



# Resolving the Crisis

**Global Energy Interconnection  
Development and Cooperation Organization  
September 2020**

The COVID-19 pandemic has sounded an alarm to all people: the earth and its populations exist in an era of crises. The climate change is evolving into climate and environment crisis which is a "gray rhino" charging toward us. The destiny of mankind lies in our hands whether we can grasp the critical window and how to deal with this major crisis..

GEIDCO publishes the "*Resolving the Crisis*" report, which aims to summarize the experience and learn lessons of mankind's response to major crises, analyze the urgent situation and far-reaching impact of the climate and environment crisis. It proposes clean development as the guideline, UHV and other innovative technologies as the key, so as to develop a new pattern for resolving climate and environment crises. It provides the development ideas, systematic plans, and implementation models for each continents in order to achieve sustainable development through low-carbon development, high-quality and prosperous development.



## **1. Reflections on Major Crises**

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## **2. The Climate and Environment Crisis**

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## **3. GEI Turns Crises into Opportunities**

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## **4. Actions Across Six Continents**

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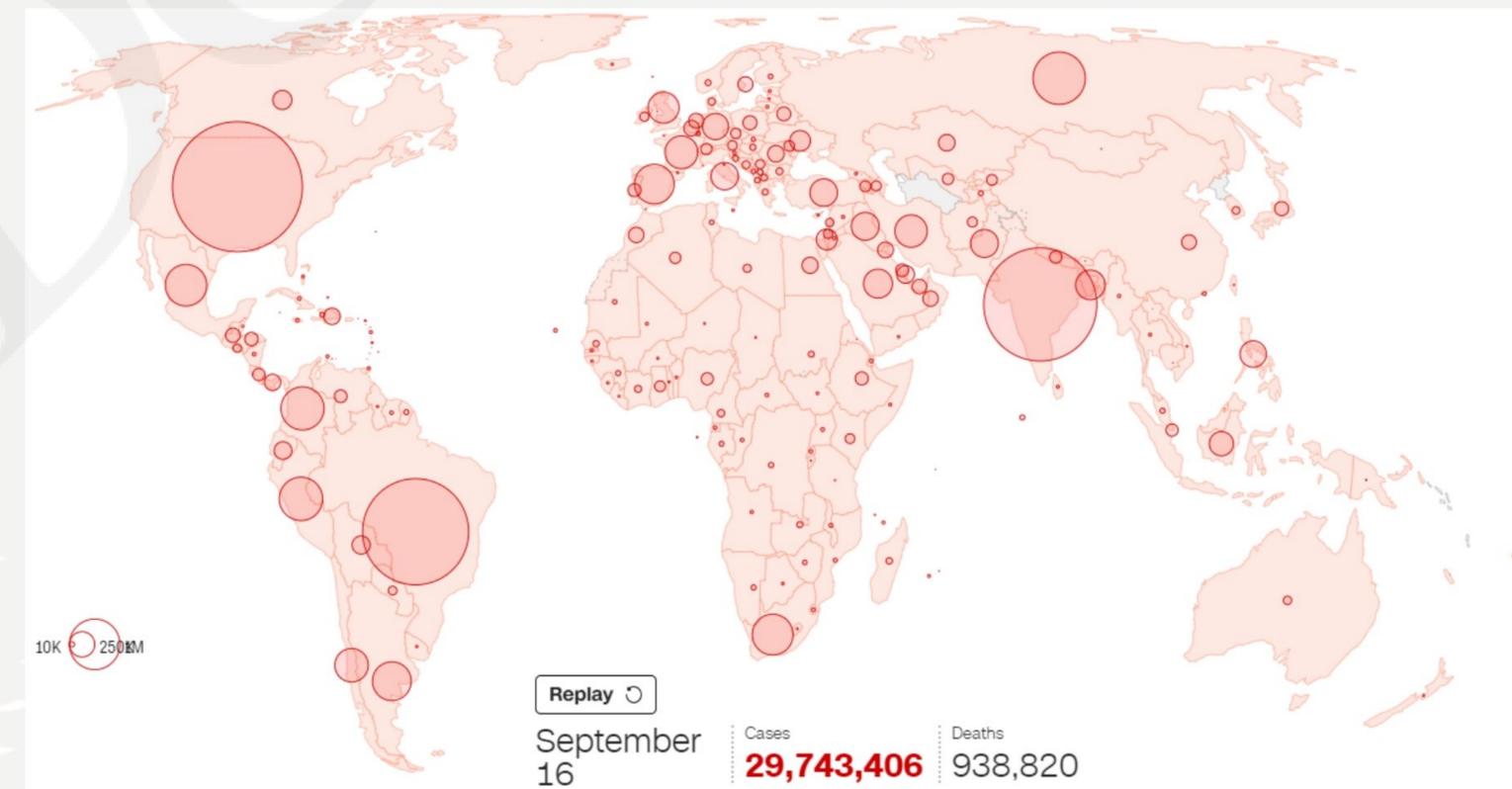
## **5. The Value for Humans and Earth**

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# 1.1 COVID-19: A Major Disaster

**COVID-19 has become the largest global public health crisis of the century, endangering the lives and health of millions, presenting a serious set-back to the world economy, and leaving hundreds of millions people unemployed.**

- **Great Loss of Life:** As of September 16, the total number of confirmed cases in 214 countries and regions has exceeded **29.74 million**, and the death toll has exceeded **930,000**.
- **Global economic recession:** The COVID-19 has had a severe impact on the global economy, finance and trade. The global economic growth rate is expected to be **-5.2%** in 2020.
- **Global governance in disorder:** The world lacks common international rules and effective governance plans, and suffers from fragmented governance system, continuously expanding deficit.



**Global Distribution of Confirmed Cases and Deaths of COVID-19 (As of September 16)**

## 1.2 The Tragic History of Major Crises

In modern times, more than ten plagues and epidemics have ravaged humanity throughout its existence, financial crises have struck roughly every ten years, and ten major ecological disasters have shocked the world.

- **Major Epidemics:** Hundreds of millions of people have been killed by various kinds of pestilence. The **Black Death** killed nearly one-third of Europeans; the **1918 Influenza** killed 100 million people worldwide.
- **Global economic and financial crises:** Since the 20th century, humanity has experienced a major economic and financial crisis every 10 years on average. The **2008 Financial Crisis** caused the global financial assets to shrink by USD 27 trillion.
- **Severe environmental disasters:** The **Chernobyl Incident** in 1986 is the worst nuclear disaster in human history. The **Great Smog of London** in 1952 is a serious air pollution disaster in the 20th century.



1918 Influenza



Great Smog of London in 1952

# 1.3 Lessons to be Learned from Crises

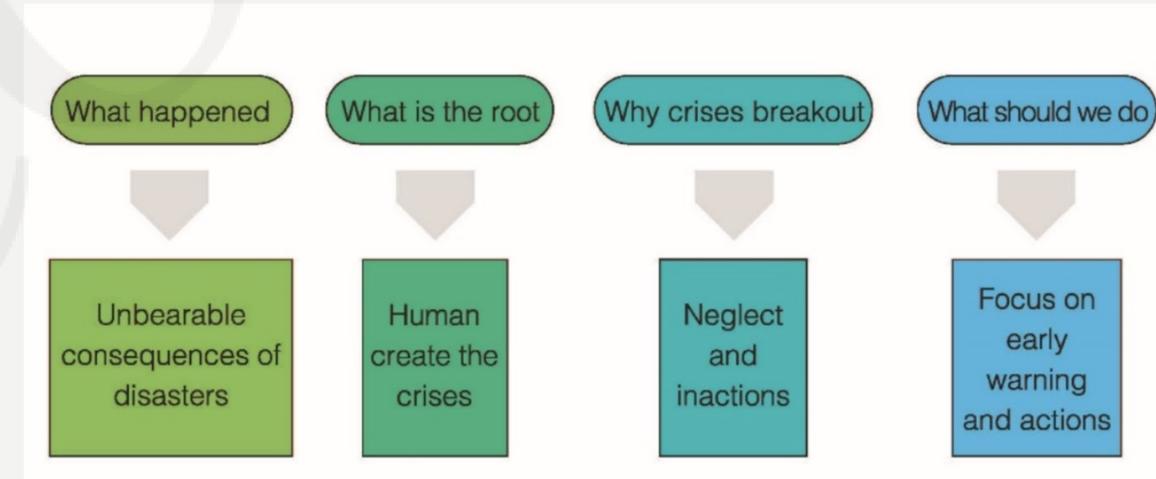
**1 The unbearable effects of disasters.** Wars, pandemics, economic depressions, and environmental disasters have deprived people's lives, leading to severe economic recessions and collapse in social governance.

**2 The concerning root causes of crises.** The lack of awe leads to the imbalance between human and nature. Violating the objective law aggravates the contradiction between human beings.

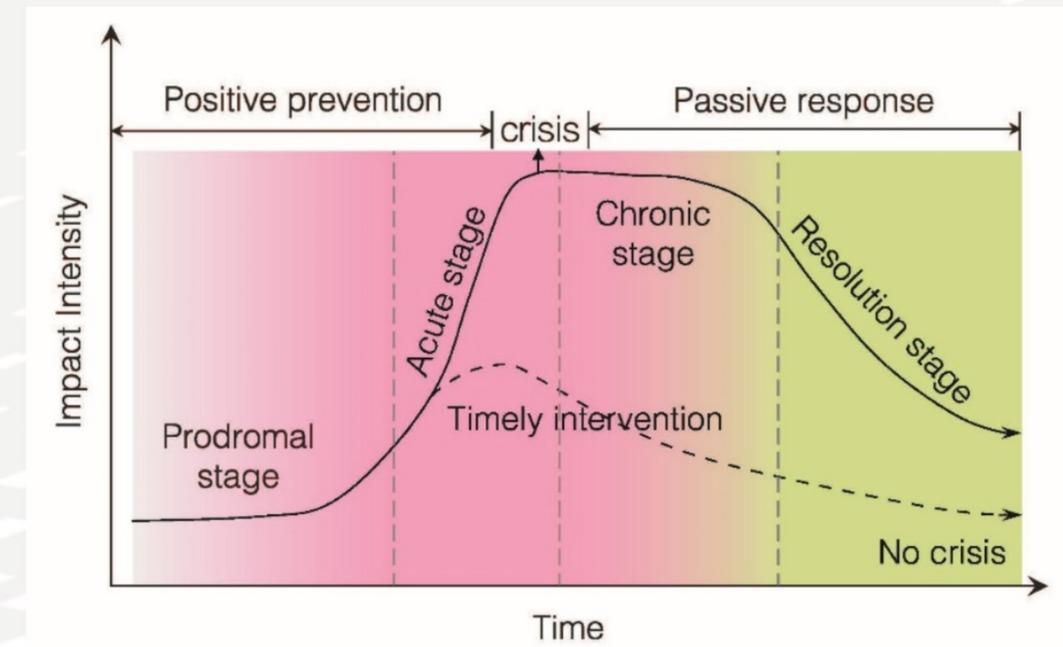
**3 Fatally flawed Ideas.** Lack of awareness of crisis, lack of vigilance to "black swan", lack of prevention of "grey rhinoceros".

**4 Inadequate action leading to missed opportunities.** Hesitation in decision-making, lack of ineffective actions lead to missed precious opportunity to resolve the crisis.

**5 Reversing crises with active prevention.** Facing the crisis is the premise of understanding and solving the crisis, and early intervention is the key to avoid the crisis.



## Lessons to be Learned from Crises



The Four Stages of Crises Evolution and the Effects of Timely Intervention



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## 2.1 An Era of Crises

The over-exploitation of natural resources and unscrupulous environmental destruction have pushed our climate and ecology to the brink of collapse, intensifying resource and energy shortages and the global spread of poverty and conflict.

**1 Global Warming.** The global mean temperature is 1.1°C higher than it was prior to the onset of the Industrial Revolution; the five-year period from 2015 to 2019 was the hottest ever on record.

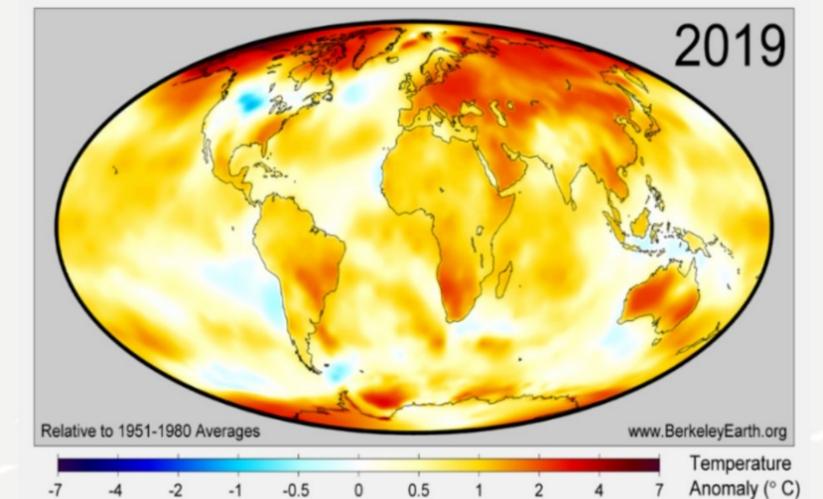
**2 Environmental Pollution and Degradation.** Nine out of every ten people in the world now live in territories where the air pollution has surpassed standards.

**3 Energy Shortage.** The global coal, oil, and natural gas reserves will be exhausted in 132 years, 50 years, and 51 years, respectively.

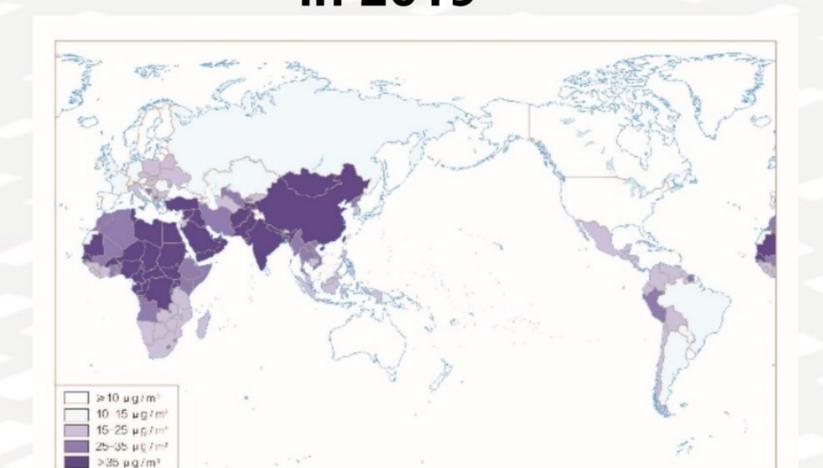
**4 Accelerated Resource Exhaustion.** The resource utilization in 2019 equals those provided by 1.75 Earths, The number of people facing food crisis across the world reaches 265 million.

**5 Recurrent Health Crises.** Environmental pollution-related diseases lead to 9 million premature deaths per year.

**6 Widespread Poverty.** 750 million people live below the international poverty line. 1.56 billion people are living in multidimensional poverty. The current pandemic may revert 40 million to 60 million people to extreme poverty conditions.



