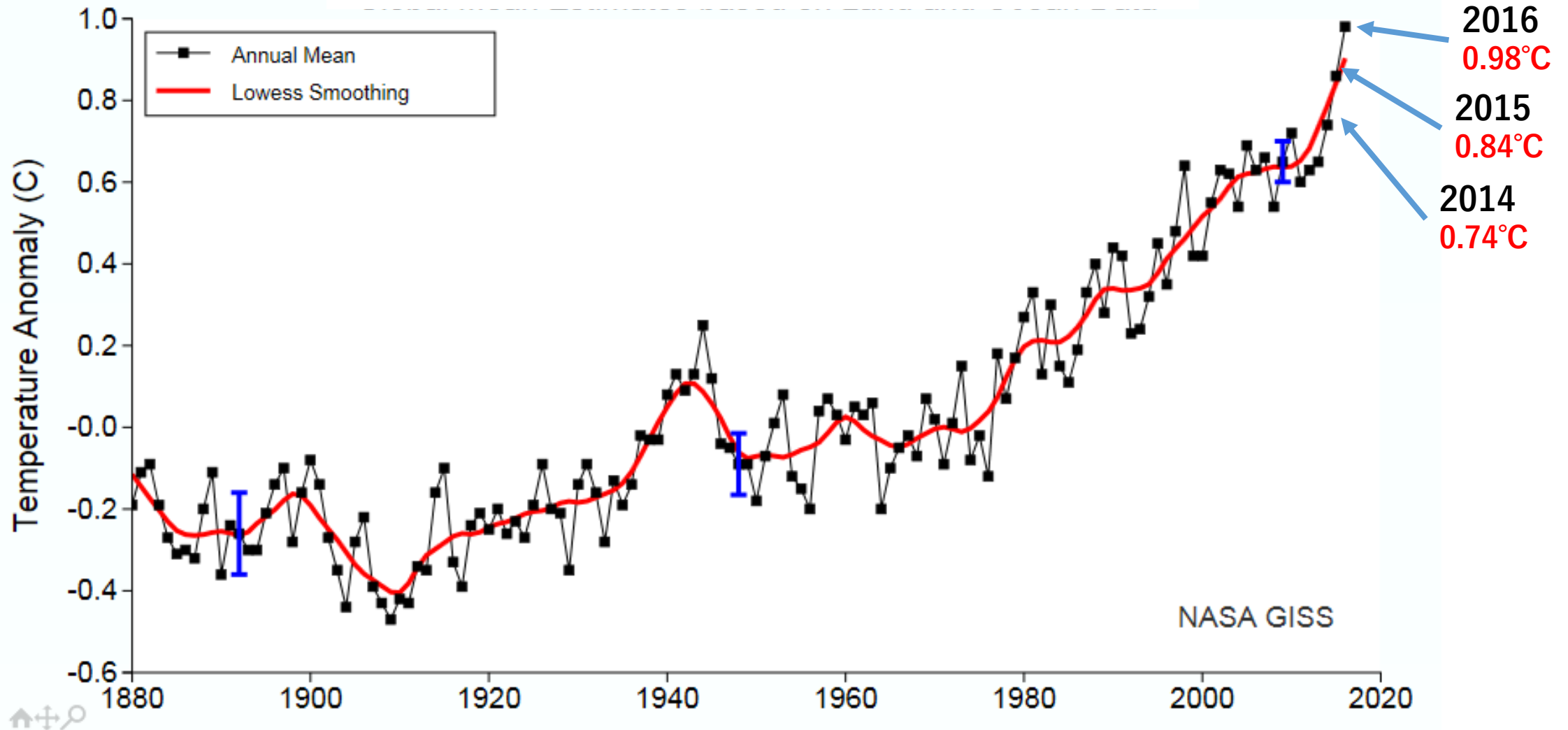


**ICAP Tokyo Symposium 2017**  
**14 June, 2017**

**A Great Transition**  
**toward Deep De-carbonization**  
**driven by concerns about climate risks**  
**and by emerging market opportunities**

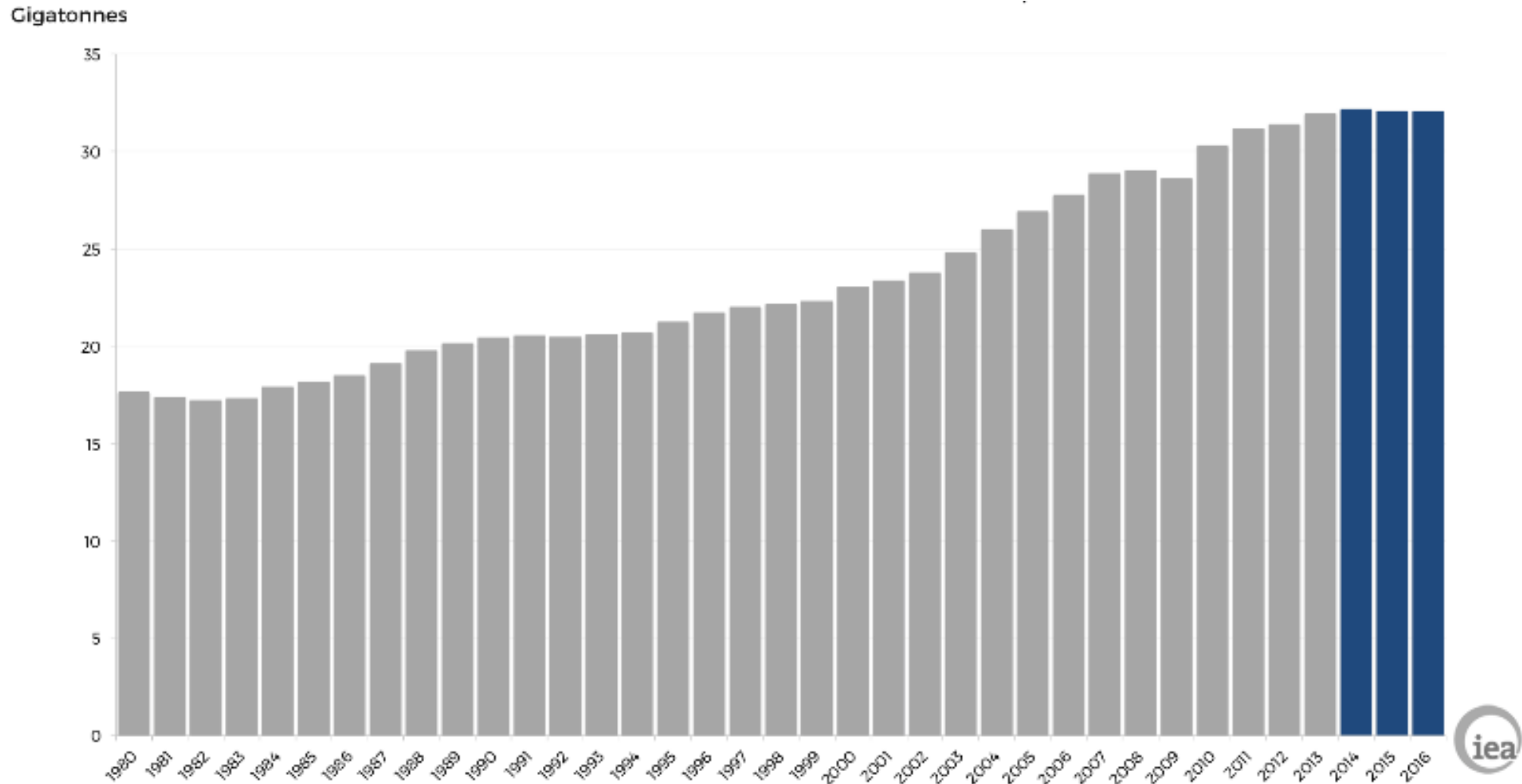
**Prof. Hironori Hamanaka**  
Chair, Board of Directors  
Institute for Global Environmental Strategies (IGES)

