Carbon Free Jeju:
Pioneering Strategies for Carbon Neutral Green Smart City

카본프리 제주의 그린 스마트 도시 선도 전략

Urban Infra Forum (2021.5.12)

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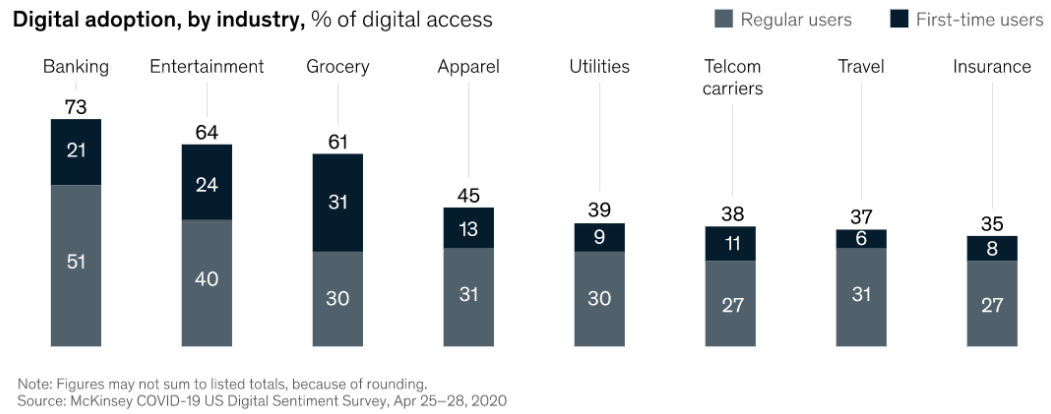
COVID19 and the Next Normal Arrives…

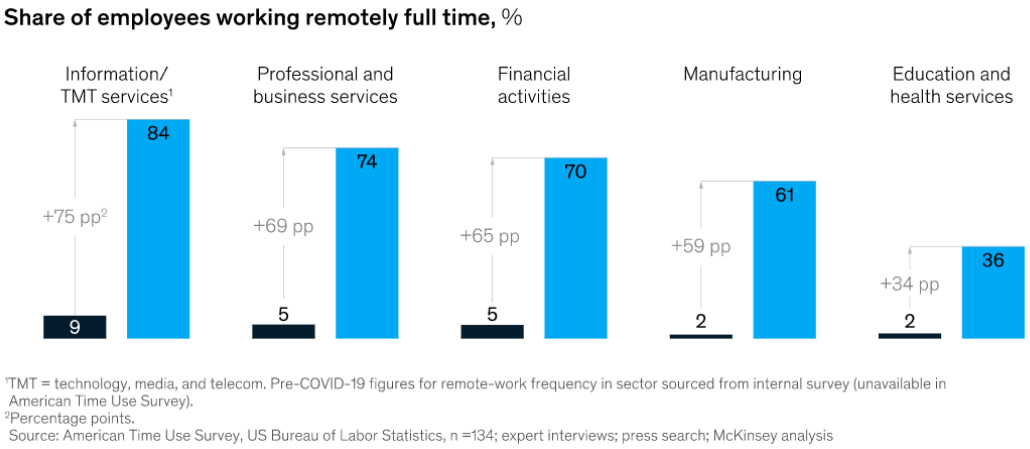
Trends that will define 2021-and beyond	*Productivity*	*Green Growth*	*Medical revolution*	*Resiliency*
The return of confidence unleashes a consumer rebound				■
Leisure travel bounces back but business travel lags				■
The crisis sparks a wave of innovation and launches a generation of entrepreneurs	■		■	
Digitally enabled productivity gains accelerate the Fourth Industrial Revolution	■			
Pandemic-induced changes in shopping behavior forever alter consumer businesses				■
Supply chains rebalance and shift		■		■
The future of work arrives ahead of schedule				■
The biopharma revolution takes hold			■	
Portfolio restructuring accelerates		■		■
Green, with a touch of brown, is the color of recovery		■		
Healthcare systems take stock—and make changes			■	
The hangovers begin as governments tackle rising debt	■			■
Stakeholder capitalism comes of age		■		■

Source: **McKinsey & Company**, January 2021, The next normal arrives: Trends that will define 2021-and beyond

Next Normal 1 Changes in Productivity



Note: Figures may not sum to listed totals, because of rounding.
Source: McKinsey COVID-19 US Digital Sentiment Survey, Apr 25–28, 2020



[1]TMT = technology, media, and telecom. Pre-COVID-19 figures for remote-work frequency in sector sourced from internal survey (unavailable in American Time Use Survey).
[2]Percentage points.
Source: American Time Use Survey, US Bureau of Labor Statistics, n =134; expert interviews; press search; McKinsey analysis

Source: **McKinsey & Company**, January 2021, The next normal arrives: Trends that will define 2021-and beyond

- **The crisis sparks a wave of innovation and launches a generation of entrepreneurs – "growth of digitization"**
- **Digitally enabled productivity gains accelerate the Fourth Industrial Revolution**