**Global Surface Temperature Rise in 2019**

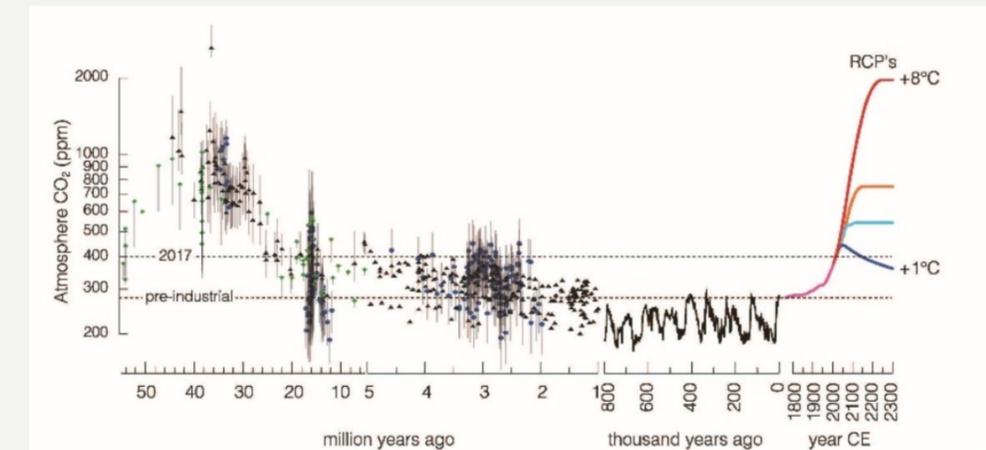


**Concentration Distribution of Global PM<sub>2.5</sub> in 2016**

# 2.2 Climate and Environment Crisis: the Deadly "Gray Rhino"

Climate and environmental crisis is a major change in the earth system caused by global climate change. The clue of the climate and environmental crisis has already appeared, and the deadly "Gray Rhino" is rushing forward.

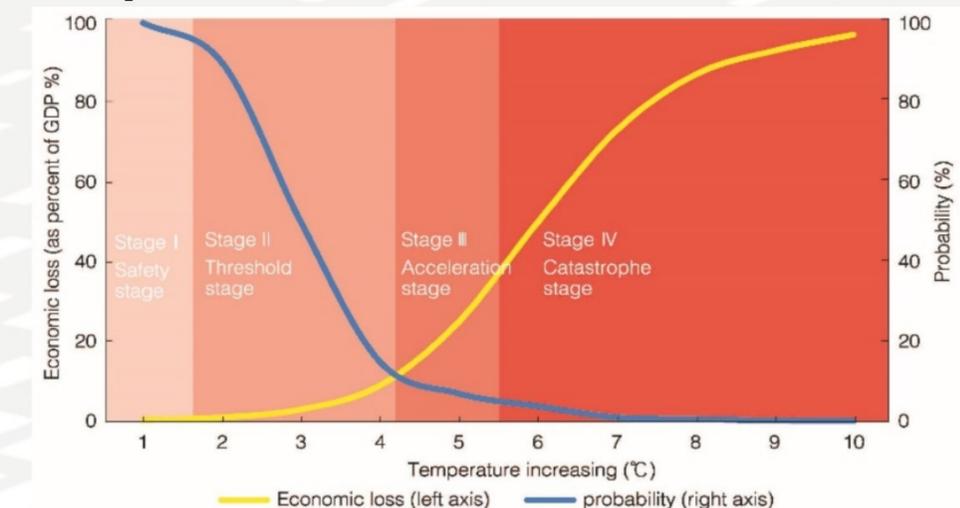
**1 Tracing the Climate and Environment Crisis.** Emissions of greenhouse gases have imbalanced the global carbon cycle. Since the Industrial Revolution, the concentration of greenhouse gases has continued to rise, reaching their highest level. CO<sub>2</sub> from fossil fuels accounts for about 85% of the total.



Evolution of CO<sub>2</sub> Concentrations in the Atmosphere over the Past 50 Million Years

**2 The Domino Effect.** The climate and environment crisis is a "risk multiplier". The climate, environment and energy, resources, health, poverty and other issues are closely linked and intertwined.

**3 Evolution of the Climate Crisis.** The development of climate crisis is likely to be characterized by four stages. Once the threshold is exceeded, the climate system will enter the stage of "total crisis". If the temperature rise exceed 3 °C, the earth system breaks away from the normal and stable natural cycle.



The Four Stages of Climate Crisis

# 2.2 Climate and Environment Crisis: the Deadly “Gray Rhino”

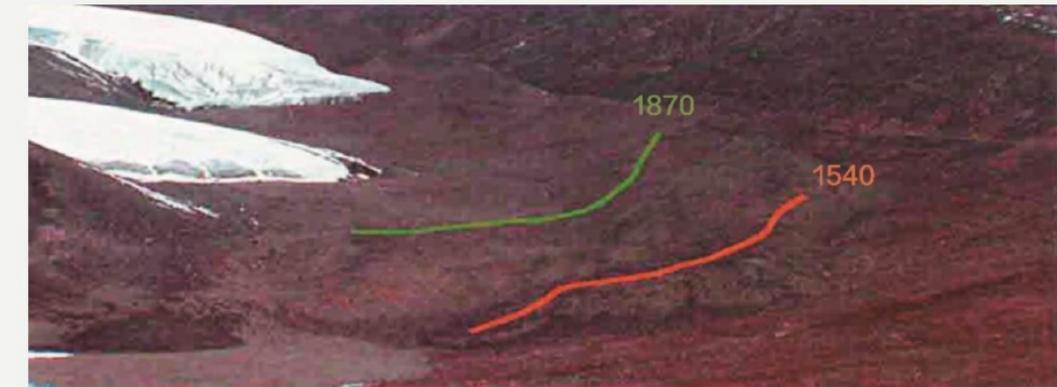
Climate and environmental problems not only affect the five spheres of the earth system, including the atmosphere, hydrosphere, lithosphere, cryosphere and biosphere, but also cause great losses to economic society and human health.

## 1 Disorder and instability of earth system

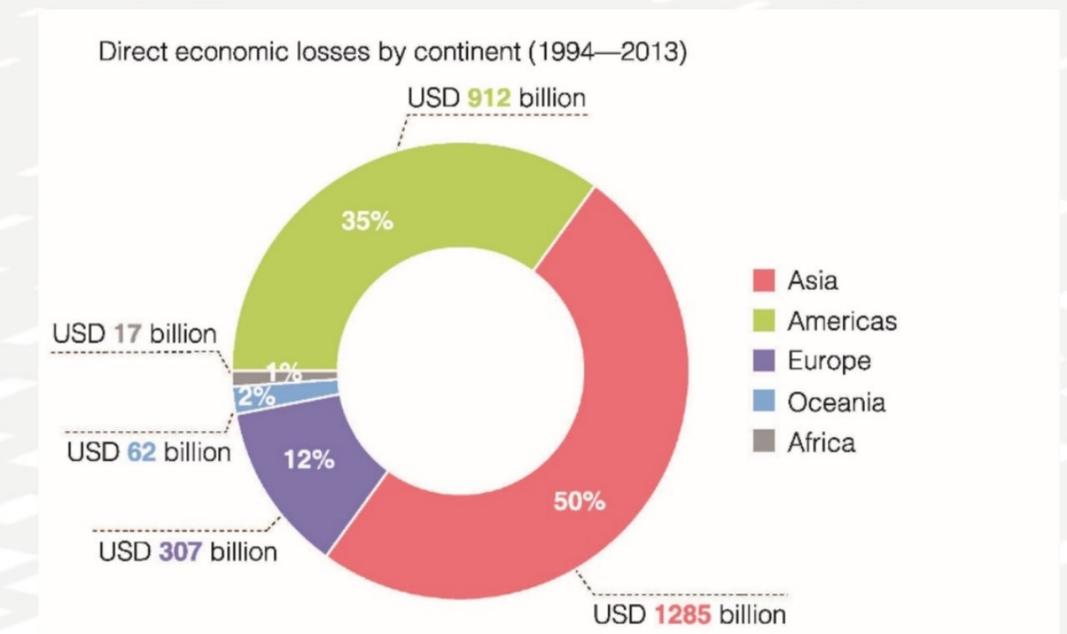
- **Atmospheric instability is increased:** The differentiation between humid and arid regions on a global scale is deepening.
- **Cryospheric ablation is accelerated:** Arctic permafrost is melting 70 years earlier than expected. The Qinghai-Tibet Plateau has seen its glaciers shrinking by 1,314 km<sup>2</sup>.
- **Acidification of the hydrosphere are exacerbated:** Sea level has risen by **0.19 meters** and the acidity of the ocean has increased by 30%.
- **Lithosphere undergoes extreme changes:** The Sahara desert has expanded by 18% and the Arctic tundra has shrunk by 16%.
- **Biospheric balance is disrupted:** The rate of species extinction increased 3-80 times.

## 2 Enormous Losses to Human Society

- **Economic development is hindered:** Climate change causes global economic losses of **42 million lives** and **300 billion USD** annually.
- **The survival and health are affected:** In the past 20 years, climate change has affected about 2 billion people, causing about 600,000 deaths.



Evolution of Urumqi Glacier No.1 at the Headwaters of the Tian Shan Urumqi River



Global Distribution of Disaster-Induced Economic Loss by Continent

## 2.3 The Four Forthcoming Catastrophes

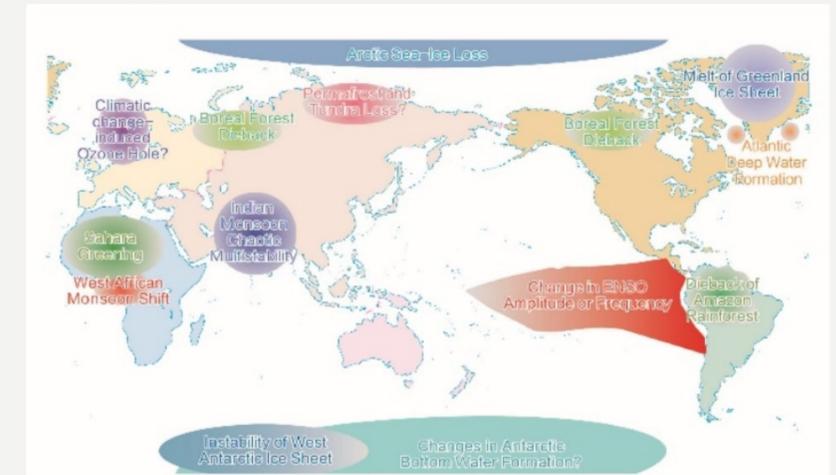
Mankind and the earth are on the fast track of total crisis. Once the global temperature rise exceeds the temperature control target of the Paris Agreement, the climate system will accelerate the temperature rise irreversibly, causing global crisis and disaster.

1 The melting of ice sheet caused the collapse of key climate systems and chain reaction, leading to **climate disasters**. The Arctic may melt completely around 2040. More than 80% of glaciers and frozen soil in the world will be lost.

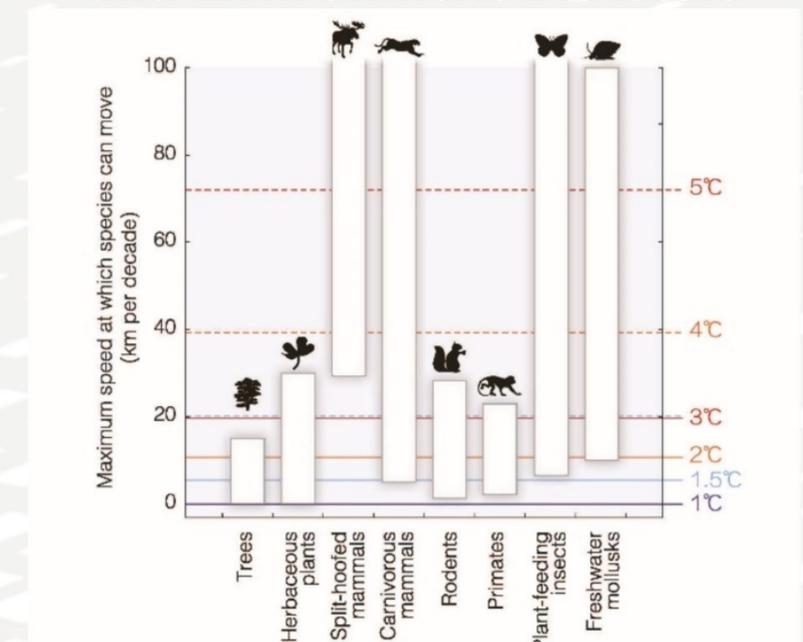
2 Climate and environmental disasters have caused **ecological disasters** in polar, terrestrial, freshwater and marine areas. Once the glaciers and permafrost melt, the ecosystem of "three poles" will be seriously damaged.

3 Climate disasters have led to a significant rise in sea level, leading to **survival disasters**. Once the sea level rises sharply, more than half of the population and economic activities will face a survival crisis.

4 Climate and environmental disasters lead to economic collapse and **social disasters**. The economic losses of the most vulnerable small island and low altitude countries are more than half of GDP.



Climate Change and Global Major Climate and Environment Disasters

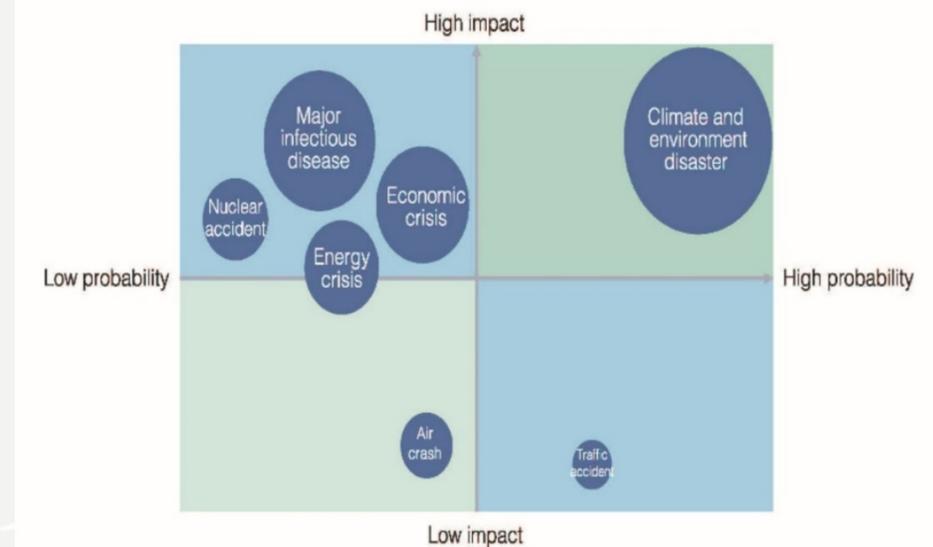


Ecological Disaster Caused by Climate Change

## 2.4 The “Last Window of Opportunity”

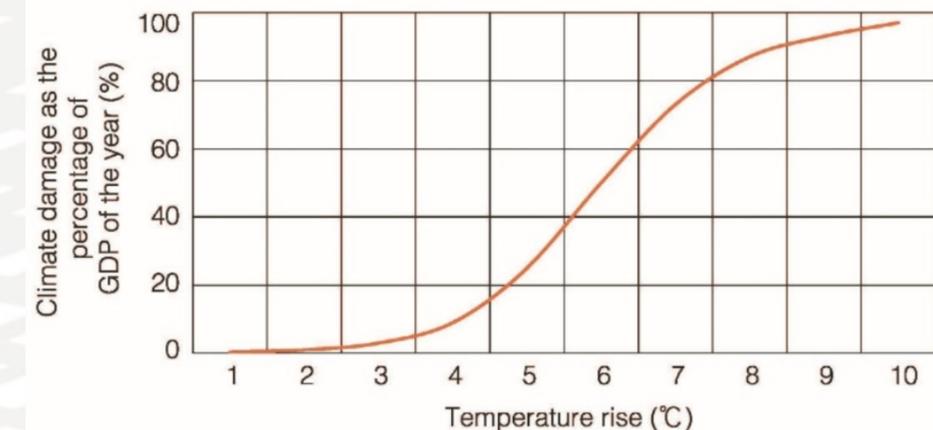
Our destiny is very much dependent on the strength of our response to the climate and environment crisis. We ought to take lessons from crisis mitigation in human history, soberly recognize that immediate action is needed.