# Earth set a temperature record for the third straight year



Global Mean Estimates based on Land and Ocean Data (1880 ~ 2016)  
(Source: NASA Goddard Institute for Space Studies)

# Global CO<sub>2</sub> emissions flat for third straight year from 2014-2016



Source: IEA, “IEA finds CO<sub>2</sub> emissions flat for third straight year even as global economy grew in 2016”, 17 March 2017  
<https://www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html>

# While US announced to withdraw from the Paris Agreement , many countries, non-state actors (States, Municipal Governments and Businesses) committed to implement the Paris Agreement

- On 1 June, President Trump announced to withdraw the US from the Paris Agreement (PA).
- Many countries, US States and municipal governments, and businesses expressed their commitments to implement the PA.
  - **G7 members other than the US** reaffirmed their commitment to implement the PA (G7 Taormina Leader's Communique)
  - **China** and **India** expressed their commitment to the PA.
  - **13 States** including **State of California and New York** formed the US Climate Alliance committed to upholding the PA. **211 cities** including **Pittsburgh** adopted the PA goals.
  - **US businesses** including Apple, Google, General Electric, General Motors, Walmart and Cargill announced that US Government's announcement to withdraw from the Agreement would not change their climate actions.

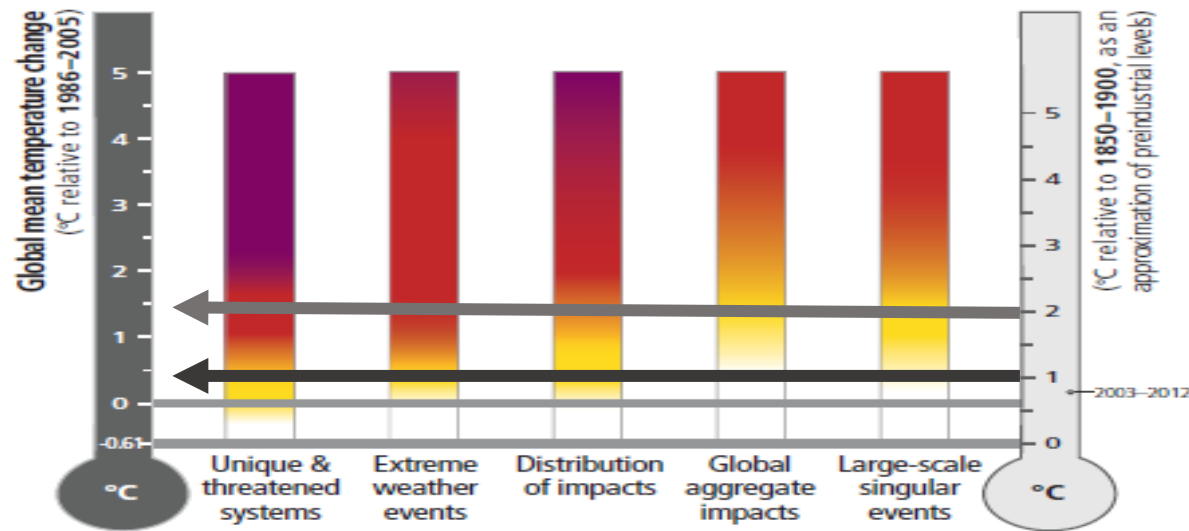
Reference: "WE ARE STILL IN", <http://www.wearestillin.com/#press-release>

# Outline

- Climate change: a serious risk to human society
  - Available scientific knowledge
  - Evidence of observed climate change impacts and extreme weather events
  - The need to limit cumulative emissions to hold temperature increase below 2°C
- Paris Agreement and its impact
  - Entry into force of the Paris Agreement and Marrakech COP22
  - Rising momentum for climate action in international community
- Knowledge available from de-carbonization scenario analysis
- Strategies to address challenges of achieving deep de-carbonization

# Climate change: A serious risk to human society

- Climate change impacts on the availability of **water resources**, **food production** and **human health**, exacerbate refugee and other security issues globally, and threaten the stability of societies