Next Normal 2 New Resiliency

The future of work arrives ahead of schedule

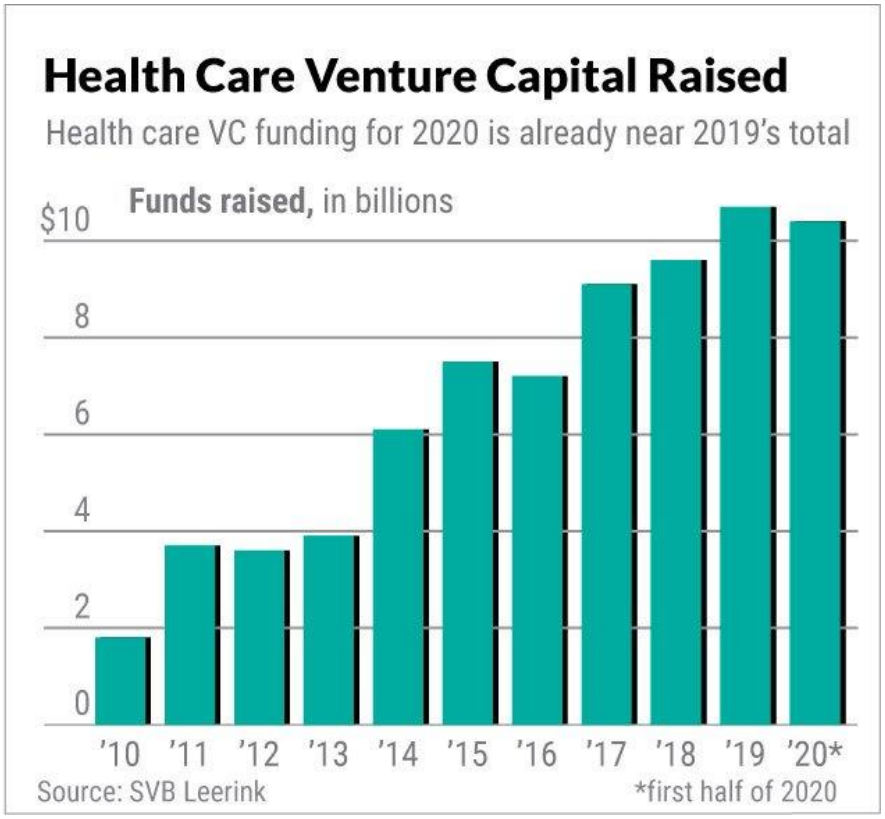
Supply chains rebalance and shift

Pandemic-induced changes in shopping behavior forever alter consumer businesses

Leisure travel bounces back but business travel lags

Source: **McKinsey & Company**, January 2021, The next normal arrives: Trends that will define 2021-and beyond

Next Normal 3 Medical Innovation



- The biopharma revolution takes hold
- Healthcare systems take stock—and make changes

Source: **McKinsey & Company**, January 2021, The next normal arrives: Trends that will define 2021-and beyond

Next Normal 3 Green Growth

States, Parties & Countries	Environmental policy priorities
European Union	Plans to dedicate 30 percent of its $880 billion plan for COVID-19-crisis to climate-change-related measures
China	In September 2020, China pledged to reduce its net carbon emissions to zero by 2060.
South Korea	South Korea's Green New Deal, invests in greener infra. and tech., with the goal of net-zero emissions by 2050.
Japan	Japan has pledged to be carbon neutral by 2050.
United States	US president-elect Joe Biden pledged to invest $2 trillion in clean Energy → **Main stream driver**
Canada	Canada is linking recovery to climate goals.
Nigeria	Plans to phase out fossil-fuel subsidies to install solar-power systems for an estimated 25 million people.

Source: **McKinsey & Company**, January 2021, The next normal arrives: Trends that will define 2021-and beyond

- Portfolio restructuring accelerates
- Green, with a touch of brown*, is the color of recovery
- Stakeholder capitalism comes of age

*A brown economy is one in which economic growth is largely dependent on environmentally destructive forms of activity, especially fossil fuels like coal, oil and gas.

U.S. Climate-Energy Policy

- Climate Policy as No. One that would differentiate the Biden Administration from the Trump
- “This is the first presidential election with climate change emerging as a top-tier issue and a lot of that was because Biden as a candidate chose to do that” (NYT)

Much Stronger than Obama's Green Policy…

Return to the Paris Agreement (Executive Order #1), Leaders Summit on Climate Change, and the Mission Innovation (American version of Green New Deal)

- Re-engagement with the Paris Climate Agreement
- Commitment to “Net Zero” by 2050 reinstate aggressive vehicle fuel economy standard with some new stronger terms Steps toward reestablishing US credibility and leadership on the climate agenda
- Major Climate–Energy legislations
  - possibly on Clean Energy Standard that would mandate a percentage of zero-carbon sources in the electricity grid,
  - American Green New Deal as a Covid-19 economic relief package and infrastructure funding bill

John Kerry, former Secretary of State, appointed Special Envoy on Climate Change Permanent member of the National Security Council

- U.S. will invest multi –trillion US $ on Clean Energy and Technology (2nd Mission Innovation after the Paris Summit)
- The US convened Major Leaders Summit within 100 days after President Biden took office on January 20, 2020.
  - Kerry visited China & Korea prior to the Leader's Summit
- Four teams under the White House
  - Climate Ambition & Implementation
  - Climate Negotiation
  - Climate Science
  - Climate Finance

The Green Cabinet, composed of BlackRock personnel

Adewale “Wally” Adeyemo

Named by Biden as Deputy Treasury Secretary

Former President of Obama Foundation

Former senior adviser and interim chief of staff to Chief Executive Larry Fink

Brian Deese

Named by Biden as head the National Economic Council

Managing Director, Global Head of Sustainable Investing at BlackRock

Former President Obama’s senior advisor for climate and energy policy

Larry Fink

Chairman and Chief Executive Officer of BlackRock

Former member of the Management Committee and a Managing Director of The First Boston Corporation

Member of the Board of Trustees of NYU and the World Economic Forum

The Federal Reserve installs the Supervision Climate Committee (SCC) and the Financial Stability Climate Committee (FSCC)

Jerome H. Powell, Chair

Climate change has become the major cause of financial crisis

Climate threat	Economic impacts	Financial impacts
Temperature rise, sea level surge, and abnormal climate Climate policy change Technology innovation Change in consumer preferences	Disturbance of the business environment Increased recovery and adaptation costs Low efficiency such as low production and low profit	Potential financial markets and credit loss Falls in stock and bond prices Declining property value

출처: San Francisco Federal Reserve Bank

Asia-Pacific Climate Policy Dialogue: A informal on-line meeting (November 11, 2020)