**1 These Disasters Are Not Flukes. The possibility of crisis is far more than expected:** the possibility of climate environmental crisis is much higher than that of major infectious diseases. **The disastrous consequences of the crisis are unbearable:** the impact and loss increase exponentially.



**Probability and Degree of Impact of Risks**

**2 The opportunity is fleeting. Action is far from enough:** the key window period to deal with climate change is less than **10 years**. The current emissions will cause a temperature rise of more than 3°C. **The earlier we address the crisis the better:** delaying actions will **doubling the cost**.



**Global Temperature Increase and Incurred Economic Loss**

**3 Immediate action is required. Global joint action is the only way out:** no country can stay away from the climate crisis. **It is necessary to act decisively:** only by increasing the emission reduction by more than three times can we achieve the goal of temperature control of the Paris Agreement.



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# 3.1 Complexity and Difficulty of Crisis Resolution

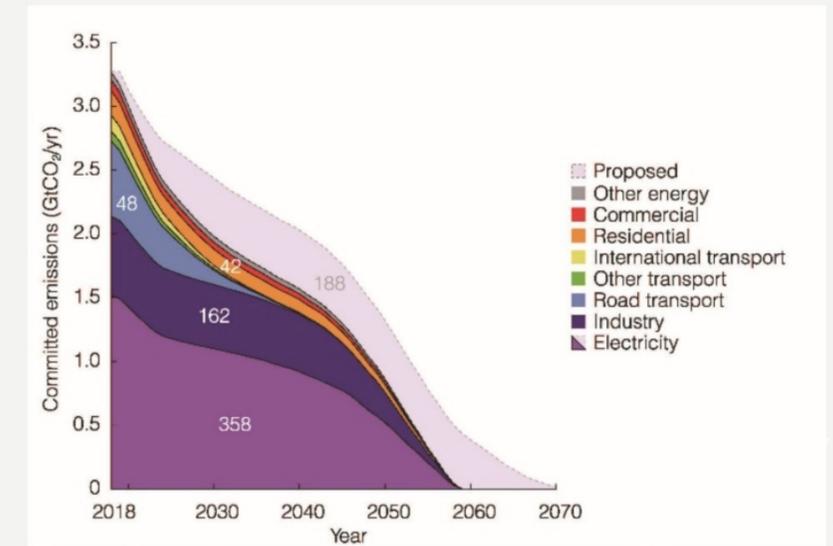
The misconceptions, the inertia of high-carbon economic development is huge, the lack of global, systematic and operable solutions, the lack of binding coordination mechanism, and the difficulty of implementation and joint action are all the difficulties in solving the crisis.

**1 Uprooting Entrenched Misconceptions.** The preparedness for the high probability and serious consequences of climate and environmental crisis is insufficient, and the mitigation action lacks determination.

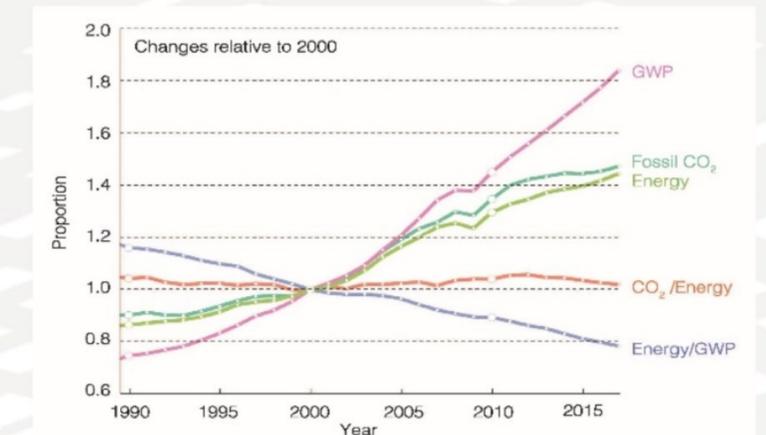
**2 Abandoning the Old Path.** Since 1990, total energy consumption and CO<sub>2</sub> emissions have increased by **1.5 times**. The fossil energy infrastructure under construction or being planned will squeeze out any additional space for emission reduction of the 1.5 °C target.

**3 Implementing Feasible Solutions.** The current governance framework can not systematically integrate objectives, plans, actions and mechanisms, and there is a lack of comprehensive integration between technologies.

**4 Promoting Coordinated Action.** The existing global governance lacks governance system to deal with major crisis.



**Fossil energy emission in construction planning**



**Global Economic Growth and CO<sub>2</sub> emissions**

## 3.2 The Innovative Path to Green, Low-carbon Development

The solution to the crisis is to focus on clean replacement and electricity replacement, accelerate the clean transition of global energy, and establish a green, low-carbon, clean and efficient modern energy system.

**Clean replacement** mainly refers to replacing fossil fuels power generation with clean energies on the supply side.

- **Power generation:** Fossil energy power generation accounts for about 65% of the total power generation in the world. With the rapid decline of wind power and photovoltaic cost, clean energy will accelerate to become the dominant power supply.
- **Final energy use:** There is about 9 Gt of coal of equivalent fossil energy in the end-use sectors every year. With the diversified development of clean energy utilization technology, it will replace the fossil energy in the terminal sector.

**Electricity replacement** mainly refers to develop the electricity to become the dominant energy on the consumption side.

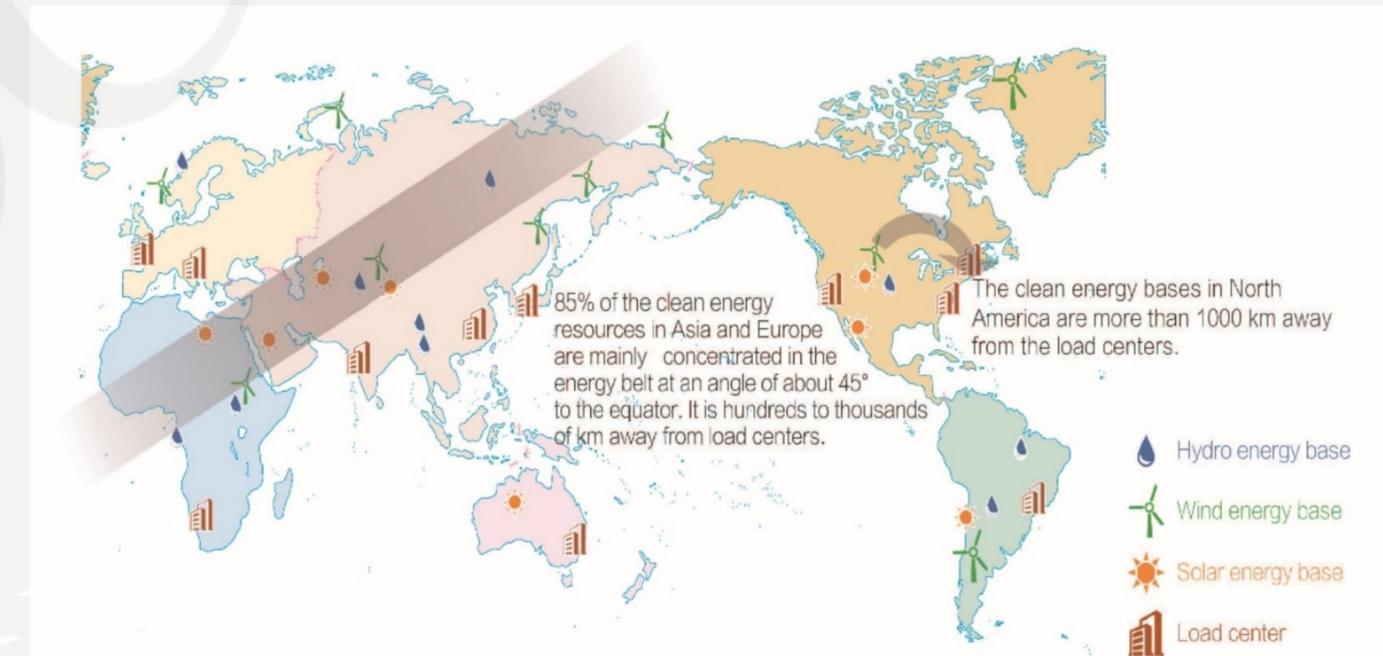
- **Replacing coal with electricity** in the final energy consumption to significantly reduce environmental pollution.
- **Replacing oil with electricity** in the field of electric vehicles, rail transit, port shore power, etc.
- **Replacing natural gas with electricity** in commercial and residential sectors, including electric cookers and heat supply.
- **Replacing primary biomass energy with electricity**, especially in rural areas of developing countries.

# 3.2 The Innovative Path to Green, Low-carbon Development

The interconnection of energy networks is the premise of and foundation for accelerating the “two replacements” and promoting a green, low-carbon energy transition.

## ➤ The Objective Need for Clean Development

- **Clean energy is converted and utilized.** Clean energy needs to be converted into electricity for efficient utilization.
- **Resources allocation is optimized globally.** Interconnected power grids create a large platform for the optimal allocation of clean energy.
- **Interconnected power grids are complementary.** Clean energy complementarity works across time and space to address seasonal and time discrepancies.
- **Clean development is accelerated across the board.** The speed and scale of clean development must be upgraded across the board.



**Reverse Distribution of Global Clean Energy Resources and Load Centers**

- **The Inevitability of Network Interconnection.** Power grids, information networks, transportation networks, and oil and gas pipeline networks are all network-based infrastructures, following the objective law of network interconnection development. A major breakthrough in key technologies is a necessary condition for the leap forward development of network interconnection.

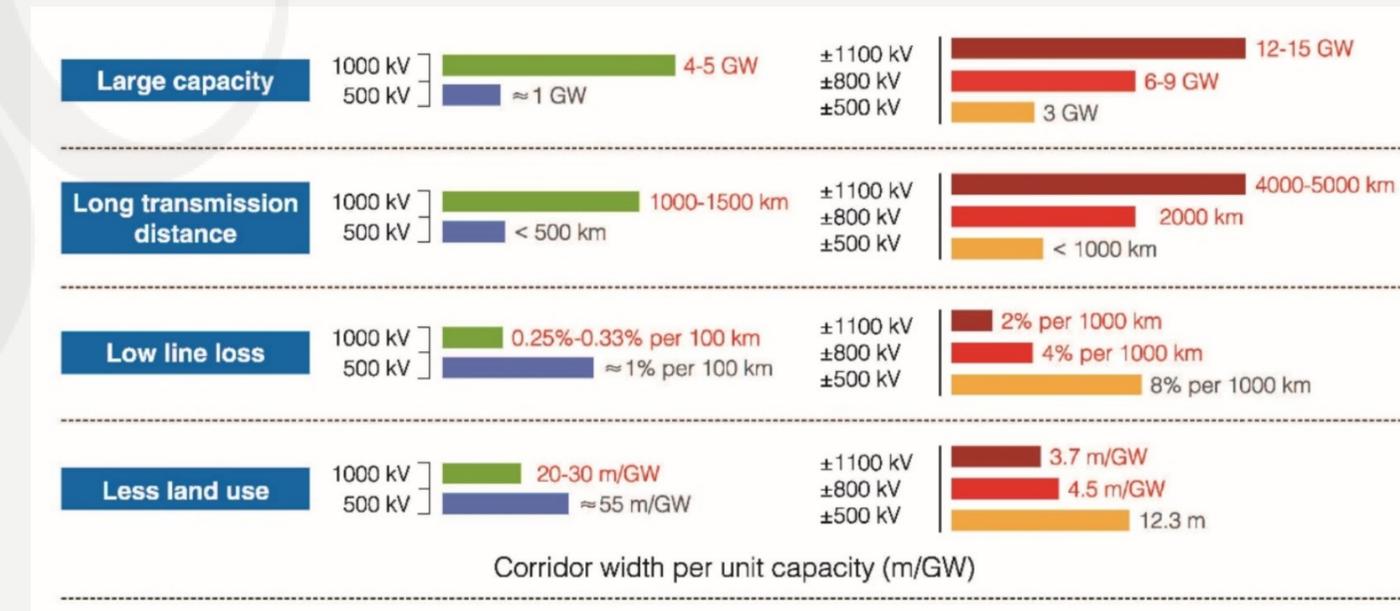
# 3.2 The Innovative Path to Green, Low-carbon Development

Energy interconnection technology is the key technology that has the most impact on the global energy development pattern.

## ➤ The Key Role of UHV

The UHV transmission technology features an AC voltage class of 1000 kV and above, and DC voltage of  $\pm 800$  kV and above.

- UHV is the apex of world energy and power technology.** Countries all over the world attach great importance to the development of power grid interconnection. China has taken the lead in achieving a comprehensive breakthrough in UHV technology, building a national grid with UHV as the backbone grid and promoting its use in Brazil and other countries.
- UHV enables global energy interconnection.** UHV has the significant advantages of large transmission capacity, high security and wide coverage. The transmission distance of  $\pm 1100$  kV lines is more than 6000 km.