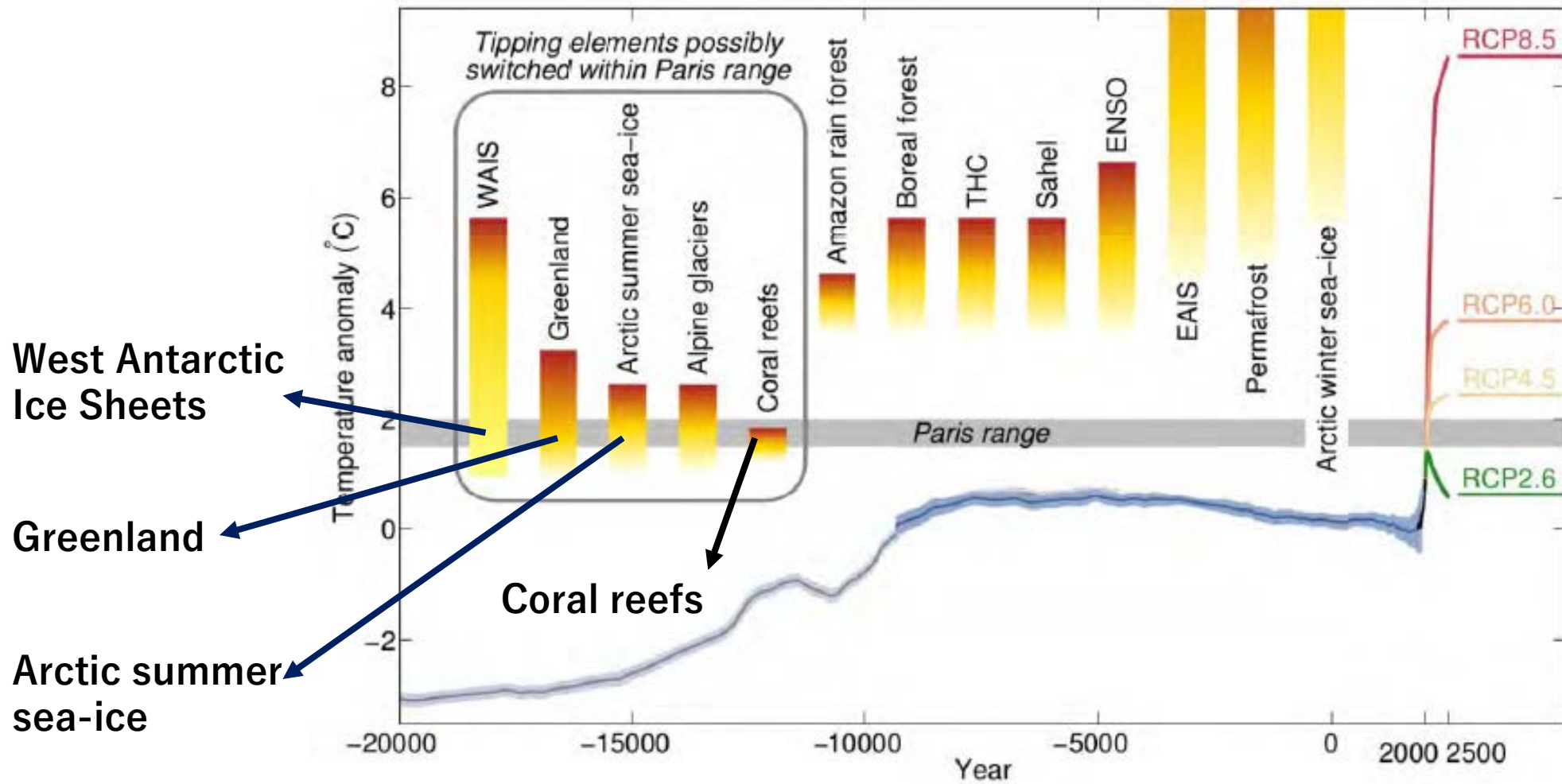


Extreme weather conditions have left farmers struggling to survive. Source:AP

Many people died, or killed themselves, due to record breaking heat wave, and as crops have withered in west India (2016).



# Tipping Points Related to 2°C Guardrail



Schellhuber et al., Nature Climate Change, 2016

Source: Schellhuber, ISAP 2016

# Greenland Is Melting Away

Source: New York Times, “Greenland Is Melting Away”, 27 October, 2015,  
<http://www.nytimes.com/interactive/2015/10/27/world/greenland-is-melting-away.html>

Video: <http://www.youtube.com/watch?v=hQghC-hrAZA>



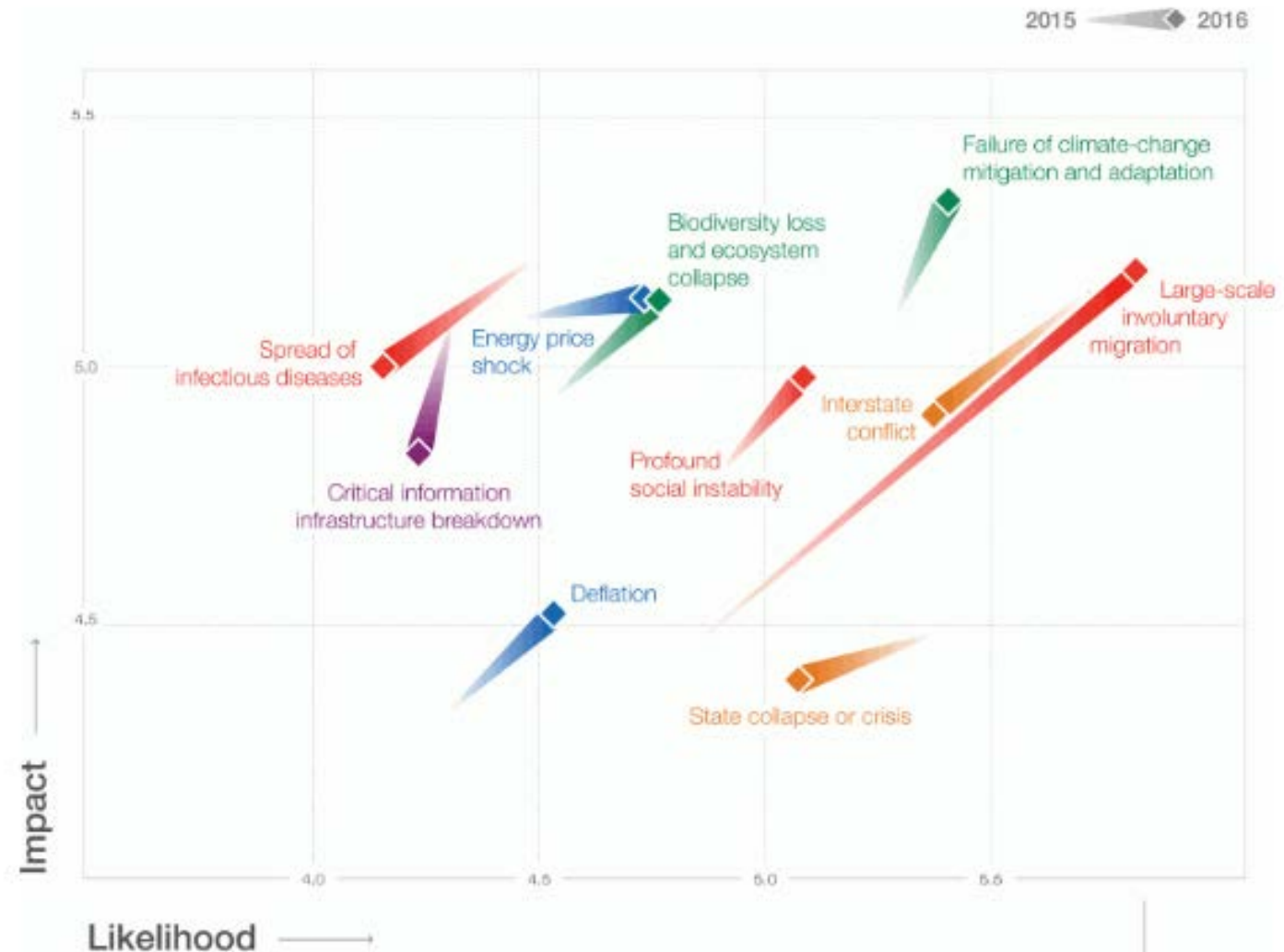


# Failure of climate change mitigation and adaptation ranked as the risk with the greatest potential impact

- The **World Economic Forum's Global Risks Report 2016** found that a failure of climate change mitigation and adaptation ranked as the risk with the greatest potential impact.
- This is the first time since the report was published in 2006 that an environmental risk has topped the ranking.