John Kerry

U.S. Special Presidential Envoy for climate

68th U.S Secretary of State

Chair of the Senate Foreign Relations Committee

Chair of the Senate Small Business Committee

Xie Zhenhua

Former Vice-chairman of the National Development and Reform Commission

Lead Negotiator at COP

Former Director of the State Environmental Protection Administration

Ban Ki-moon

Chair of the National Council on Climate and Envirionment

8th U.N Secretary General

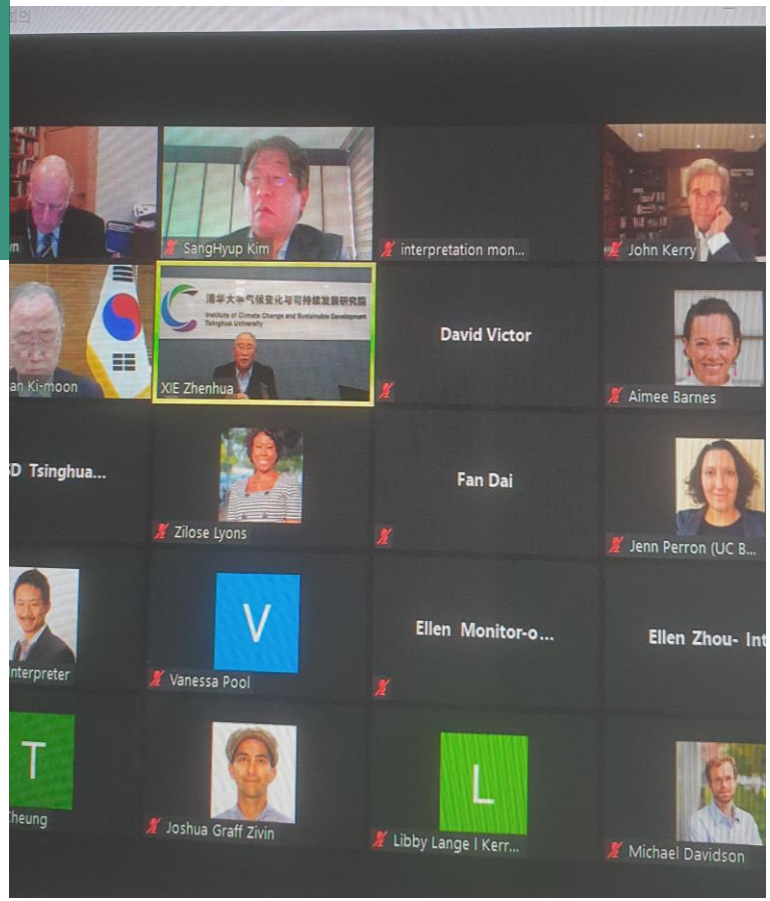
31st Minister of Foreign Affairs and Trade

Delegations of the US, China and Korea

< Dialogue Chair> BAN Ki-Moon , Gov. Jerry BROWN, John KERRY, Min. XIE Zhenhua

< Participants/Observers > Aimee BARNES Senior Advisor California-China Climate Institute University of California, Berkeley/ Dr. Tai Ming CHEUNG Director, UC Institute on Global Conflict & Cooperation /Dr. Fan DAI Director California-China Climate Institute University of California, Berkeley/ Dr. Michael DAVIDSON Professor, School of Global Policy and Strategy/ Dr. Josh GRAFF ZIVIN Director, Center on Global Transformation Professor/

KIM Sang-Hyup, President Jeju Research Institute , Republic of Korea / Amb. KIM Sook Chairman of Strategic Planning and Coordination Committee of the National Council on Climate, Republic of KoreaDr. OU Xunmin Beijing, People's Republic of China/ Dr. Susan SHIRK Chair 21st Century China Center University of California San Diego /Dr. David VICTOR Co-director, Laboratory on International Law and Regulation Professor, School of Global Policy and Strategy University of California /Evan WESTRUP Senior Advisor California-China Climate Institute University of California, Berkeley /Dr. YANG Xiu Beijing, People's Republic of China



Xie Zhenhua, Special Adviser to the President and the UN

- Greenhouse Gas Emission Peak by 2030, Net Zero by 2060 (2020.10.26) - Massive Investment for Green Development undergoing
- Long Waited for the US Leadership Back. More than Welcome the China-US Cooperation on Climate and Energy Issues
- Suggestions for “Carbon Market Cooperation” among China, the US (California), Korea and Japan taking advantage of market friendly emission trading schemes ➔
  establishing the Green Finance system

Ban Ki Moon, 8th U.N Secretary-General & President and Chair of GGGI

- Multi-Billion $ Investment for Korea's Green New Deal by 2025, Net Zero by 2050 (2020.10.28)
- P4G Summit 2021 in Seoul to enhance multilateral cooperation for Green Growth and Global Goals
- Suggestions for Quadrilateral Cooperation Group (No.1 Emitter China + No.2 US +
  No. 5 Japan + No. 7 Korea) - resource mobilization for the Green Climate Fund

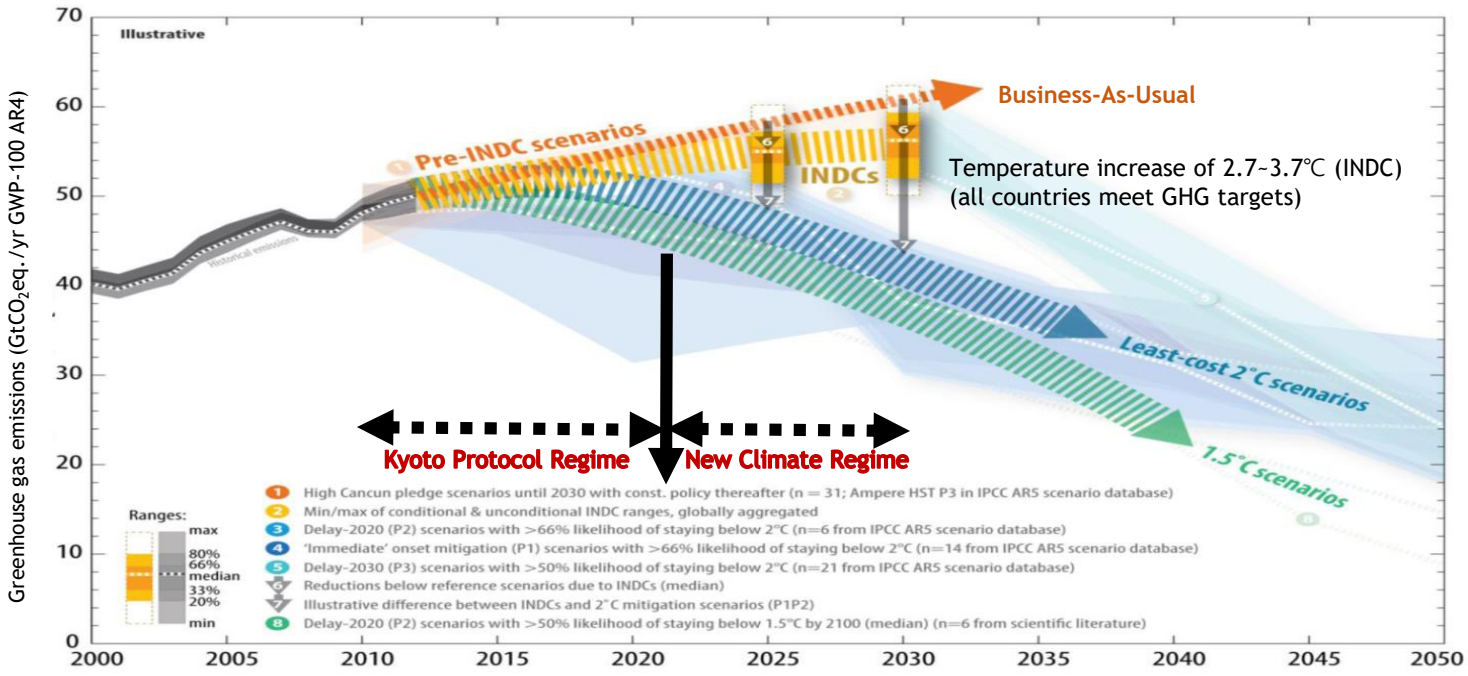
*Japan Net Zero 2050(2020.10.26)