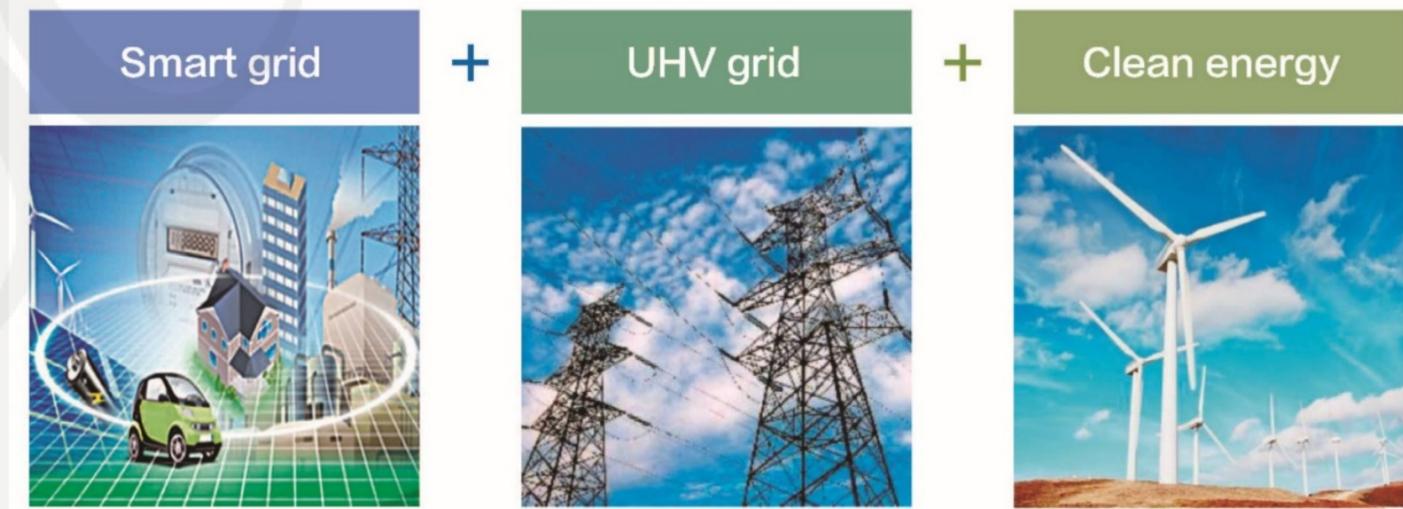
## Characteristics of UHV Transmission Technology



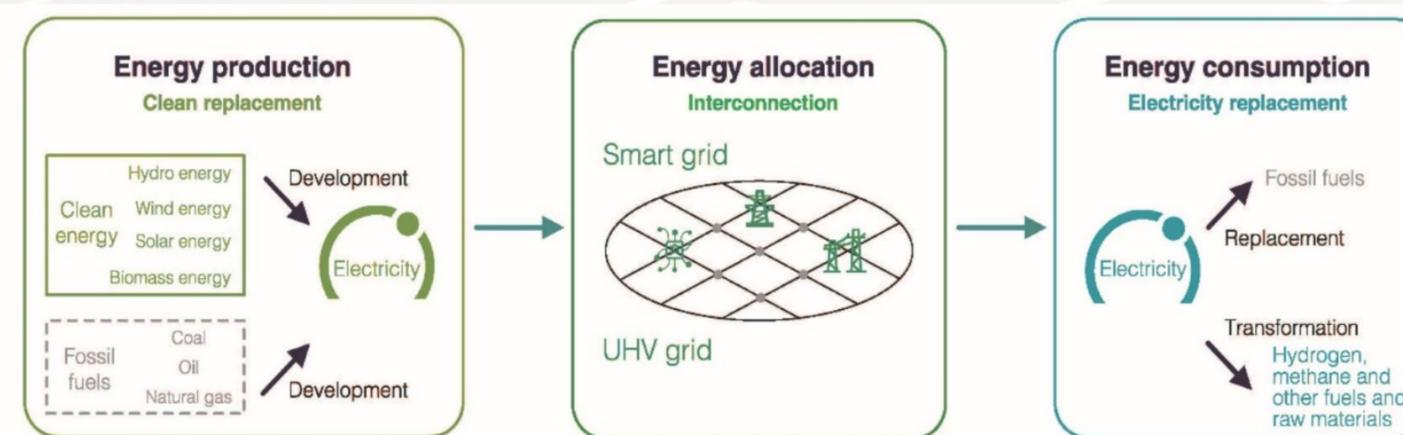
# 3.3 GEI Turns Crises into Opportunities

GEI is a primary platform for the large-scale exploitation, transmission and use of clean energy worldwide. GEI will form a pattern of global energy development featured by clean approaches, electricity and interconnections.

- **Energy development: clean energy production system.** Clean replacement is implemented to accelerate the realization of clean energy surpassing fossil energy in an all-round way.
- **Energy allocation: interconnected global power network.** Using UHV power grid to build a global backbone grid, regional and national interconnected power grid to meet the needs of clean energy development and use in various regions.
- **Energy consumption: power centered energy utilization system.** Taking electricity as the core, a new energy utilization system is formed. The fossil energy is used as industrial raw materials.



Basic Elements of GEI

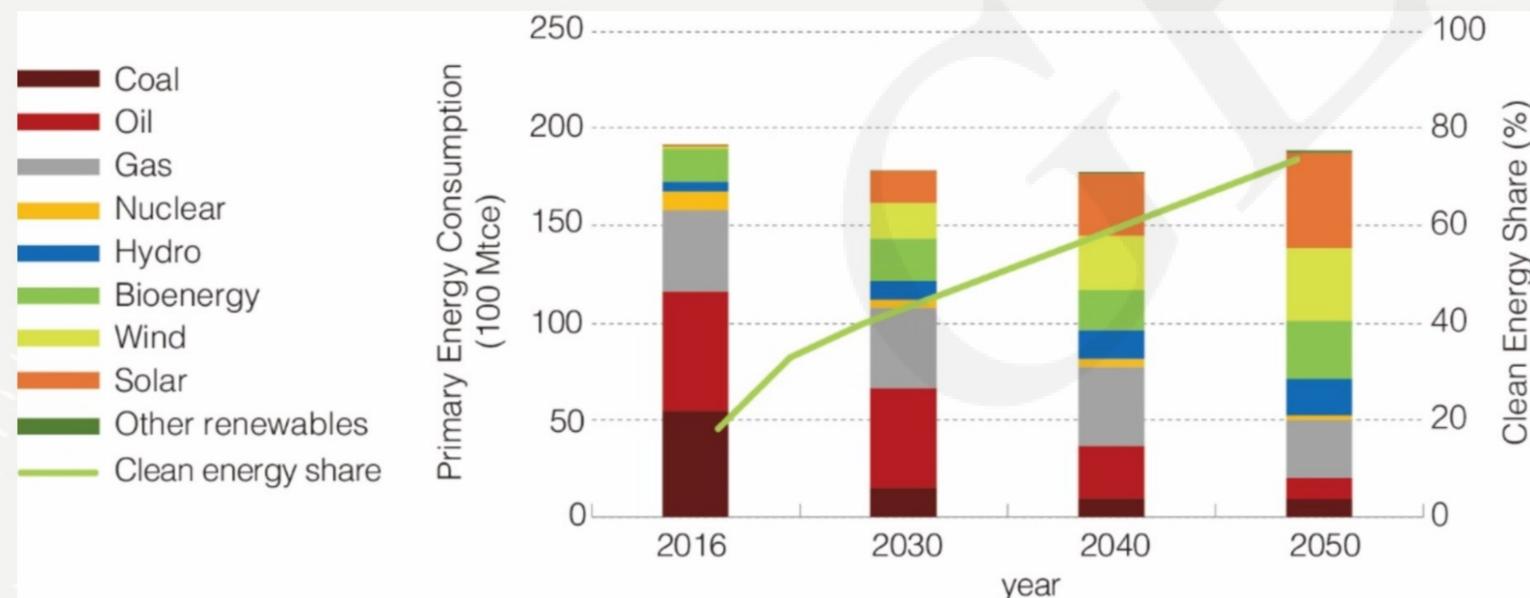


GEI System Structure

# 3.3 GEI Turns Crises into Opportunities

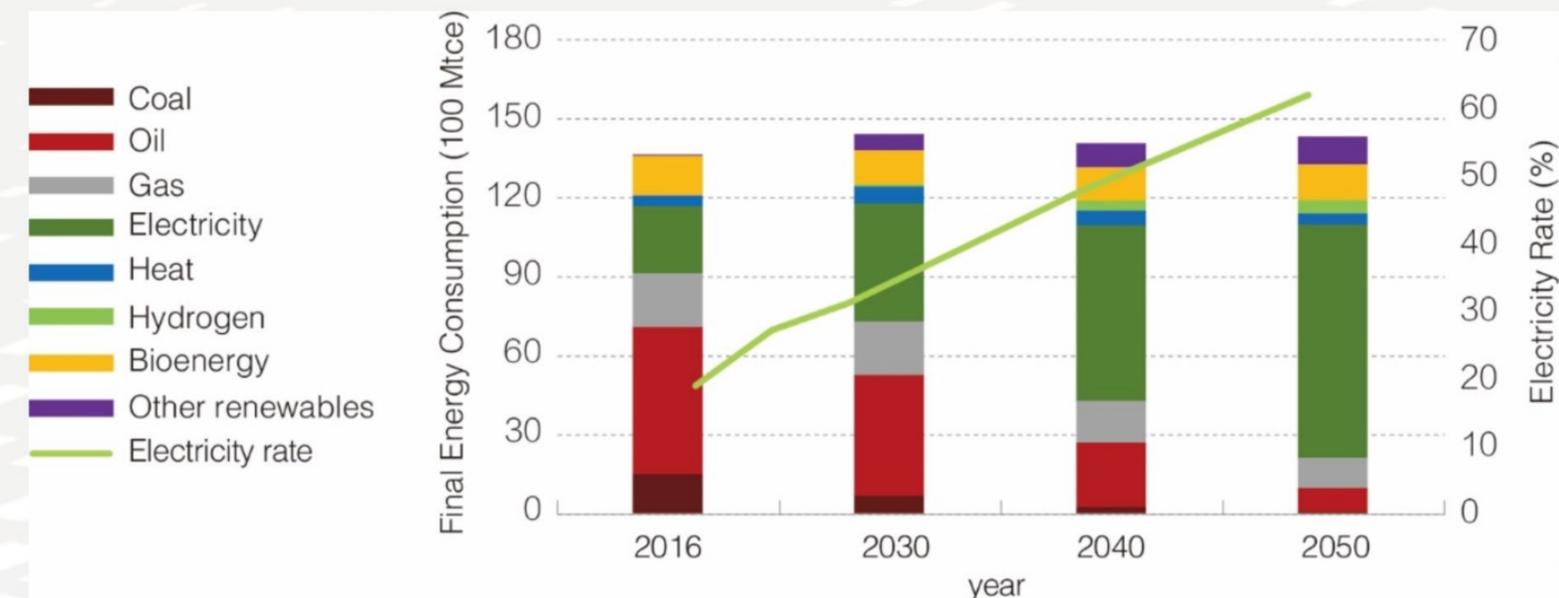
## 1 Energy Production Roadmap

- **Development pathway: from fossil energy to clean energy.** By 2050, the proportion of clean energy in primary energy will reach **75%**.
- **Key measures: centralized and distributed, intensive and efficient development of global large clean energy bases.** By 2050, the total installed capacity of global large-scale hydropower, wind power and solar energy bases will reach 1.3TW, 1.5TW and 3.8TW respectively.



## 2 Energy Consumption Roadmap

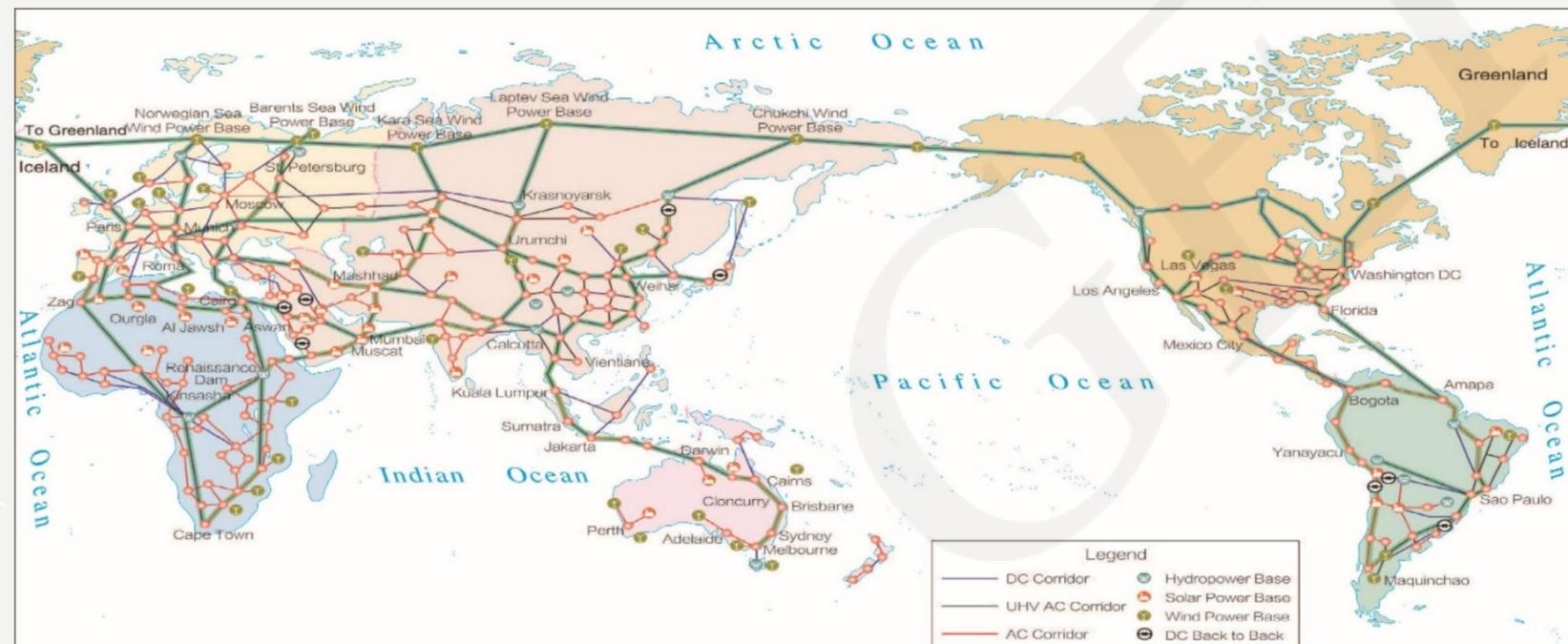
- **Development pathway: from fossil energy to electricity.** By 2050, the total final energy consumption will be 14.3Gt of coal of equivalent, and the global electricity consumption will be 70 Pwh, accounting for **65%** of the final energy consumption.
- **Key measures:** By 2050, the share of electricity consumption in industry, transport and construction sectors will reach 48%, 56% and 67% respectively.



# 3.3 GEI Turns Crises into Opportunities

## 3 Energy Interconnections Roadmap

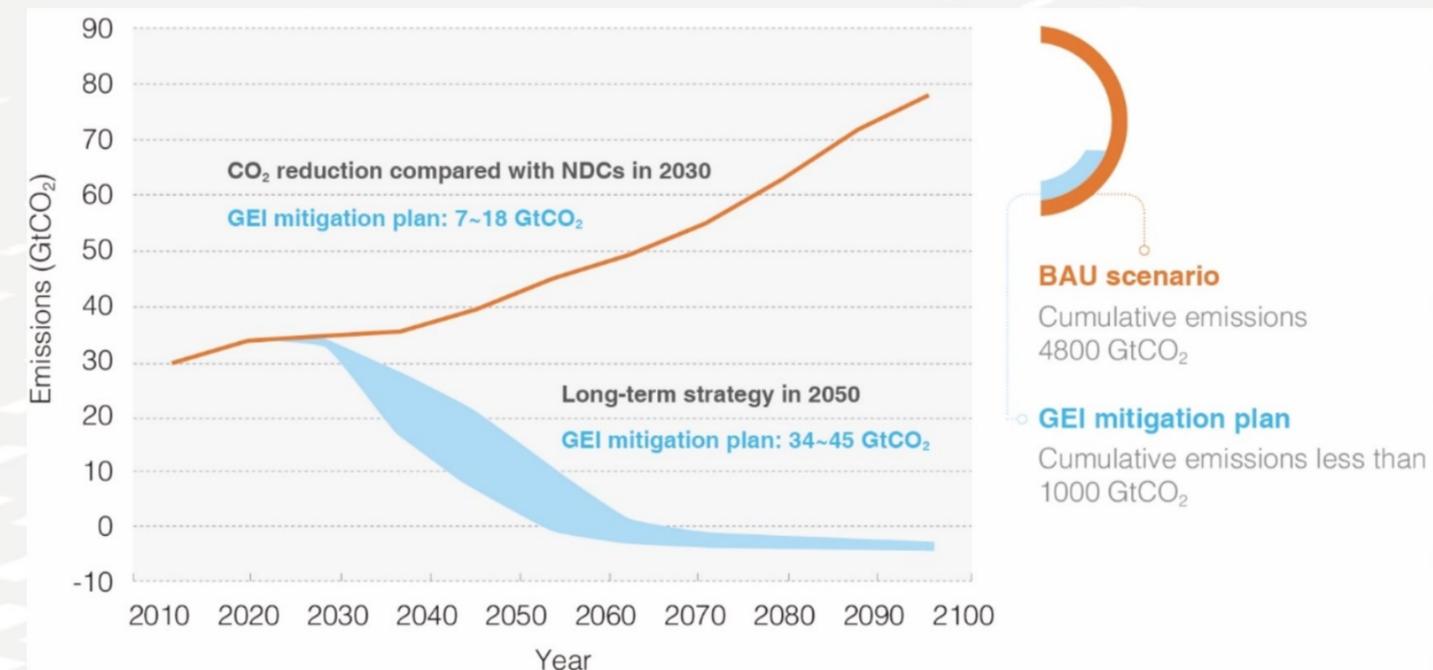
- **Development pathway:** from the current local balance to cross-border, cross regional and global allocation, and promote orderly in accordance with domestic interconnection, intra continent interconnection and global interconnection. **By 2050, a global network pattern will be formed.**
- **Key measures:** build the nine horizontal and nine vertical backbone grid for global clean power transmission.