Source: World Economic Forum,  
<http://reports.weforum.org/global-risks-2016/part-1-title-tba/>

Figure 1.1: The Changing Global Risks Landscape 2015–2016: The 10 Most Changing Global Risks

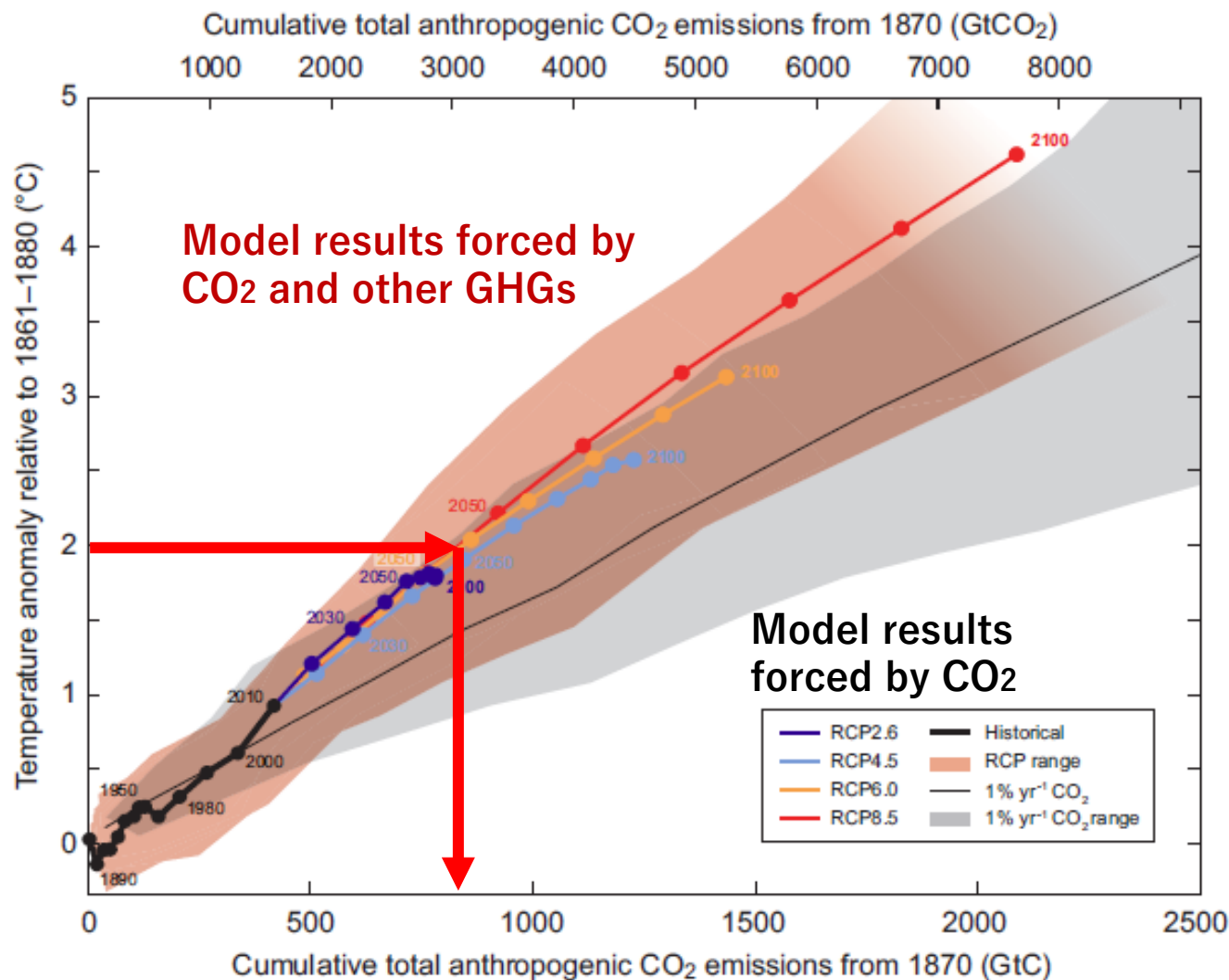


# Global mean surface temperature increase as a function of cumulative global CO2 emissions

Limiting the warming caused by anthropogenic CO2 emissions alone with a **probability of >66%**, and **>50%** to less than 2°C, will require cumulative CO2 emissions from all anthropogenic sources to stay less than about 1000 GtC and about 1210 GtC respectively (about **790 GtC** and about **820 GtC** respectively, when accounting for non-CO2 forcings). An amount of **515 GtC** was already emitted by 2011.

Figure SPM.10 Global mean surface temperature increase as a function of cumulative total global CO2 emissions from various lines of evidence.

Source: IPCC Fifth Assessment Report, "Climate Change 2013: The Physical Science Basis", Summary for Policy Makers



# Entry into force of the Paris Agreement and Marrakech COP22

- Paris Agreement (PA) **entered into force** on 4 November, 2016. 148 countries including Japan, and European Union have ratified the PA (UNFCCC, as of 13 June 2017).
- **Major outcomes** of Marrakech COP22
  - Adopted decisions that set **2018 as the deadline** for writing **a rulebook to implement the PA**.
  - Issued “**Marrakech Action Proclamation**” to signal a shift towards implementation and action on climate and sustainable development.
  - Launched **Marrakech Platform for Global Climate Action**: Facilitate climate action from 2017 – 2020, by convening Party and non-Party stakeholders, to showcase successes, to collectively identify and address barriers to enhanced implementation, and to report to the COP on achievements and options to enhance action.