Climate Summit (U.S) on Earth Day April 22

- On the road to Glasgow in UK (COP26), November 2021
- P4G Summit in Seoul, May 30~31 (Partnership for Green Growth and Global Goals)

  “ The World is Hungry for Best Practices ! “

Global GHG emissions projections After Paris Climate Agreement



* Source : UNFCCC (2016)

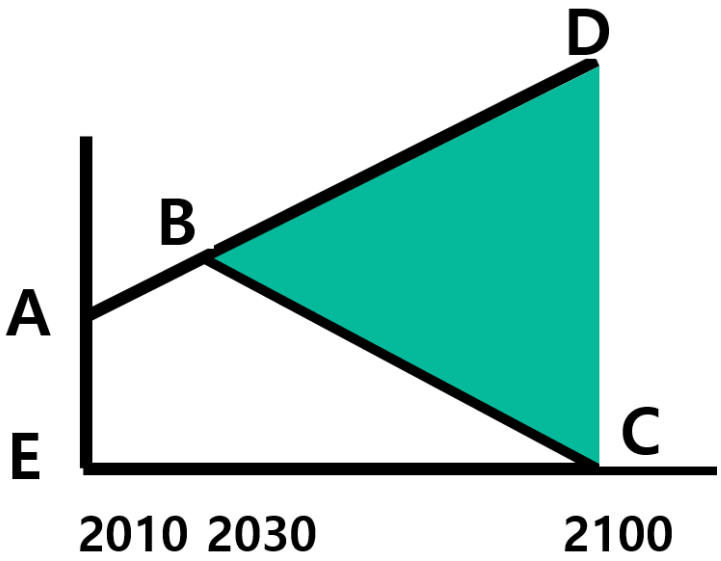
From BAU(Business As Usual) To BAW(Business As Wanted)
(Essence of Green Growth : Catch-up➔Early Mover)

ABD (Existing) = 2.5 times increase in 2100

ABC (New) = 50 Gt CO2 peak in 2030, 0 Gt in 2100

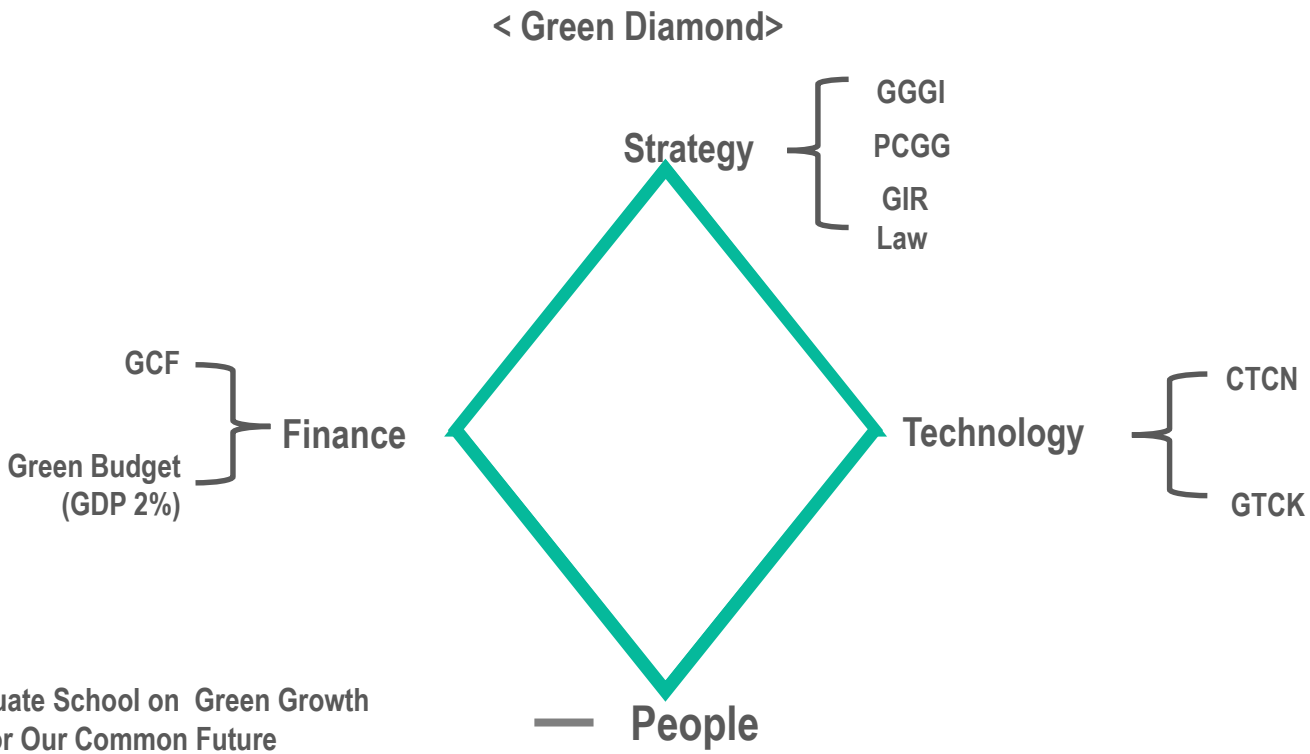
EABC = Global carbon emission ceiling

BDC (New low carbon market) = Green Growth Opportunity for employment and economic-social development