GEI Backbone Grid Layout

## 4 Emission Mitigation Roadmap

- **Development pathway:** by mitigation in energy system, promote the whole society to achieve the **net-zero**. In 2030 and 2050, the carbon dioxide emissions from the energy system will be lower than 28 Gt and 11 Gt, respectively.
- **Key measures:** clean replacement and electricity replacement reduce CO<sub>2</sub> emissions by 1.8 trillion tons and 1.1 trillion tons, contributing more than **80%** of emission reduction.



GEI Mitigation Roadmap

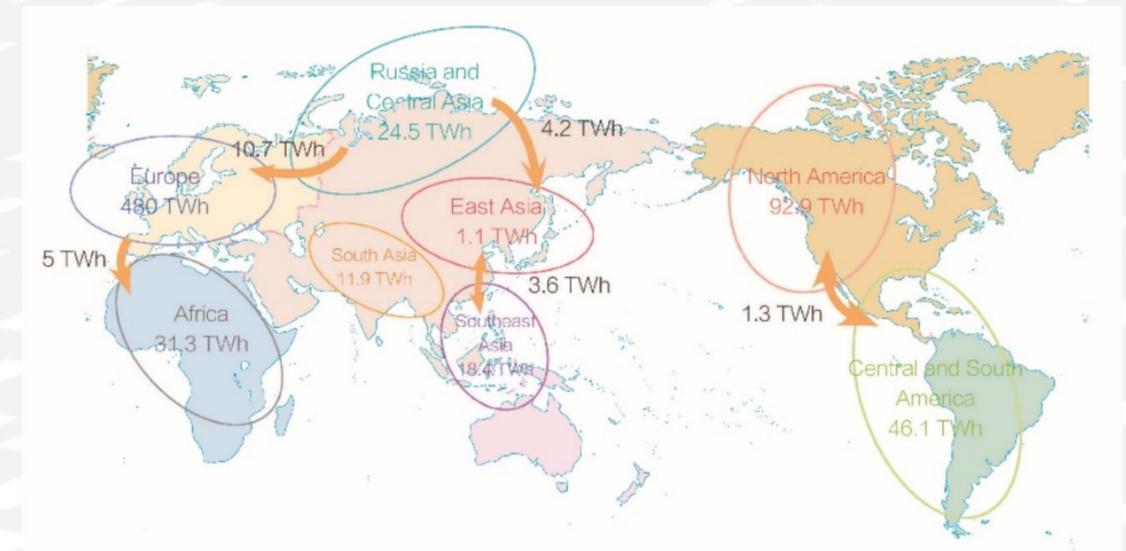
# 3.3 GEI Turns Crises into Opportunities

With technological feasibility, economic efficiency, guaranteed resources, a basis in interconnections and political consensus, GEI stands ready to embark on the fast track for development.

- **Concept:** A consensus on green and low-carbon development has taken shape.
- **Resources:** The theoretical reserves of global hydropower, wind power and solar power are **38 times** of the remaining reserves proven recoverable of global fossil fuels resources.
- **Technologies:** UHV technology is advanced and mature, and smart grid technology is widely used. China has completed **24 UHV projects**, including 10 with AC lines and 14 with DC lines.
- **Economy:** The cost of clean energy continues to fall, with PV power generation and onshore wind power generation to be more competitive than fossil fuels by 2025.
- **Interconnection:** The world has formed transnational interconnected power networks in continental Europe and North America, as well as from Russia to the Baltic Sea.



**UHV Grid Interconnections in China**



**Intercontinental and Transnational Power Trading in 2016**

## 3.4 Strengths and Effectiveness of GEI

**1 Championing sustainable development: the connotation of GEI is sustainable development, advancing green & low carbon, innovative development, natural harmony, and common prosperity.**

- **Green and low-carbon energy development as the strategic direction:** accelerating the development of clean energy and power system is the general trend of world energy development.
- **Innovation-led development as the primary driver of sustainable development:** the sustainable development of energy is driven by the innovation of thought, technology, mode and mechanism.
- **Harmony between human and nature as a mode of integrated development:** it is the common pursuit of all mankind to build a world with blue sky, green land and clean water.
- **The “shared destiny” as the common belief and pursuit of people of all countries:** we uphold the common belief and promote a shared future energy community for mankind.

# 3.4 Strengths and Effectiveness of GEI

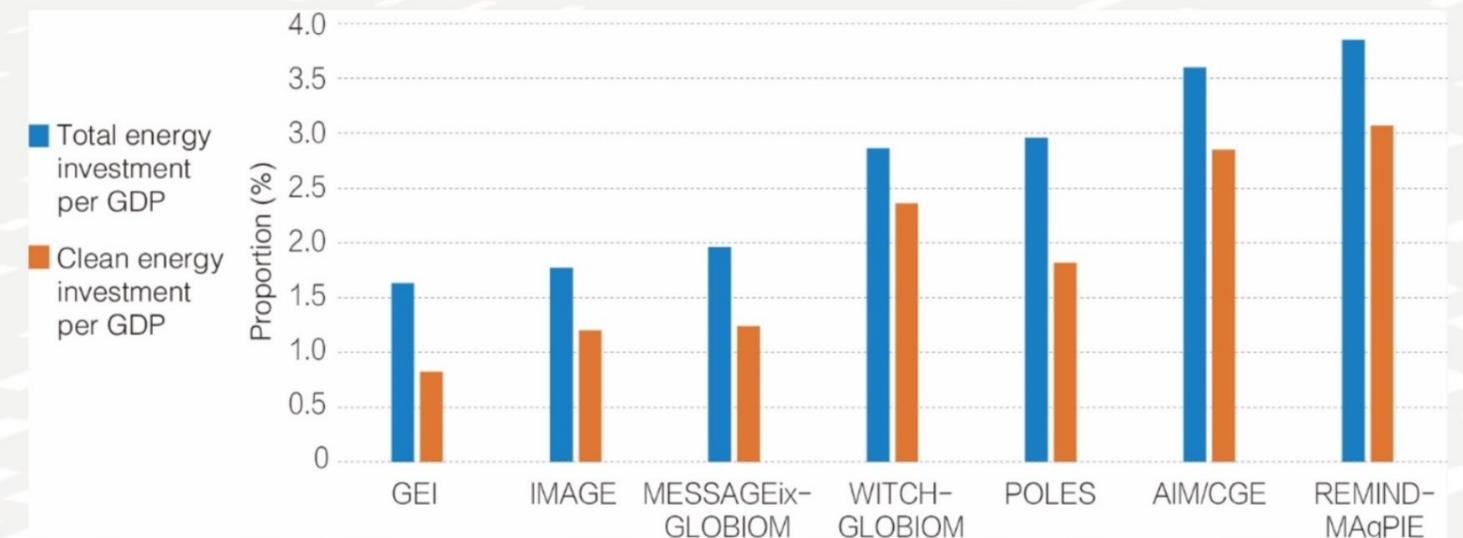
**2 An Advanced, Efficient and Comprehensive Solution: GEI represents a sophisticated technological orientation of the energy sector.**

## ➤ State-of-the-Art Technologies

- **UHV transmission and smart grid technology is advanced.** The GEI integrates the most advanced technologies, and is deeply integrated with the latest information and intelligent technology.
- **Zero carbon technology integration.** GEI realizes systematic integration of 29 types of zero carbon technologies in 6 fields.
- **Clean energy development is fast and efficient.** By 2050, the global power production will exceed 70 PWh, and the clean energy power generation will account for more than **90%**. The scale of global clean energy development will be increased by **3 times**, and the annual growth rate of clean energy consumption will be increased by **4 times**.

## ➤ Economy and Efficiency

- **Making energy investment more efficient.** The cumulative investments in the energy system during the period of 2016-2050 range from **USD 78 trillion to 92 trillion**, which might not exceed 2% of global GDP.
- **Lowering the cost of mitigation.** The carbon price will be just **15 USD/tCO<sub>2</sub>** to achieve the Paris Agreement, and the carbon emission intensity in 2050 will be reduced by **90%** compared with that in 2010.

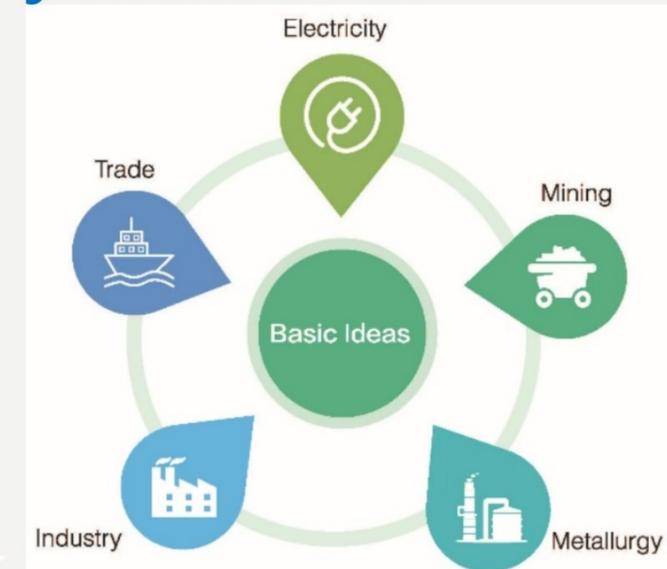


**Comparison of Energy Investment Between GEI and Global Mainstream Solutions**

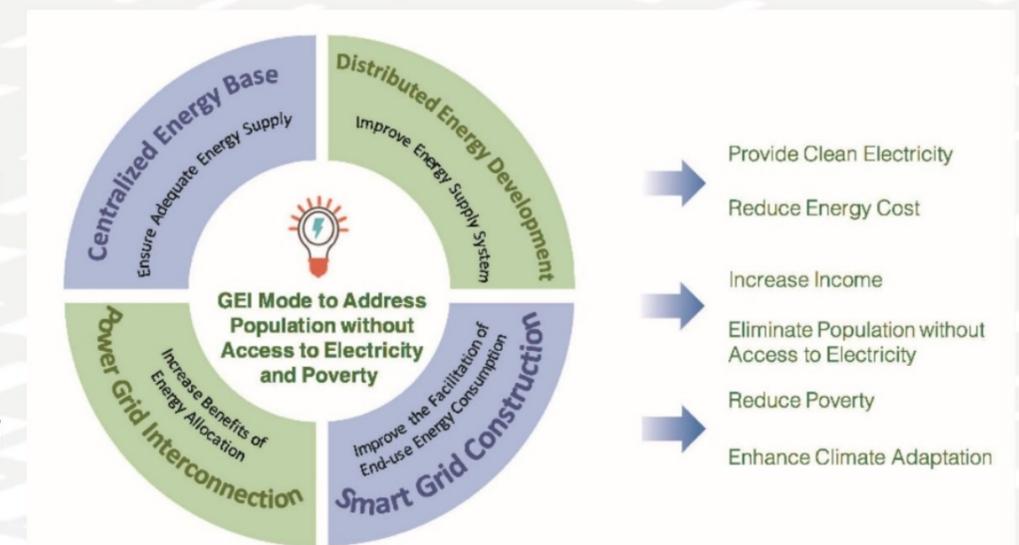
# 3.4 Strengths and Effectiveness of GEI

**3 Viable Development Modes:** By offering a package of operable, replicable and scalable development modes, GEI can help address the issues of clean energy demand and supply, ecological restoration and protection, and access to electricity, poverty and health.

- **An intensive, efficient and clean development mode:** Large power grids and large markets can be used to match clean resources with energy demand.
- **An electricity-mining-metallurgy-industry-trade development mode:** The low-carbon development of the whole industrial chain is realized.
- **An electricity-water-land-forest-carbon sink ecological restoration mode:** Using clean electricity to desalinate seawater, fresh water resources can be developed to promote ecological restoration and increase forest carbon sink.
- **An inclusive and shared model for universal electricity access mode:** Implement "building a centralized energy base, coordinating the development of distributed energy, promoting the interconnection of power grids, and accelerating the construction of smart grids".
- **An innovative and coordinated electricity-carbon market mode:** Electricity and carbon emission rights will be combined to form the multi-level trading market.



**Electricity-Mining-Metallurgy-Industry-Trade Development Model**



**GEI' s Mode of Universal Clean Electricity Access**

## 3.4 Strengths and Effectiveness of GEI

**4 A Global Cooperation Platform for Mutually Beneficial Outcomes: GEI can effectively align with the work of the United Nations, facilitate regional strategic development, and promote policy coordination among countries.**

➤ **Full support for the work framework of the UN.**

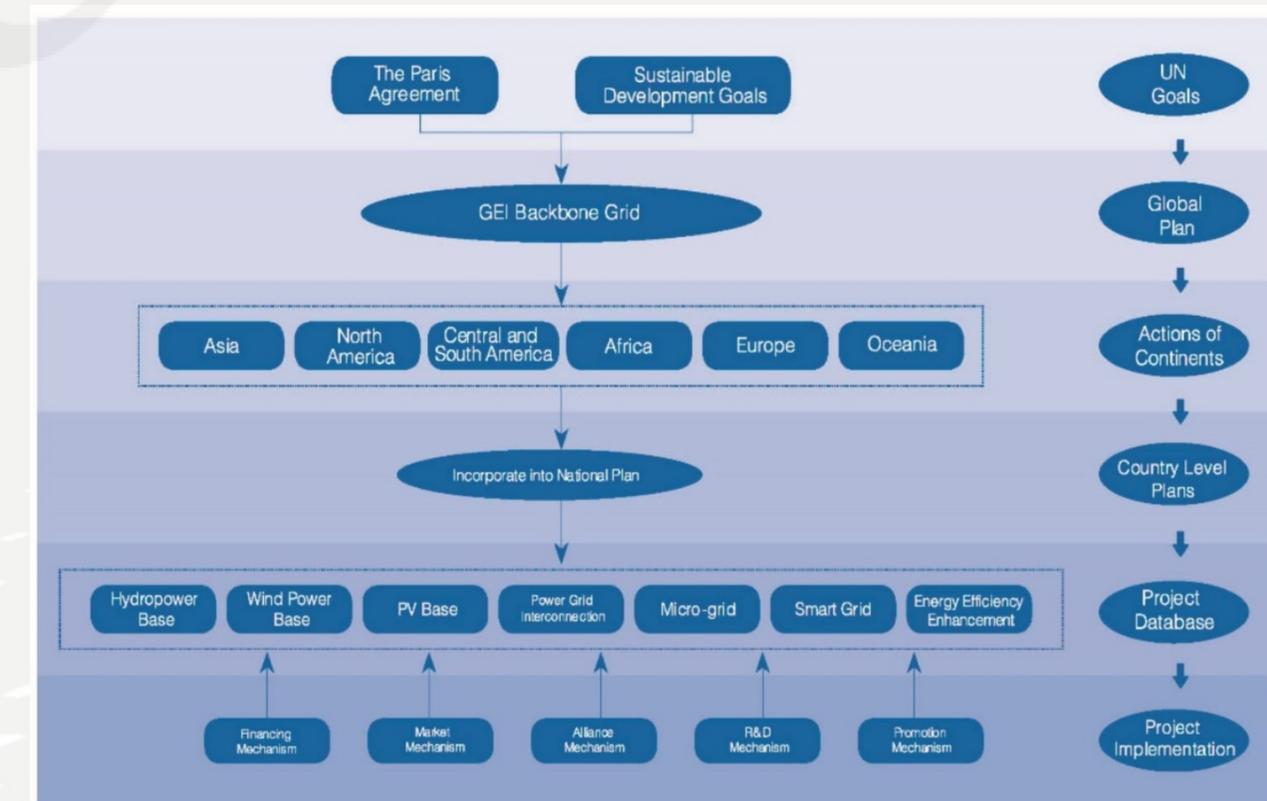
- **UN 2030 Agenda:** aligning with 17 sustainable development goals.
- **Paris Agreement:** putting forward the comprehensive technical scheme and action roadmap of GEI to achieve the goals of the Paris Agreement.
- **Global Environmental Governance:** GEI for the solution of nine environmental issues.
- **Electricity access, poverty and health issues:** putting forward the comprehensive plan of power popularization and poverty reduction.