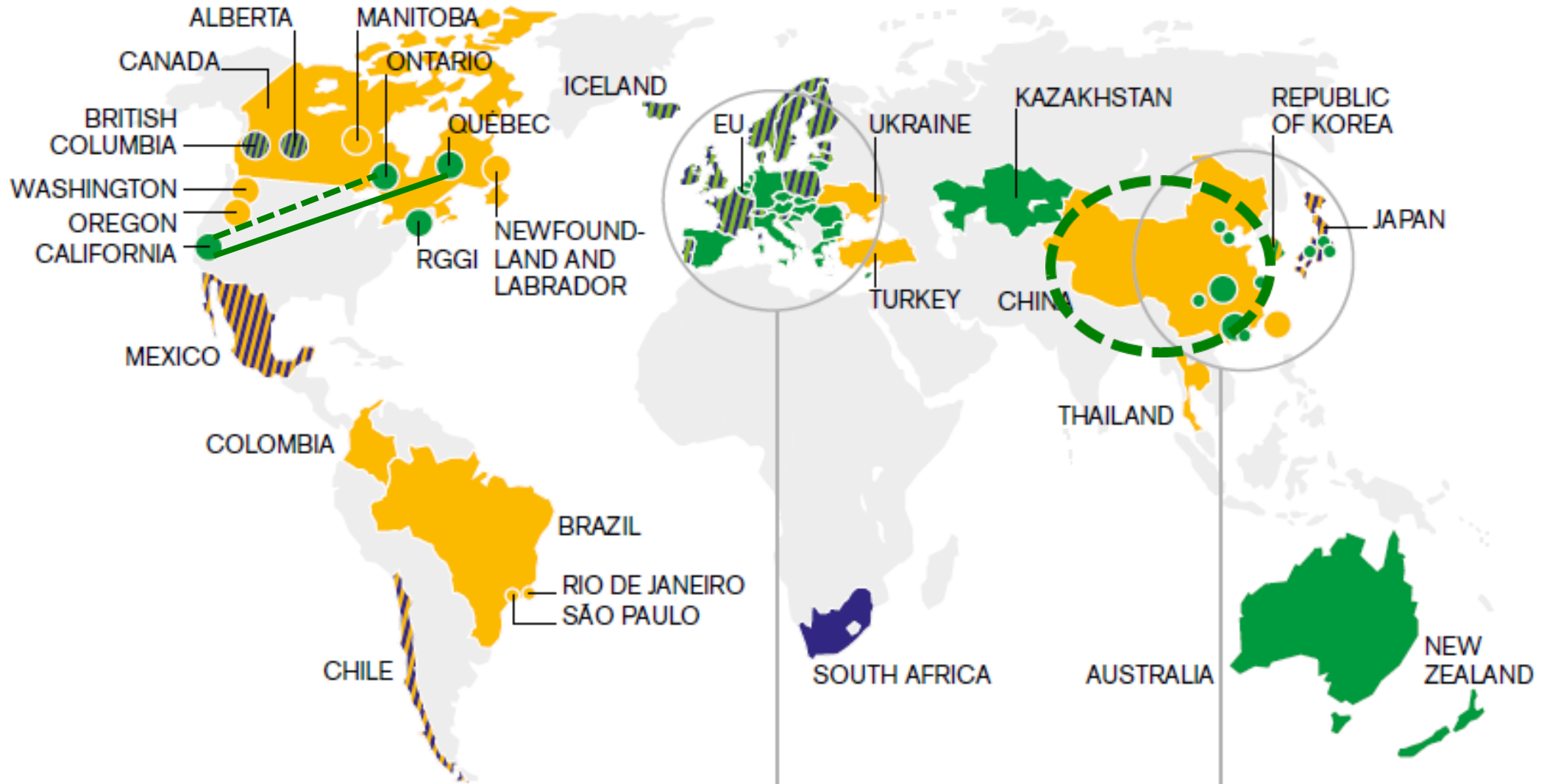
**MARRAKECH 2016**  
COP22 | CMP12 | CMA1  
UN CLIMATE CHANGE CONFERENCE

# Rising momentum for climate action

- COP22 was successful in further enhancing momentum for climate action in international community.
- Governments including **China** and **India**, sub-national governments like **California**, as well as many **businesses** have committed to ambitious climate actions:
  - China is going to introduce nation-wide emissions trading scheme → **20~25% of global GHG emissions** to be covered by **carbon pricing initiatives** (The World Bank)
  - India and France jointly launched the International Solar Alliance, committed to mobilize \$1 trillion of investments by 2030 for the massive deployment of solar energy in tropical countries.
  - California is taking leadership in implementing emissions trading scheme, ZEV program, and Under 2 Coalition initiative.



# State and Trends of Carbon Pricing 2016

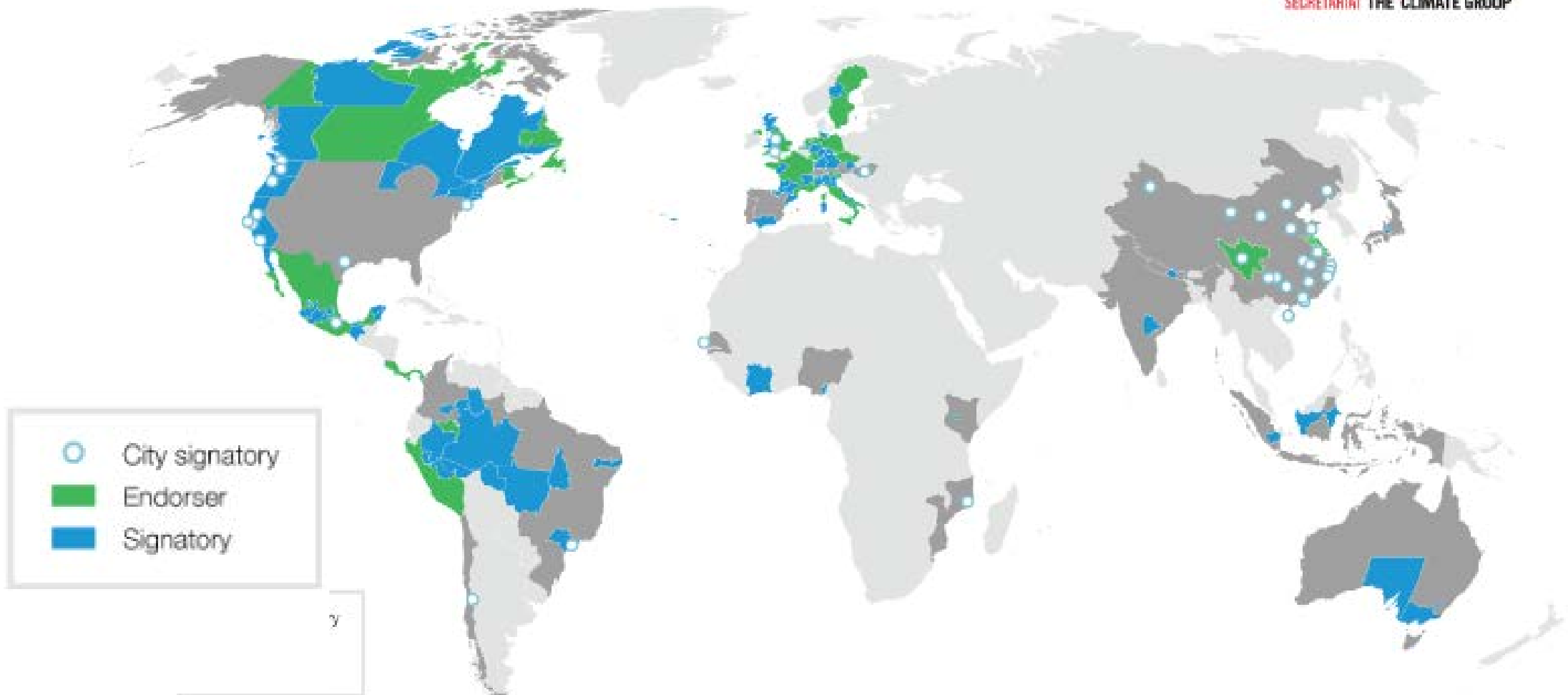


Source: The World Bank Group, “State and Trends of Carbon Pricing 2016”, Washington DC, October 2016  
<https://openknowledge.worldbank.org/bitstream/handle/10986/25160/9781464810015.pdf?sequence=7&isAllowed=y>