Source: Lee, Hoesung, Chair of IPCC & Kim, Sang Hyup 2016

Green Growth Architecture in Korea since 2008



KAIST Graduate School on Green Growth
Coalition for Our Common Future

Green Big Bang to Move Faster and Bigger

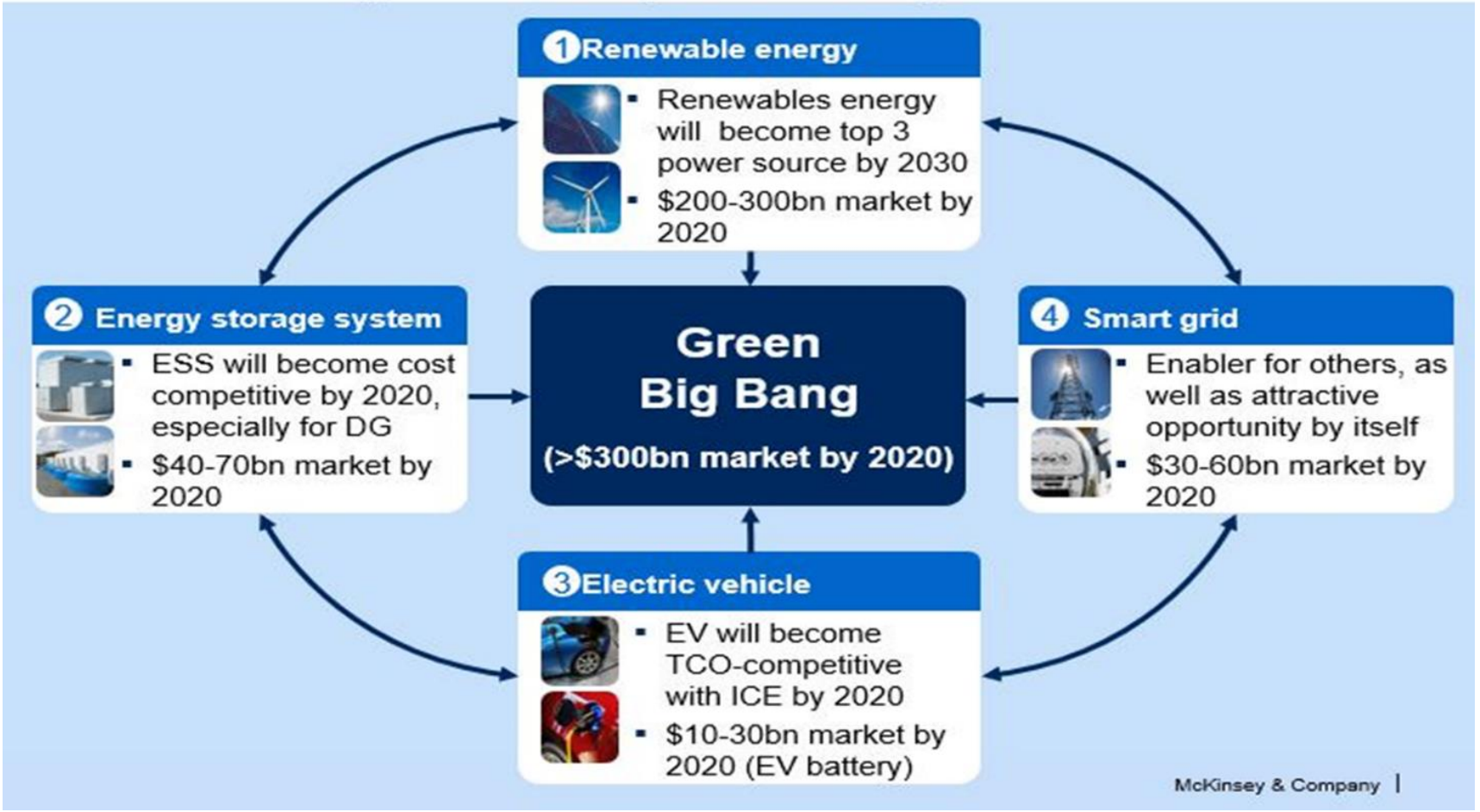
New Energy ➔ New Economy & New Jobs
New Transport ➔ New Way of Life
New Communication ➔ New Power Shift

If you get renewable energy, energy storage system, electric vehicle and energy internet altogether, you can **exponentially change the world** and **spur new industrial revolution**. **(Jeremy Rifkin)**

“GREEN BIG BANG”

RE-EV- ESS-SG Low Carbon New Industrial Ecosystem

Four pillars for Green Big Bang: Their interoperability will transform life, business and the global economy fundamentally



Green Big Bang: Green New Deal Frontier Jeju , where nature and humans cohabitate

“The largest island and special province in Korea “

“ Natural World Heritage site, but in climate trouble”

- **Population:** 692,032 people (2018)
- **Economy:** Jeju’s GRDP(Gross Regional Domestic Product) 19.9 trillion won (2018)
- **Tourism:** 15.02 million tourists (2019)

Vision for International Free Jeju Since 2001 and its Revision into Green & Smart City

VISION

"Jeju, a green smart city where people and nature coexist."

TARGET

People	Environment	Economy	International Exchange
Safe & comfortable place to live. Happy Jeju	Sustainable Island Clean Jeju	vibrant and win-win economy. Innovative Jeju	Interacting with the world. Global Jeju

STRATEGY

Happiness	Strategy 1	Creating a pleasant and healthy living space
	Strategy 2	Expands a convenient, intelligent infrastructure foundation
	Strategy 3	Strengthening inclusive policies across generations, and gender
Cleanness	Strategy 4	Clean environment management and attractive landscape creation
Innovation	Strategy 5	Expansion of Jeju Industrial Foundations
	Strategy 6	Promote innovation capabilities for future industry
Global	Strategy 7	Promoting international exchanges and expanding the world-class cultural foundation
	Strategy 8	Improving foreign settlement conditions to strengthen global competitiveness

History of Jeju CFI and Invitation to Paris COP

CFI (Carbon Neutrality) 2030 : RE, EV 100%

The CFI 2030 is about reducing greenhouse gas emissions ambitiously through achieving objectives including 100% renewable energy and 100% electric vehicle.