➤ **Vigorous implementation of regional development goals.**

- **Regional development:** putting forward the plan of backbone grid and energy interconnection of all continents.
- **Belt and Road:** proposing national energy interconnection schemes.

➤ **Alignment with national development strategies.**

- Promoting the implementation of NDCs, implementing major clean and low-carbon projects, and supporting and improving national policy mechanisms.



**Global Governance System and Cooperation Platform**



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## 5. The Value for Humans and Earth

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# 4. Actions on Clean and Low-Carbon Development Across Various Continents

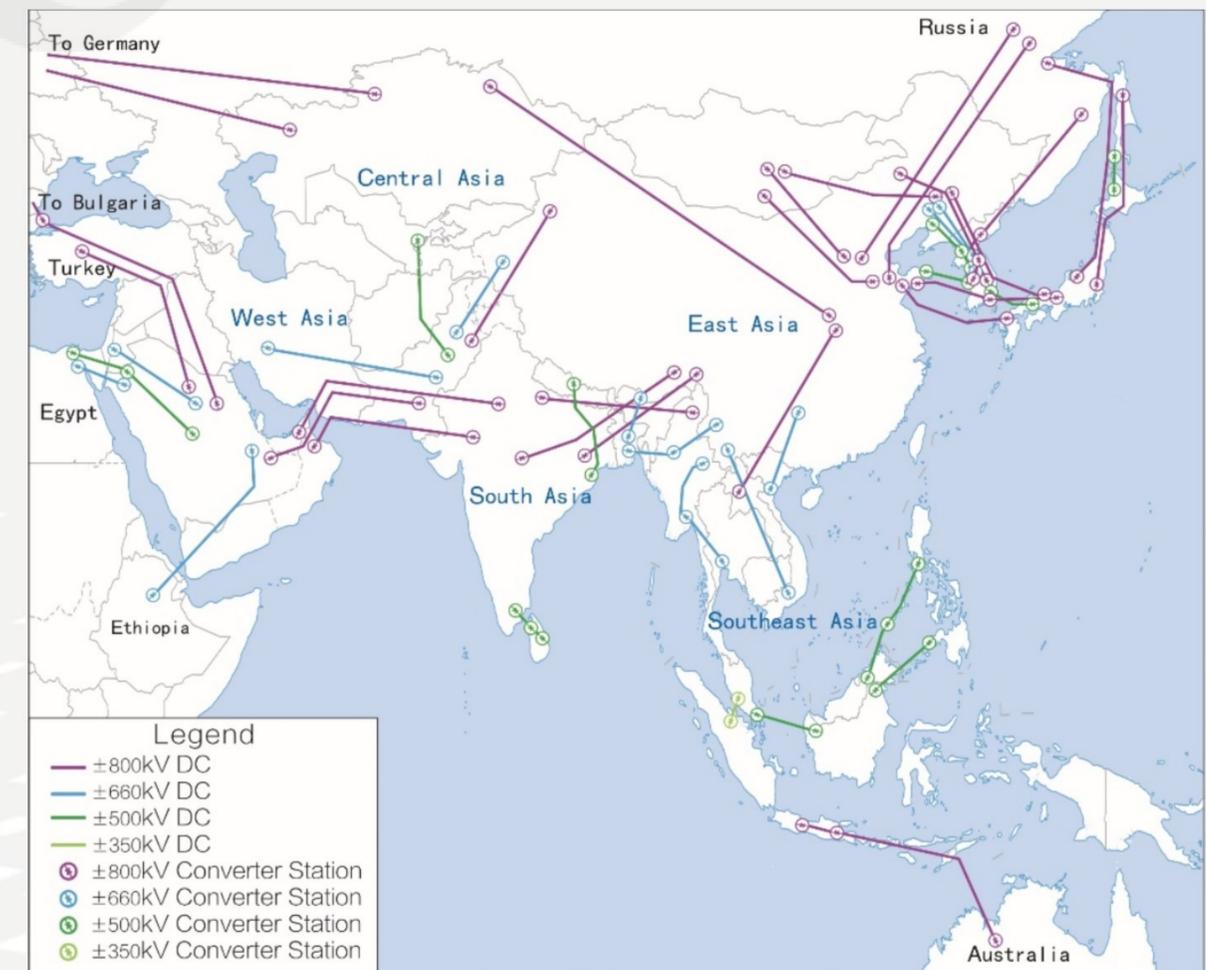
GEI is composed of energy interconnections across all continents. With an increased awareness for clean and low-carbon development, various continents and countries have paved the way for energy interconnections. Different fields need to be prioritized to respond to climate and environment crisis and to accelerate high-quality, sustainable development.



# 4.1 Asia

The general principle of building the Asian Energy Interconnection is as follows. With a focus on enabling a low-carbon transition, measures should be taken to use clean energy to promote development and to use development to promote emissions mitigation.

- **Clean development.** By 2050, the share of clean energy in primary energy consumption is projected to reach **72%**. The installed capacity of clean power is projected to reach 17.7 TW, accounting for **93%** of the total;
- **Grid interconnections.** The interconnections will give rise to **“four horizontal and three vertical”** intercontinental and cross-regional interconnection channels. By 2050, 7.31 TW of power demand in Asia is projected to be met. The capacity of intercontinental power flows and installed capacity integrated into grids is projected to amount to **67 GW** and 19.1 TW, respectively;
- **Electricity access.** By 2035, electricity access in Asia is projected to rise to 97%, and the number of people without electricity access could be reduced to 150 million. By 2050, electricity access could be made available to all.

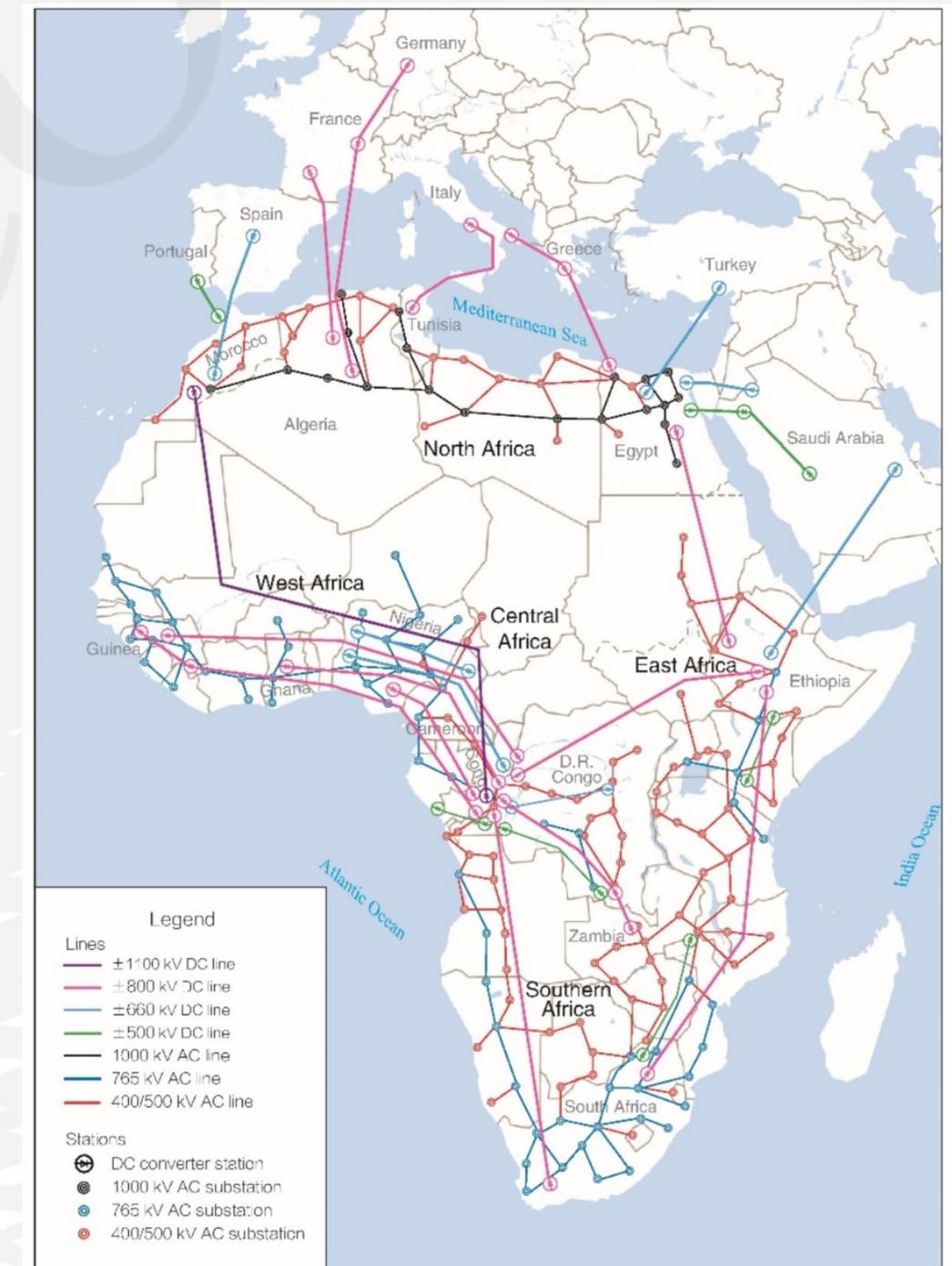


2050 Overall Pattern of Asian Grid Interconnections

## 4.2 Africa

The general principle of building the African Energy Interconnection is as follows. By prioritizing green electrification and industrialization, efforts should be made to accelerate the intensive development of solar and wind energy to realize the sustainable development.

- **Clean development.** By 2050, increase the share of clean energy in total primary energy consumption to **76%**, and increase installed capacity from clean sources to 1.48 TW by 2050, accounting for **83%** of the total;
- **Grid interconnections.** **“Two horizontal and two vertical”** intercontinental interconnection channels will be built. By 2050, 800 GW of power demand in Africa is projected to be met, and cross-regional and intercontinental power flow is expected to exceed **170 GW**;
- **Electricity access.** Strong action is required to promote power infrastructure, to provide electricity access for those living without steady electricity access.

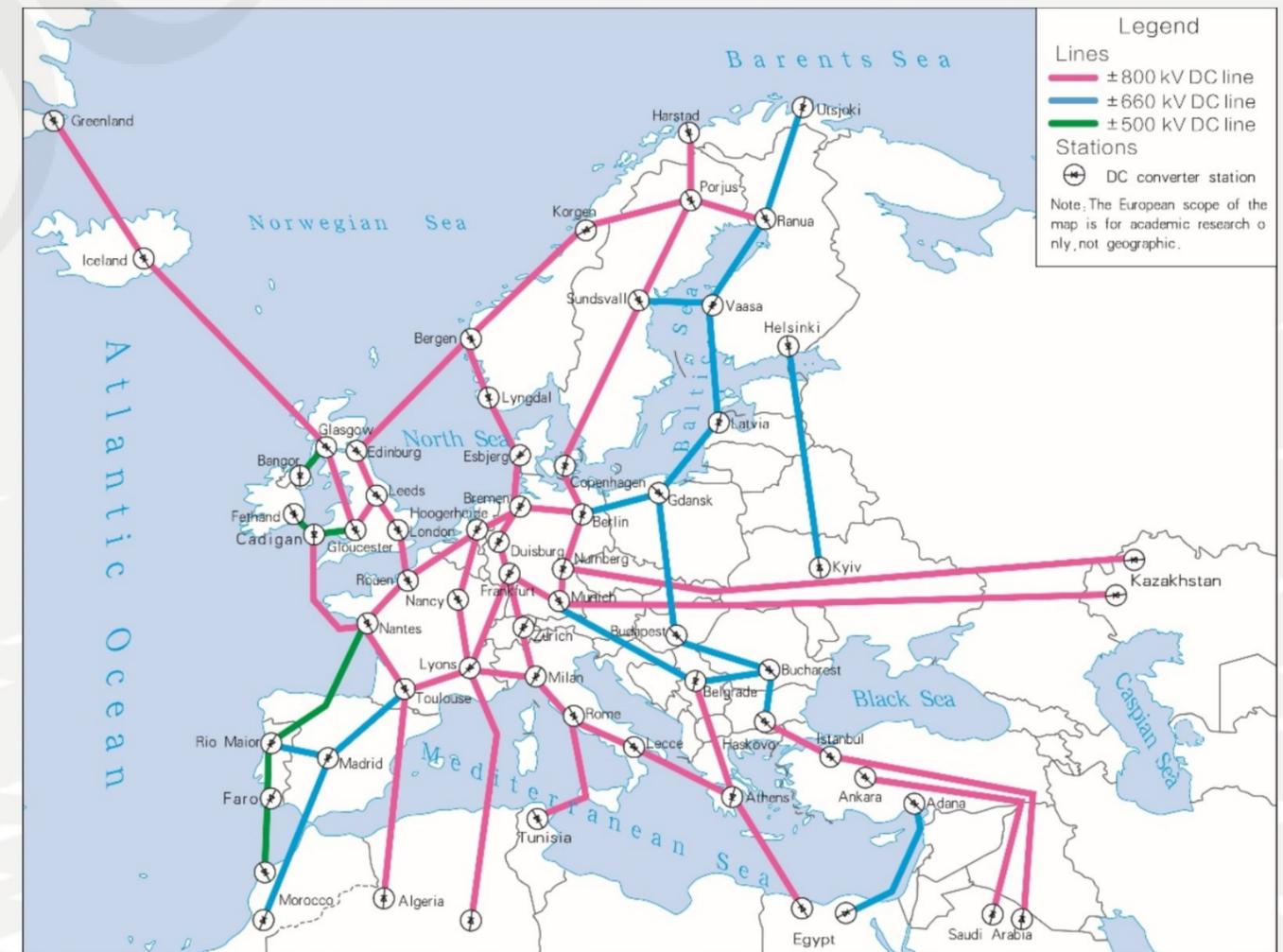


2050 Overall Pattern of African Grid Interconnections

## 4.3 Europe

**The general principle of building the European Energy Interconnection is as follows. Driven by the overarching goal of building a zero-carbon society, Europe should accelerate clean energy development within the continent and increase the import of clean energy from other continents and regions.**

- **Clean development.** Increase the share of clean energy in total primary energy consumption to **81%** by 2050. Expand the installed capacity of clean power to **3.92 TW** accounting for **97%** of the total;
- **Grid interconnections.** The **“two horizontal and three vertical”** intercontinental and cross-regional interconnection channels should be developed. By 2050, 1.64 TW of power demand in Europe is projected to be satisfied, and the total capacity of cross-regional and intercontinental power flows and installed capacity integrated into grids is estimated to reach **157 GW** and **4.05 TW**, respectively.
- **Improvement of energy efficiency.** By 2050, energy efficiency in Europe can be increased by 25% compared with 2015, and energy density is projected to drop to 0.08 kgce/USD.