# THE UNDER2 COALITION



SECRETARIAT THE CLIMATE GROUP

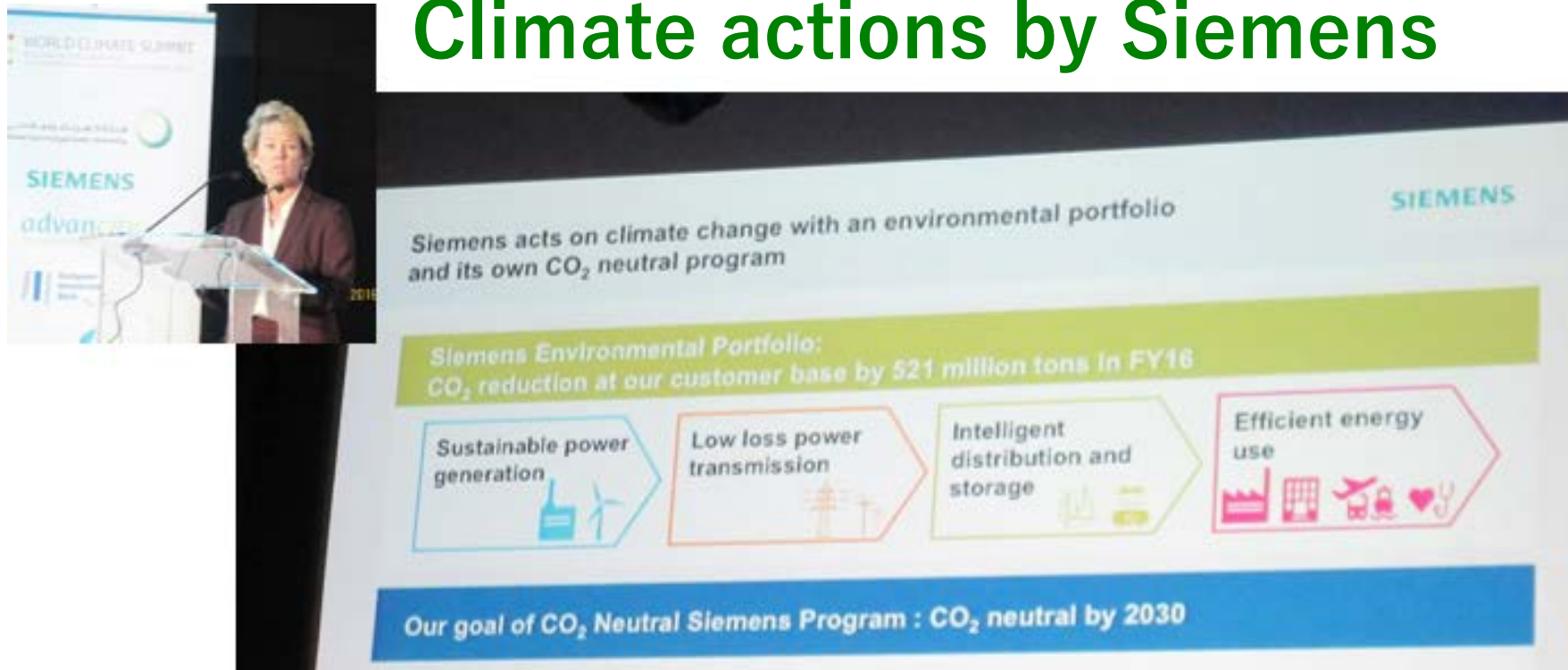


**Under2 MOU: a commitment by sub-national governments to reduce their greenhouse gas (GHG) emissions by 80-95% on 1990 levels, or 2 metric tons of CO<sub>2</sub> equivalent per capita, by 2050.**

Source: Under 2 Coalition, <https://www.theclimategroup.org/project/under2-coalition>

# Rising momentum for climate actions (continued)

## Climate actions by Siemens



- Siemens sets the goal of CO<sub>2</sub> neutral by 2030, and provides solutions for power generation, transmission, distribution and storage, and for demand-side management, enabling their customers to reduce CO<sub>2</sub> emissions by 520 million tons in 2016.

Source : World Climate Summit 2016, Marrakech (Photo by IGES)

# Global trends in renewable energy investment

- **Investments in renewable energy** totaled **\$241.6 billion** (excluding large hydro) in 2016, roughly double that in fossil fuel generation and they added **138.5 GW** to power capacity, equivalent to **55%** of all new power. Investment in **China** was **\$78.3 billion**. (UNEP, Global Trends in Renewable Energy Investment 2017)
- Costs of power generation from renewable energy sources have been drastically decreasing: announced record-low prices ranging from **\$30/MWh to 50/MWh** for both **onshore wind** and **solar (PV)** plants.
- **Huge investments in storage system and power network**
  - TOTAL agreed to buy French battery maker Saft in a \$1.1 billion deal, ratcheting up investments in clean energy. (Bloomberg, 9 May, 2016)
  - China's State Grid Chairman Mr. Liu outlined a big plan to build a \$50 trillion global power network, linking Asia, Europe, North America, etc. He said the world grid could be running by 2050, with advances in renewable power and transmission technology. (Wall Street Journal, 30 March 2016)

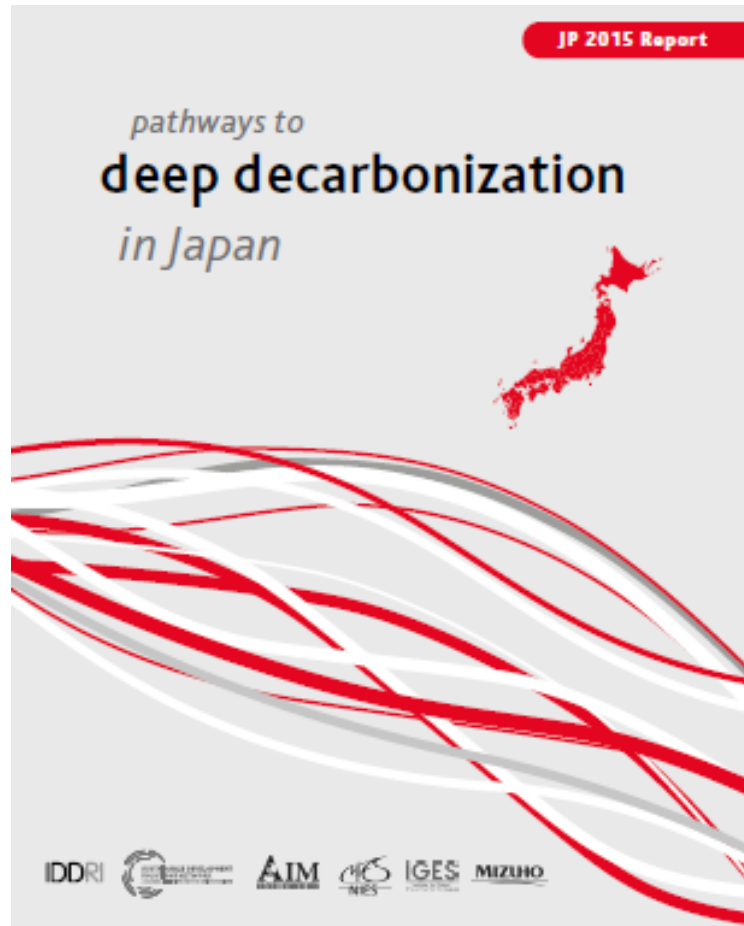


# Developing climate-related financial disclosure

- Financial Stability Board (FSB, which works to develop regulatory, supervisory and other financial sector policies)
  - FSB Task Force is developing voluntary **climate-related financial disclosure**, which will help to reduce financial stability risks.
- **Climate risks that can affect financial stability**
  - **Physical risks** of extreme weather events that damage property.
  - **Liability risks**: if parties suffered loss or damage from the effects of climate change seek compensation from those they hold responsible.
  - **Transition risks** resulting from the introduction of carbon pricing and other changes in policy, technology and physical risks that could prompt a reassessment of the value of assets (**“stranded assets”**)

Source: Mark Carney, Governor of the Bank of England, “Breaking the Tragedy of the Horizon – climate change and financial stability”, Lloyd’s of London, 29 September 2015)

# Knowledge available from de-carbonization scenario analysis : Pathways to deep de-carbonization in Japan



Illustrates **deep de-carbonization pathways** for Japan, and assesses the feasibility to achieve **80% GHG emission reduction from 1990 levels by 2050**.