Renewable Energy

Carbon Free Island 2030

Renewable energy capacity : 4,085 GW

Electric Vehicles

Regulation-Free EV Charging Special District

Regulation-Free Drone Service Special District

# of EVs on the road: 377,000

Energy Efficiency

Smart City Challenge 2020

Energy Efficiency: 23%

CFI 2030 Jeju, Renewables

14% RE. #1 in Korea
Achieved 70% of government target

30% of local power demand supplied with renewables

Country's first offshore wind farm: Jeju Tam-Ra Offshore Wind farm + first Floating Wind-power Test bed 2021

CFI 2030: Milestones in 2019

As of now, renewable energy comprises 15% of the energy mix and 20,000 EVs are on the road: both numbers are at the top of the national ranking.

Gapado Smart Grid Pilot
- **Wind: 250kW**
- **Solar: 144kW**
- ESS: 3,860kW
- Diesel: 450 kW

Capacity (2019)
- Total: 1,468 MW
- **Wind: 290 MW (20%)**
- **Solar: 261 MW (18%)**
- Others: 917 MW (62%)

Phase 1 (2012) → **Phase 2 (2020)** → **Phase 3 (2030)**

Output (2019)
- Total: 5,700 GWh
- **Wind: 550 GWh (9%)**
- **Solar: 250 GWh (4%)**
- Others: 4,900 GWh (86%)

CFI 2030 Jeju, Electric Vehicles

Exceeded 20,000 units for the first time

Designated as a special zone for regulation- free EV charging district

EV battery industrialization center

No More ICE Registry by2030

CFI 2030 Jeju, Demonstration of Smart Grid

First Smart Grid Pilot Test

First to secure SG interoperability technology

Supporting domestic companies venture into the world

CFI 2030 Jeju, Gapa Island

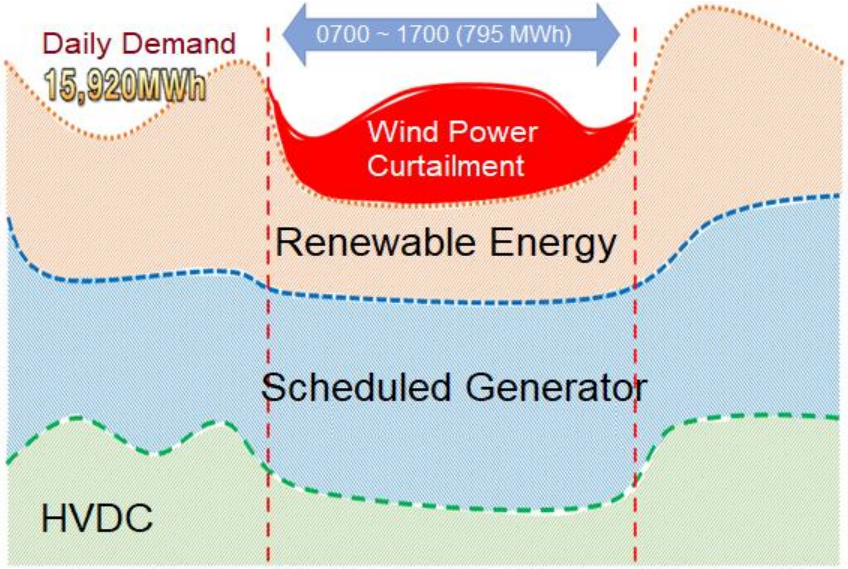
First RE energy independent island

Remote metering, efficient microgrid operation center

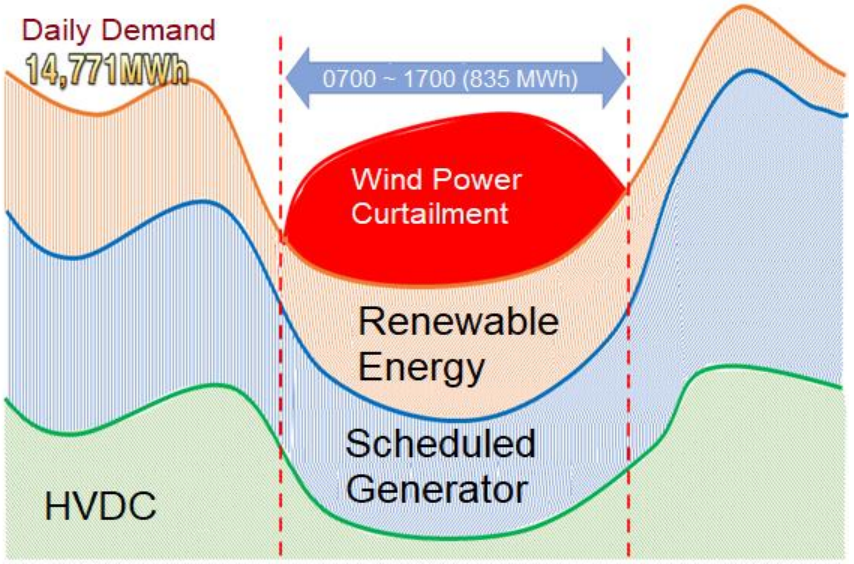
All wires underground

Curtailment Problem of Renewables !

The surge of renewable power generation is invoking a problem known as curtailment. In 2015, total renewable energy opportunity lost due to curtailment amounted up to 152MWh (3 times). In 2020, this figure increased to 13,417MWh (45 times) by September.



