the disaster sites&gt;</b>			
<input type="checkbox"/> Scouting/monitoring technologies using unmanned helicopters, etc. <input type="checkbox"/> Travelling/lifesaving technologies of fire engines for areas that are filled with rubble and/or water			Implementation
<b>&lt;Establishment of basic technologies for securing resilient logistics systems that function swiftly and appropriately&gt;</b>			
<input type="checkbox"/> R&D of the Advanced Land Observation Satellite-2 (ALOS-2), etc.		Partial implementation (ALOS-2 high-resolution observation data utilization system)	
<b>&lt;Acquisition of necessary data, securing resilience of communication methods&gt;</b>			
<input type="checkbox"/> R&D of communication infrastructure technologies for the time of disasters			Partial implementation
<input type="checkbox"/> Acquisition of disaster information at the time of large-scale disasters, using airplane synthetic aperture radar (SAR)		Partial implementation (SAR that can be mounted on small airplanes)	
<input type="checkbox"/> Research on prompt damage estimation technologies for large-scale wide-area earthquakes			Implementation