Methodology: **AIM/End-use model of Japan** was used.

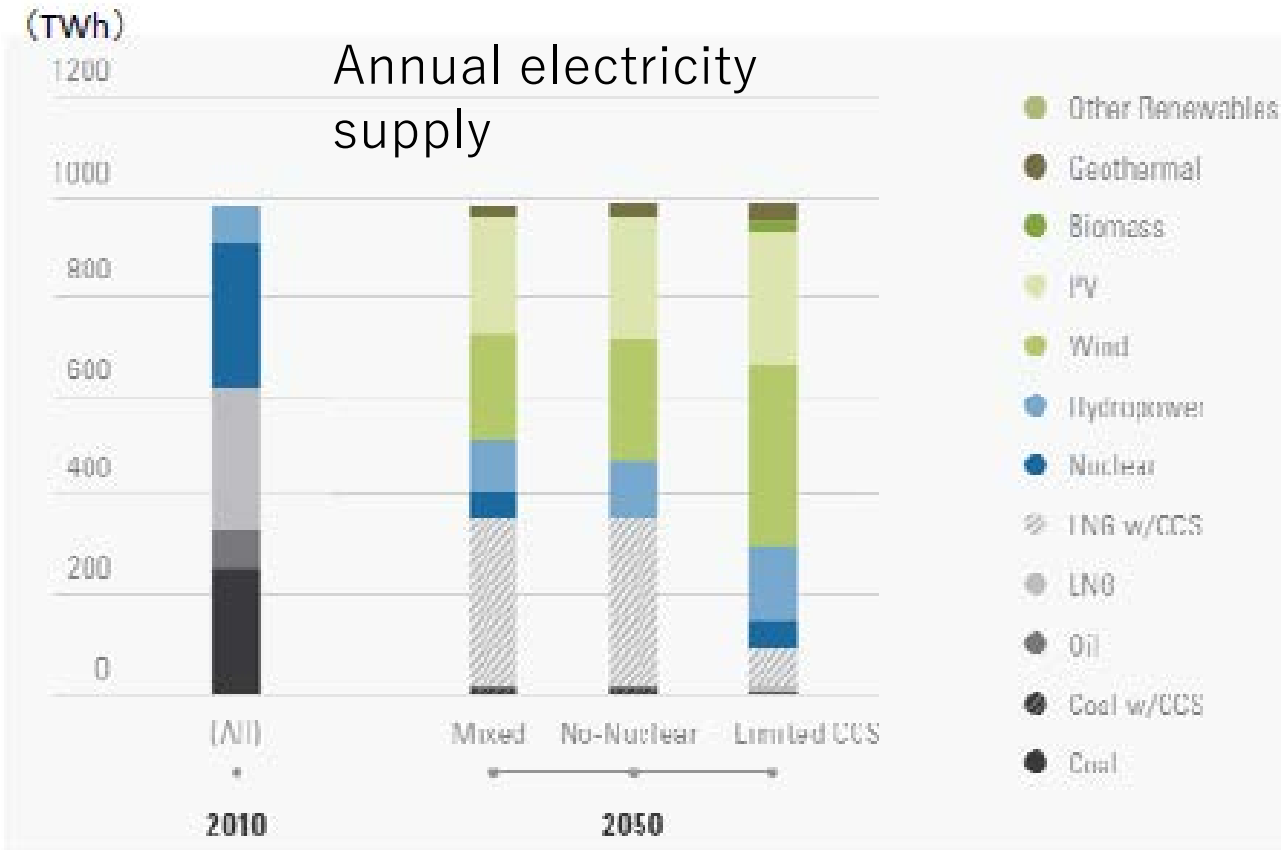
**Three deep de-carbonization scenarios:**

- Mixed scenario
- No-nuclear scenario
- Limited CCS scenario

In all scenarios, **total final energy demand decreased by more than 50%**, and **energy-related CO<sub>2</sub> emissions by more than 80%** by 2050 from 2010 levels respectively.

Source: [http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP\\_JPN.pdf](http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP_JPN.pdf)

# Knowledge available from de-carbonization scenario analysis : Pathways to deep de-carbonization in Japan (continued)

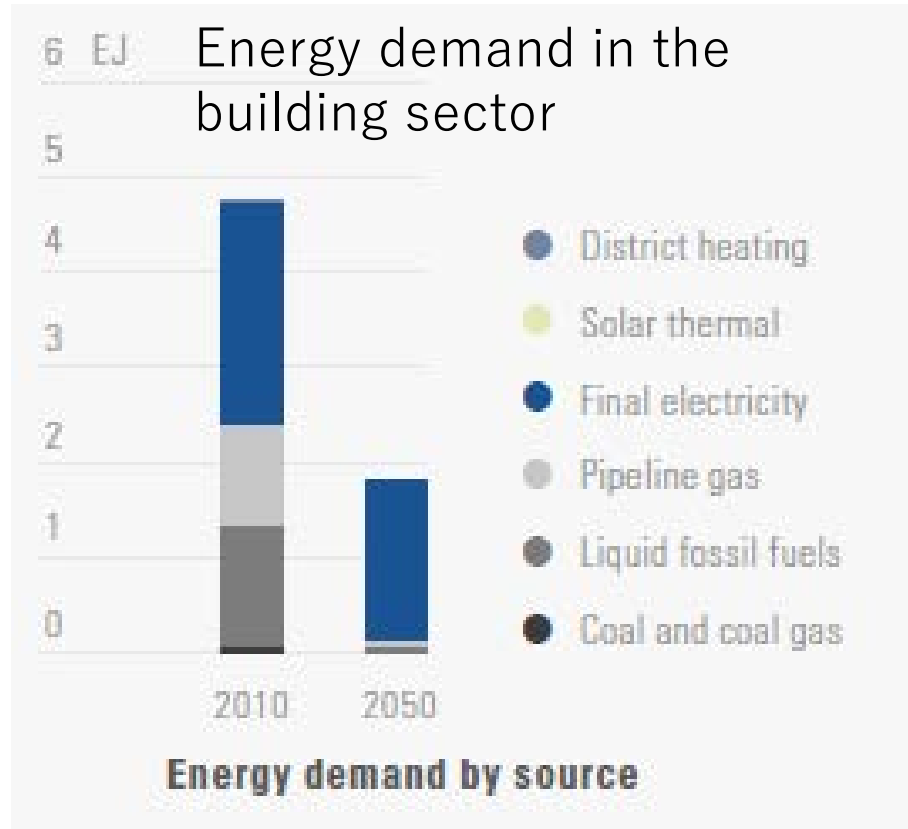


In all scenarios, **carbon intensity of electricity falls to nearly zero** in **2050** by large scale deployment of renewable energy and/or natural gas with CCS.