[2019 Curtailment in Jeju's Power Grid]

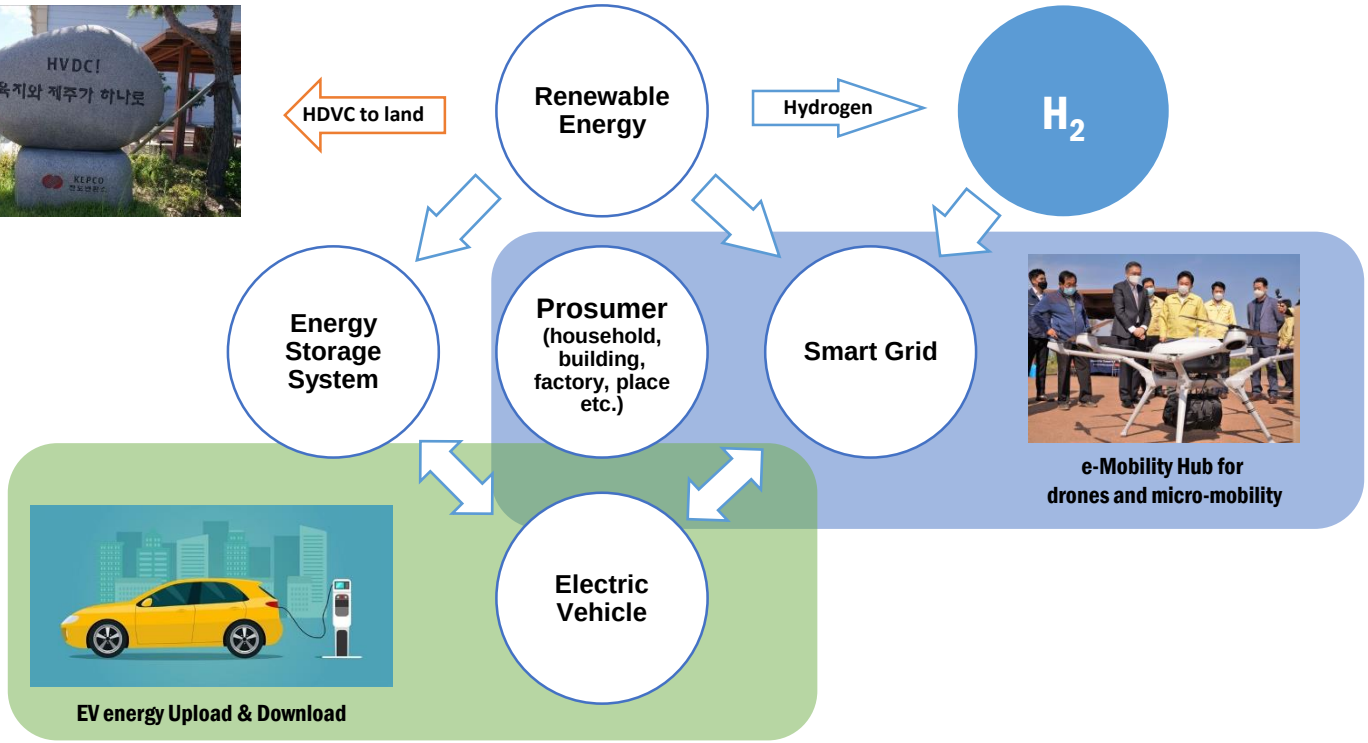


[2020 Curtailment in Jeju's Power Grid]

Source : Korea Power Exchange

“Problems are New Opportunities “ : P2G pilot district, V2G, VPP, HVDC…

Technological solutions to the issue of curtailment include: using excess electric power to generate hydrogen, storing excess power in ESS and V2G vehicles, and +DR.



Multiple Solutions for Power Curtailments

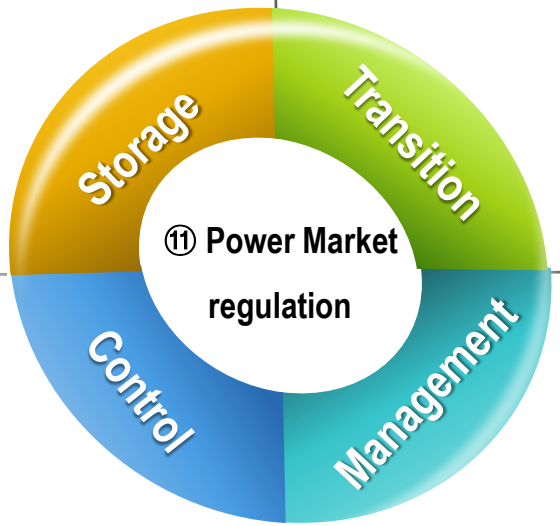
① BESS

② V2G(EVs)

③ P2G(Green Hydrogen)

④ P2H(Heat Pumps)

⑤ Electrification



⑧ AGC(Auto control)

⑨ Output Prediction

⑥ DR(Demand Response)

⑦ VPP(Virtual Power Plant)

Transmission

⑩ HVDC

North-East Asia Super Grid (Green Energy Ring)

Paradigm shift to Distributed Energy System

	Current Energy System	Distributed Energy System
Direction	① Centralized power generation system based on large scale power plants ② Consumption in cities from a long-distance coastal area generation	① Distributed generation schemes based on small power plants ② Build infrastructure that can be produced and consumed locally
Infra.	① Linear nationwide network ② One-sided power system *power producer → T&D → Consumer	① Area-Based Micro Grid ② Two-way system based on prosumer platform
Power Transaction	① An efficiency-driven power market based on economies of scale ② No emergent dispatch of Variable RE	① Self-consumption, trading near demand ② Strengthen generation management by a bidding system for renewable energy
Energy Decentralization	Establishing a centralized power system led by the central government	Central and local governments collaborate to establish a decentralized energy system and encourage residents to participate

Planning to Designate Jeju as a Nation's No.1 Special District for Distributed Energy

Regulatory improvements (deregulation, liberalization of power transactions)