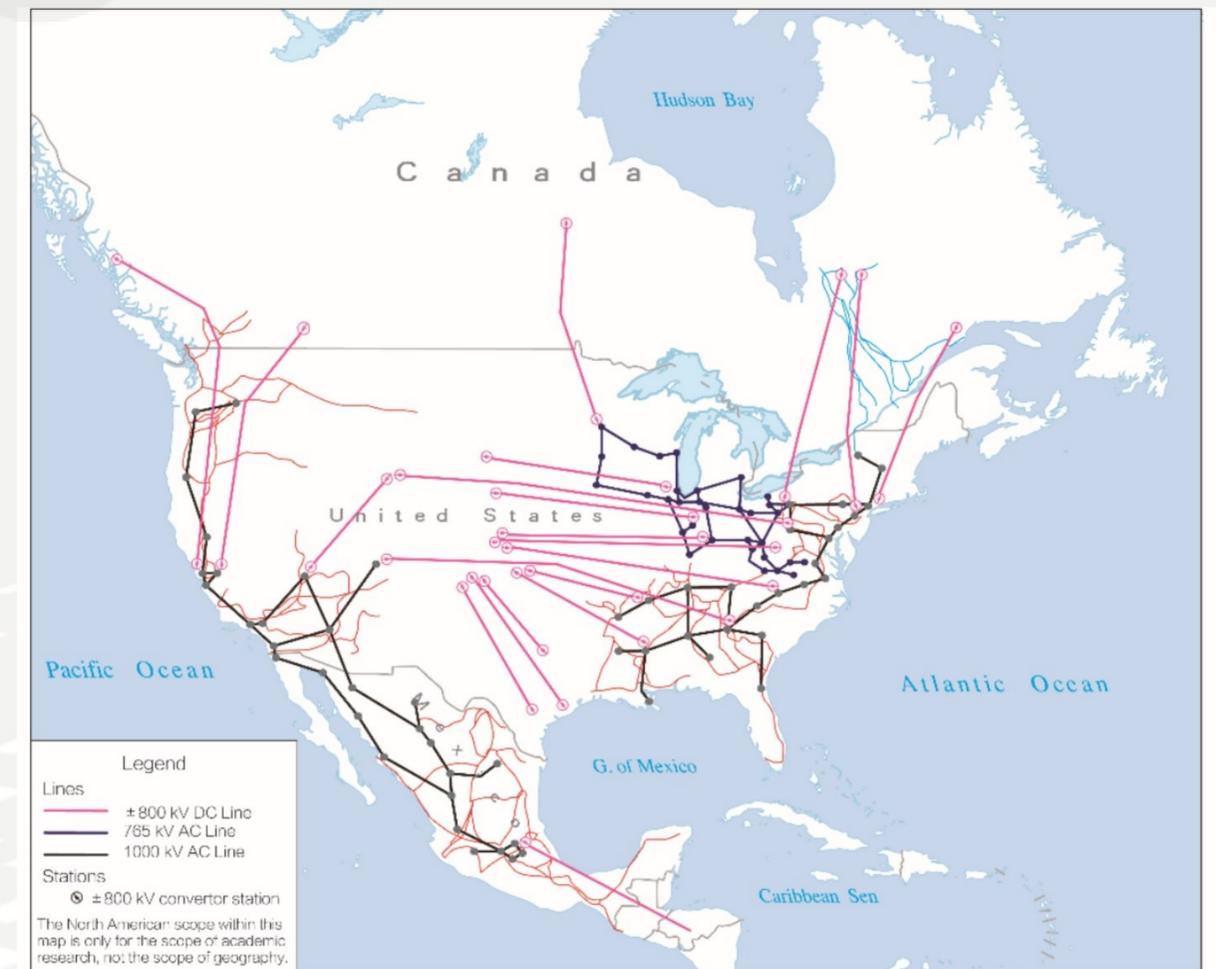


**2050 Overall Pattern of European Grid Interconnections**

## 4.4 North America

**The general principle of building the North American Energy Interconnection is as follows. While striving to accelerate decarbonization, North America should ensure a sustained energy supply through clean development to realize diverse and inclusive development.**

- **Clean development.** By 2050, the share of clean energy in total primary energy consumption will reach **77%**. The installed capacity of clean power rises to 3.87 TW, accounting for **86.5%** of the total;
- **Grid interconnections.** By 2050, 1.73 TW of power demand in North America is projected to be met. Installed capacity integrated into grids and the capacity of intercontinental, cross-border and cross-regional power flows is projected to reach 4.48 TW and **250 GW**, respectively. Specifically, the capacity involved in complementary energy support with Central and South America is expected to reach 10 GW;
- **Electricity replacement.** By 2050, the rate of electricity consumption in total final energy consumption exceeds **75%**.

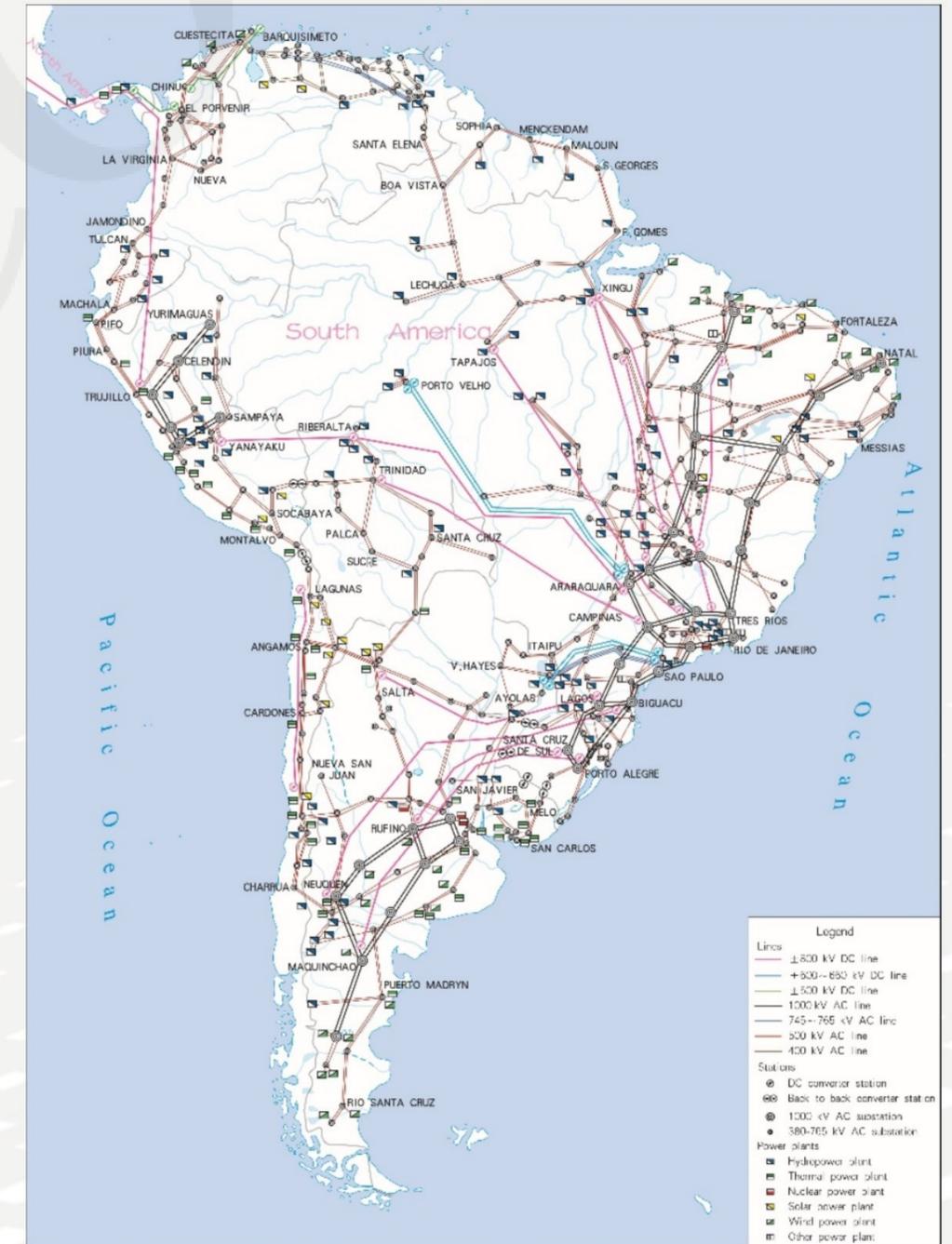


**2050 Overall Pattern of North American Grid Interconnections**

# 4.5 Central and South America

The general principle of building the Central and South American Energy Interconnection is as follows. Focusing on both the complementary support of energy sources and reindustrialization, the advantages of clean energy resources should be brought fully into play to coordinate their economic growth, energy transitions and emissions mitigation.

- **Clean development.** By 2050, increase the share of clean energy in total primary energy consumption to **81%**. Increase the installed capacity of clean power to 1.29 TW, accounting for **86%** of the total;
- **Grid interconnections.** By 2050, 710 GW of power demand in Central and South America is expected to be met, and installed capacity integrated into grids and the total capacity of intercontinental, cross-regional and cross-border power flows is projected to reach 1.49 TW and **100 GW**, respectively;
- **Electricity replacement.** By 2050, the proportion of electricity consumption in total final energy consumption is expected to exceed **59%**.

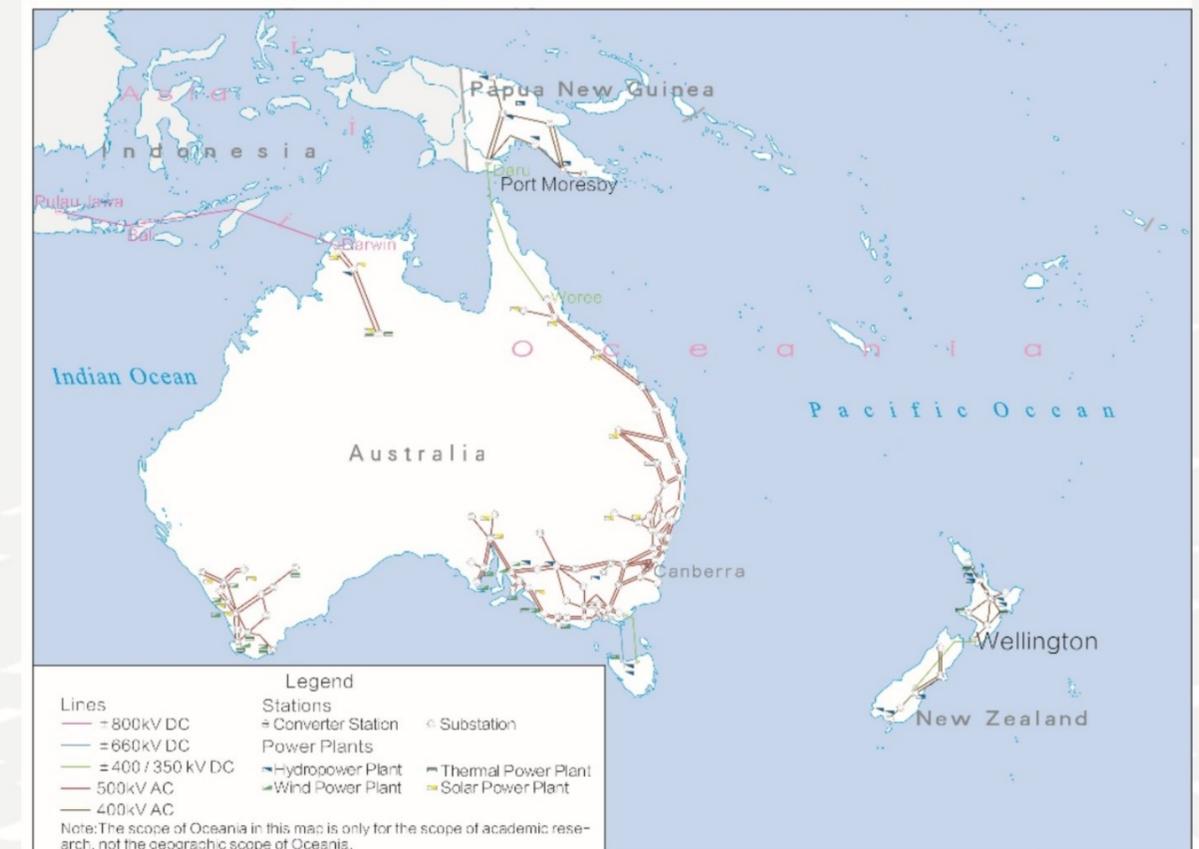


2050 Overall Pattern of Central American and South American Grid Interconnections

## 4.6 Oceania

The general principle of building the Oceanian Energy Interconnection is as follows. Coordinated efforts should be made to enable the development of energy systems without coal and to increase the adaptability of small island states to climate change. Moreover, emissions mitigation and adaption need to be advanced together.

- **Clean development.** By 2050, increase the share of clean energy in total primary energy consumption to **74%**. Installed clean power capacity should be increased to 210 GW, accounting for **91%** of the total;
- **Grid interconnections.** By 2050, 110 GW of power demand in Oceania could be met, and installed capacity integrated into grids and the capacity of intercontinental and cross-border power flows is projected to reach 230 GW and **20 GW**, respectively.
- **Electricity replacement.** By 2050, the rate of electricity consumption in total final energy consumption is estimated to become **68%**.