Solar PV and wind power provide up to 75% of electricity supply during daytime (from 10am to 3pm). In order to integrate intermittent supply from these power sources, electricity supply and demand are assumed to be balanced every 3 hours in a day.

Source: [http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP\\_JPN.pdf](http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP_JPN.pdf)

# Knowledge available from de-carbonization scenario analysis : Pathways to deep de-carbonization in Japan (continued)



In all scenarios, **final energy demand in the building sector is reduced by approximately 60-70% in 2050** from the **2010** level.

The share of electricity increases from about 50% in 2010 to more than 90% in 2050. Building sector **CO<sub>2</sub> emissions reaches almost zero in 2050.**

Source: [http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP\\_JPN.pdf](http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP_JPN.pdf)



# Strategies to address challenges of achieving deep de-carbonization

- National vision/goals and strategies need to be established.
  - Transformational change in socio-economic structure is required.
  - Need to be integrated into policies addressing other challenges (depopulation, aging society, revitalization of local economies, etc.).
- Promoting public acceptance of deep de-carbonization pathways
  - Serious risks posed by climate change to be widely shared.
  - Inclusive multi-stakeholder engagement process.
- Developing policy framework to create enabling environments for non-state actors to take ambitious actions
  - Carbon pricing
  - Mobilizing innovative local actions and business models

# Anthropocene: Is it the beginning of a new Dark Age, or the age of new hope?

The last glacial inter-glacial cycle over the past 100 thousand years, and  
the Holocene over the past 10 thousand years

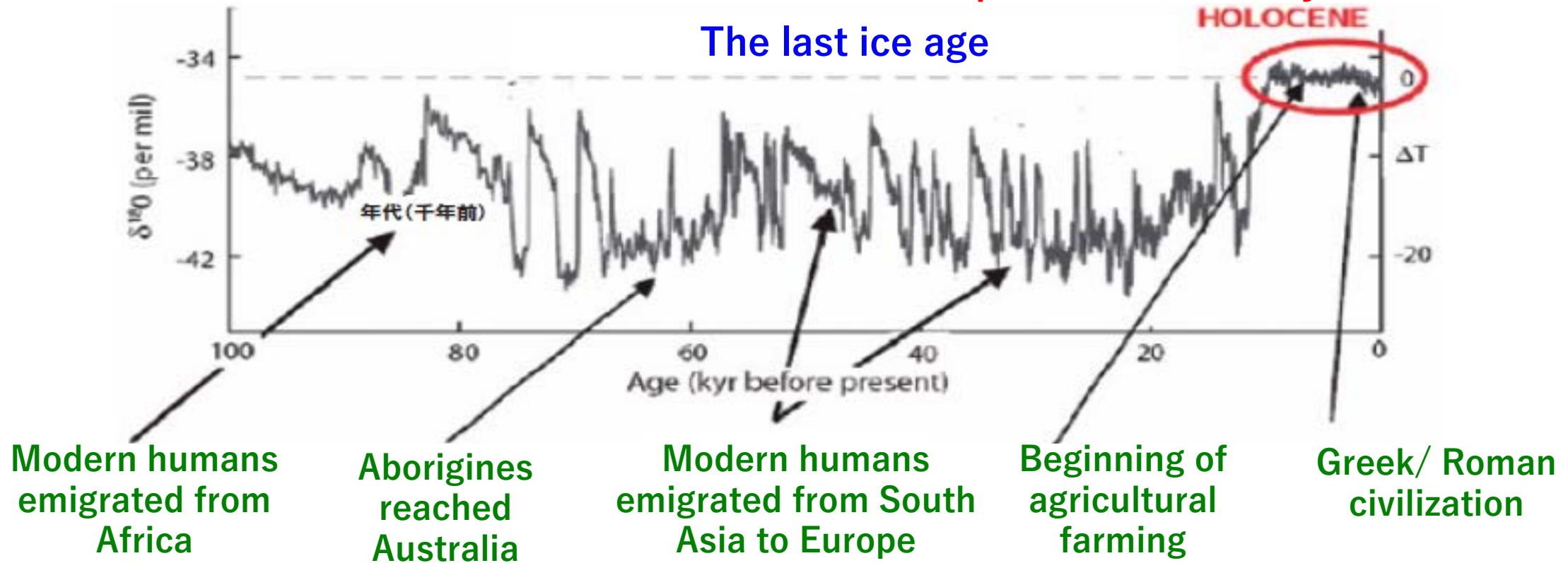


図1 酸素同位体  $\delta^{18}\text{O}$  (全球気温の指標) からみた 10 万年前以降の最後の氷期・間氷期サイクルと過去約 1 万年の完新世 (Holocene)。いくつかの人類史上のイベントが記されている。(Rockstrom et al., (2009) に基づく)

Spurce : Tetsuzo Yasunari, 「Future Earth —地球環境変化研究における新たな国際的な枠組み—」, SCJ Bulletin, 2012

# Anthropocene: Is it the beginning of a new Dark Age, or the age of new hope?

The last glacial inter-glacial cycle over the past 100 thousand years, and  
the Holocene over the past 10 thousand years

## Anthropocene ?

Today, humans exert great influence over natural resources and ecosystems: we must change the folly of undermining the very foundation of our prosperity, and pursue a new prosperity by creating a new wisdom

Humans have prospered over the past 10,000 years under relatively stable climate system: "Garden of Eden"

As a result of this prosperity, humans intervened climate system and undermined the very foundation of their prosperity

Modern humans emigrated from Africa

Aborigines reached Australia

Modern humans emigrated from South Asia to Europe

Beginning of agriculture

図1 酸素同位体  $\delta^{18}O$  (全球気温の指標) からみた 10 万年前以降の最後の氷期・間氷期サイクルと新世 (Holocene)。いくつかの人類史上のイベントが記されている。(Rockstrom et al., (2009) に基づく)

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14 June, 2017

# Thank you very much

Prof. Hironori Hamanaka, Chair, Board of Directors, Institute for Global Environmental Strategies

(IGES)



**ISAP 2017** 25-26 July  
Pacifico Yokohama

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As the world works towards implementing the Paris Agreement and the 2030 Agenda with its accompanying SDGs, positive action is being taken not just at the national government level, but by a wide range of stakeholders including cities, businesses and financial institutions. It is going to take a fundamental shift in our entire socio-economic system to achieve a

## Programme



Understanding Where We Are



Delivering a Better Future