+

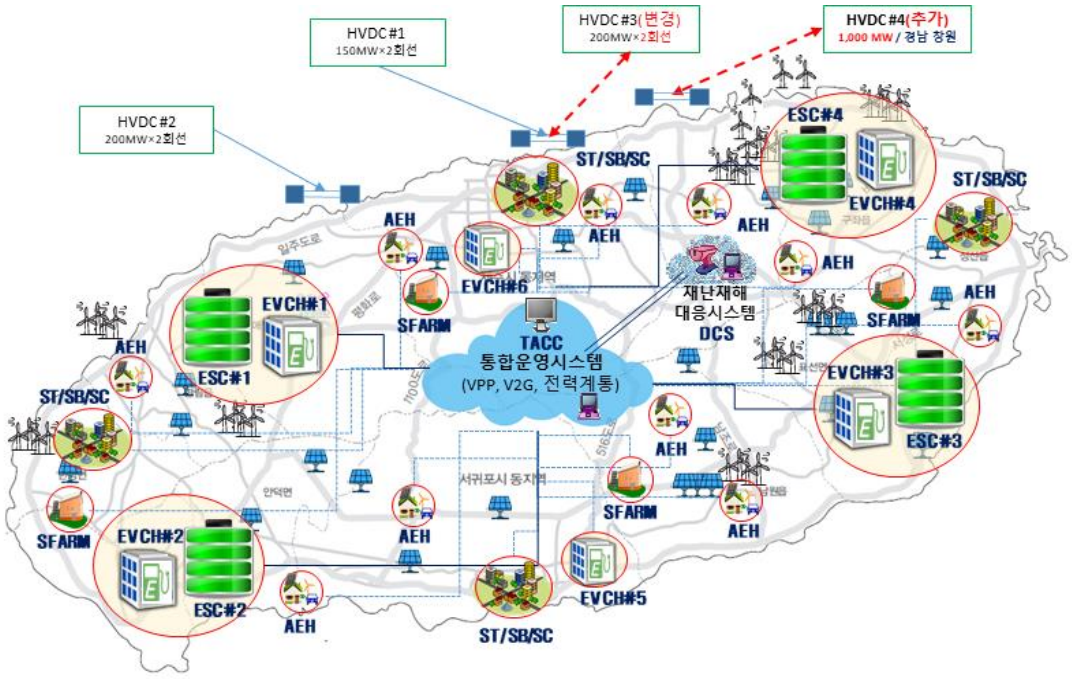
Establishing an industrial framework (production, utilization, industrialization)

Special District for Distributed Energy | VPP, Monitoring system for RE + Energy governance

Green New Deal Initiative

3-phase (town → district → city)

As New Deal Frontier, Jeju plans to lead the global green smart city through ecofriendly pioneering RE300 MEGA Green Big Bang Projects



HVDC Expansion
- #3 200MW x 2
- #4 1,000MW
- Land-Jeju Bilateral Stabilizer
- Reduce curtailment

ESS
- 500MWh x 4
- Store renewable energy

EV Charging Station
- 6 charging stations
- 500 simultaneous charging
- V2G connected EV Charging Tower

ST/SB/SC
- Microgrids in apartments, town houses, etc.
- Transform public bldgs. to smart bldgs.

Smart Farm
- Smart farming & distribution
- Energy independence & management

AEH
- Transform household heat energy into RE

TACC
- Integrated VPP, V2G, grid monitoring
- RE300 generation & supply-demand management

DCS
- TACC-connected disaster control system using AI, Big Data

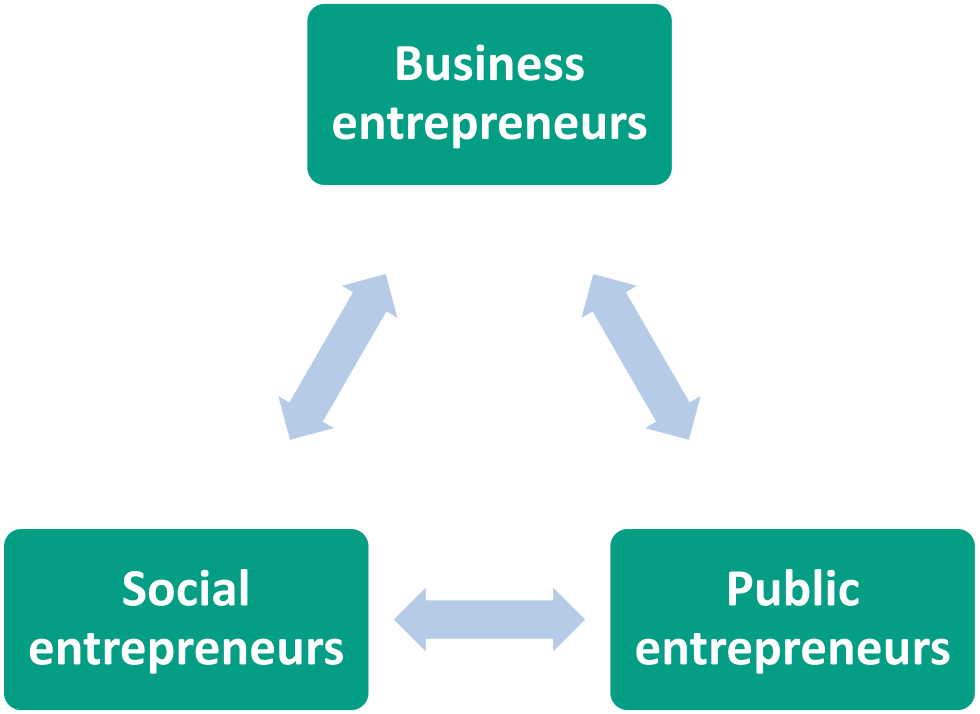
Jeju's CFI & New Frontier Governance is structured on three stakeholder

Local Citizens, experts, businesses ➔ Green City (Ministry of Environment), Smart Challenge City (Ministry of Land and Transport), Special District of Decentralized Energy System (Ministry of Industry and Energy)…

Local Citizenry Governance	• 43 Representatives from each districts • 66 Jeju citizens chosen through public participation • The citizenry's main duty during their 1-year term is CFI policy monitoring and consulting
CFI Expert Governance	• 21 CFI Subject Matter Experts • Expert background include electric vehicles, renewable energy, hydrogen energy and climate change
CFI Business Governance	• 18 CFI Businesses & Stakeholders • The majority of entities in this governance structure operate in the energy sector (electric power, gas, wind, solar, etc.) • Businesses also have a 1-year term

Young entrepreneurs we all need for New Frontier

Long and tough ways for pioneers to go !
We need to anchor our goals within the business and society together.



The entrepreneurship should engage in partnerships to induce deep impact: we need **business entrepreneurs, social entrepreneurs, public entrepreneurs together**.

E.O.D

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