2050 Overall Pattern of Oceanian  
Grid Interconnections



## 1. Reflections on Major Crises

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## 2. The Climate and Environment Crisis

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## 3. GEI Turns Crises into Opportunities

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## 4. Actions Across Six Continents

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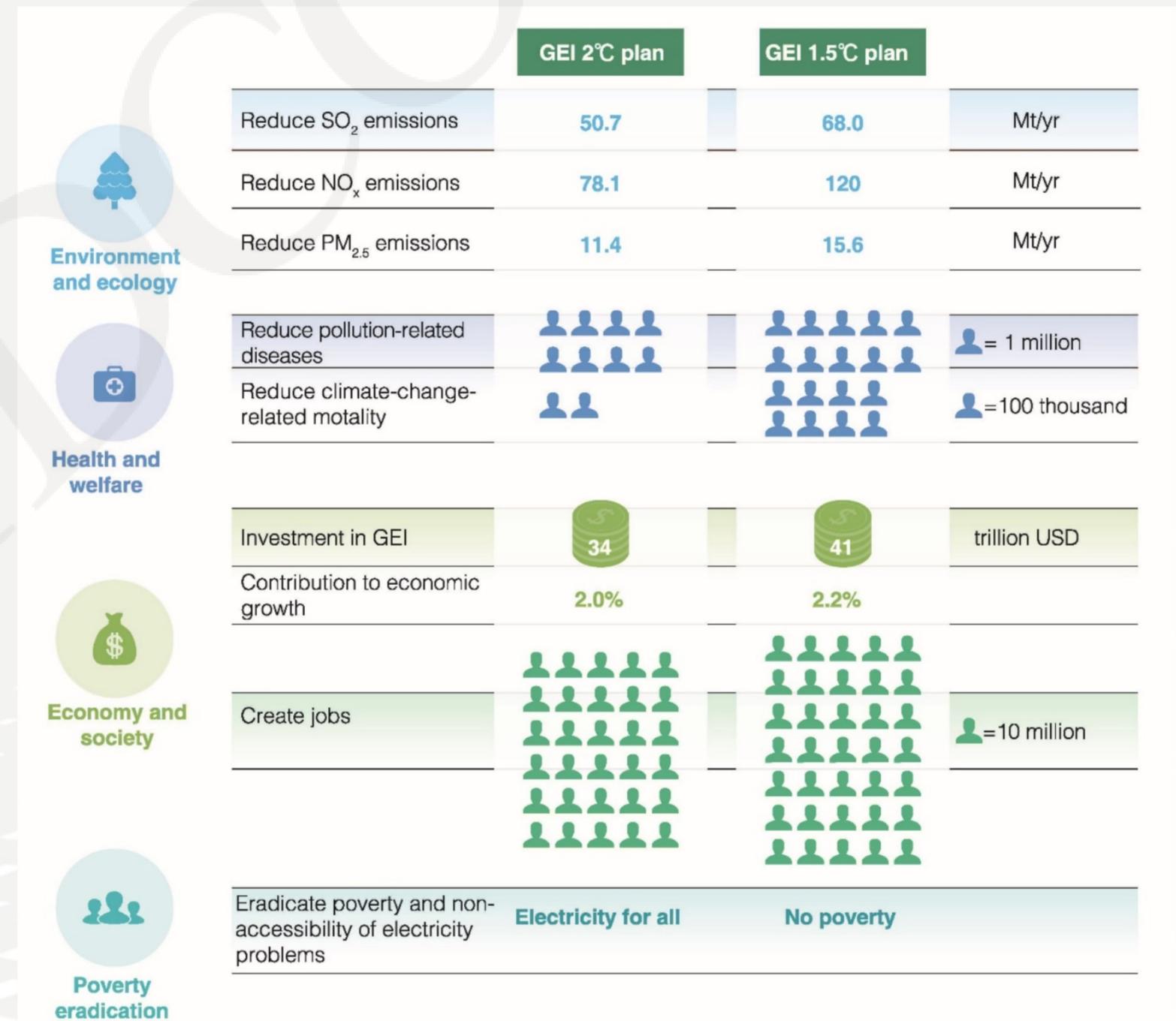
## 5. The Value for Humans and Earth

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# 5. The Value for Humans and Earth

There is only one Earth, and one shared human future. GEI provides practical and systematic solutions to resolve the major climate and environment disasters bearing down upon us. It will comprehensively and profoundly transform global energy patterns, and set us out on a development path of peace, prosperity, openness, innovation, greenness, and civilization.

- Lead the way to clean, low-carbon development
- Eliminate human-made pollution at the source
- Improve the living environment
- Build a zero-carbon economy
- Make energy more accessible to all



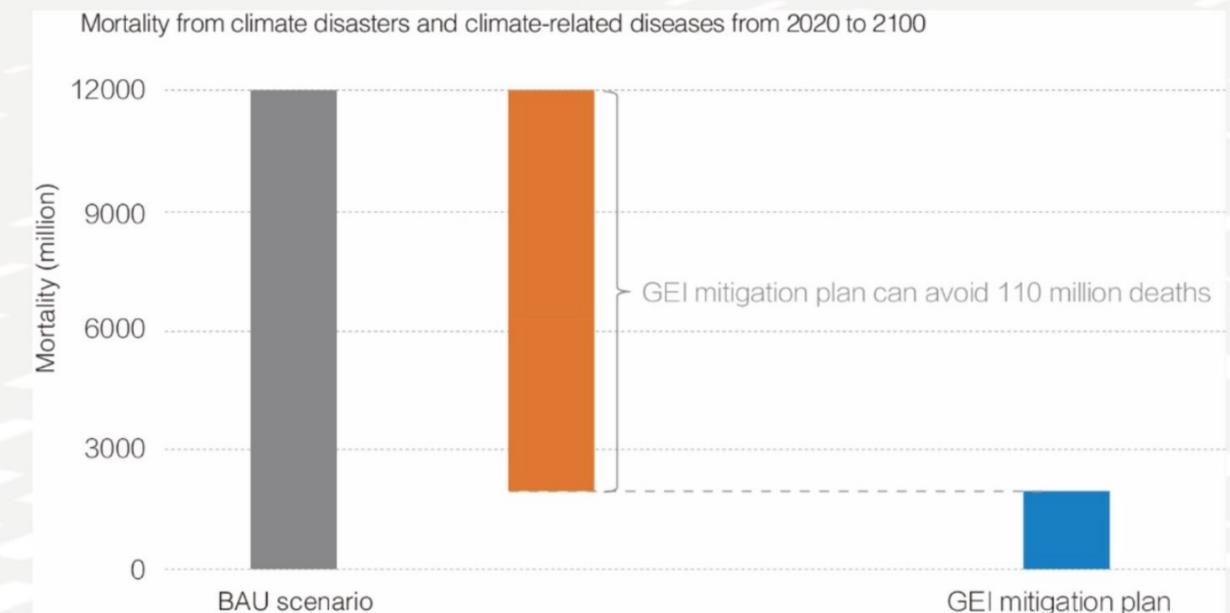
# 5.1 A Definitely Resolved Crisis

**1 Resolving Climate Change Risks: Meet temperature control goals as set in the Paris Agreement, greatly reduce climate change-associated risks.**

- **Protecting the earth system:** Effectively control carbon dioxide emissions and overall risks will be controlled at safe, manageable, and reversible levels.
- **Curbing the rise in sea level:** Substantially lower the probability of climate triggering events, and the rise in global sea level can be kept within 0.45-1 m.
- **Reducing the risk of species extinction:** Effectively lower the risk of extinction facing by birds, amphibians and mammals.
- **Reducing economic and social losses:** Avoid economic losses of more than USD 470 trillion cumulatively this century, equivalent to between **five and six times** the cost of investment in the global energy system.

**2 Protecting Earth's Natural Ecology: Eliminate pollution at the source and protect our home planet.**

- **Improving environmental quality:** By 2050, emissions of SO<sub>2</sub>, NO<sub>x</sub> and fine particulate matter will decrease **86%, 84%, and 85%**.
- **Reducing impact of disaster-related and environmental diseases:** By 2100, a total of **60-110 million deaths** will be prevented.

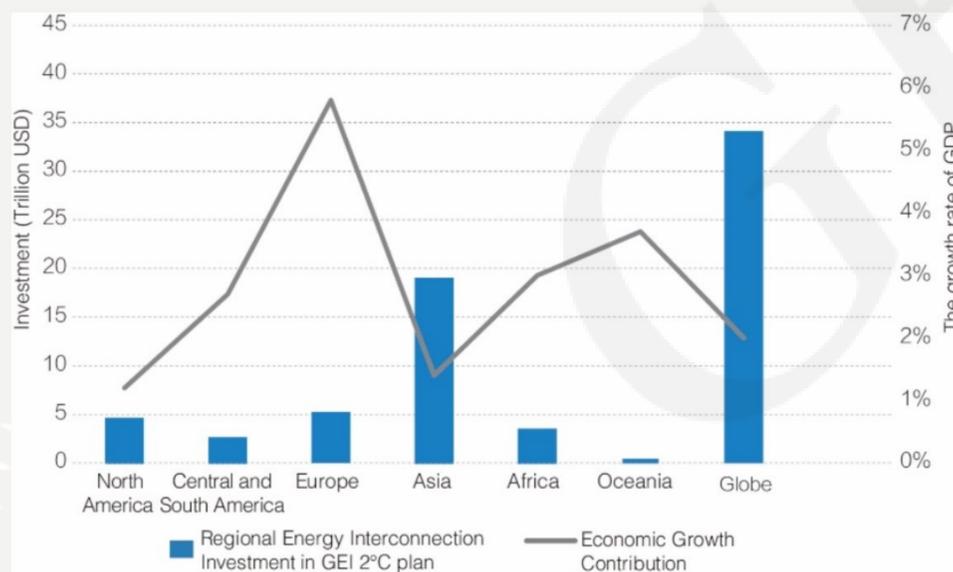


**Deaths from Climate Disasters and Related Diseases Avoided**

# 5.1 A Definitely Resolved Crisis

## 3 Securing Economic and Social Prosperity: Stimulate energy investment and improve the efficiency of resource allocation.

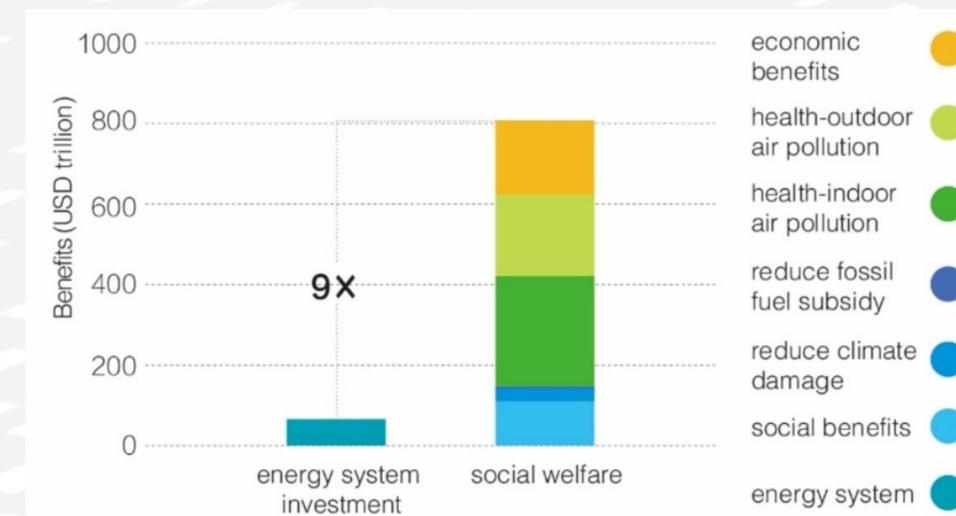
- **Stimulating rapid economic development:** By 2050, the cumulative investment in GEI is estimated to reach USD **34 trillion to 41 trillion**, contributing **2% to 2.2%** to the global economic growth.
- **Creating extensive job opportunities:** By 2050, GEI investment will propel investment and creating nearly **300 million** jobs worldwide.



**Economic Growth Benefits Stimulated by GEI Construction in 2050**

## 4 Poverty Eradication and Inclusive Development: By ensuring access to zero-carbon electricity to ensure social harmony and inclusive development.

- **Boosting sustainable development across the board:** GEI will bring about a total of **USD 720 trillion to 800 trillion** in social welfare, meaning that every one dollar of energy investment results in **nine dollars** for social welfare.
- **Popularize modern energy and electricity:** By 2050, multi-dimensional poverty will be completely eradicated.

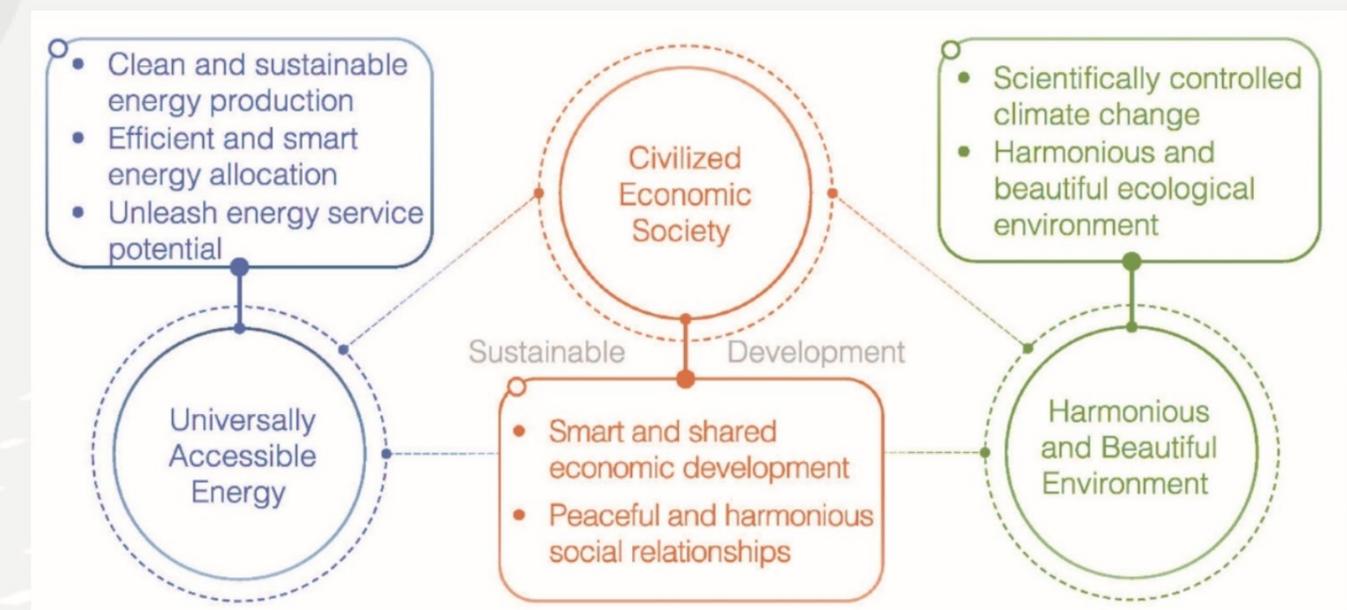


**GEI Investment Leads to a Nine-fold Increase in Social Welfare**

## 5.2 A Sustainable World

In the long-term, the prospects and potential for human energy development are bright. Based on GEI, a global electricity-centric energy system that is abundantly supplied, diversified and efficient, interconnected, clean and green, collaborative and shared, open and inclusive will be formed, enabling everyone to access clean, smart and sufficient sustainable energy.

- **Universally accessible energy:** Future innovative energy development will break constraints on resources, space, time, and materials. Human productivity will be liberated, and production and lifestyles will be transformed.
- **Civilized economic society:** Clean electricity will promote and ensure the efficient operation of smart economy, opening a new era of collaboration, sharing, peace and harmony.
- **Environmental harmony and beauty:** With the development of clean electricity, never again will we have to face the problems of greenhouse gases and pollutant emissions, entering a new stage of ecological civilization.



**A New Sustainable Post-Crisis World**

# EPILOGUE

The COVID-19 pandemic reminds us that we are a human community with a shared future, and no country can stand alone to address all the challenges faced by humankind. The climate and environment crisis will be another major challenge. The fundamental way out is to build the Global Energy Interconnection, promote energy transition, enhance energy cooperation and establish a community of shared future for mankind. Let's work together to turn crises into opportunities, lead the world economy to high-quality and sustainable development through energy interconnection and green and low-carbon development, and jointly usher in a new era of better world.

