



CATALYSTS FOR ENERGY TRANSFORMATION

New US and EU Policy Ecosystems as Global Climate Risk Escalates

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March 28, 2023



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O U T L I N E

- US Policy Ecosystem (Byrne)
 - President Biden's Inflation Reduction Act of 2022 (IRA)
 - Polycentric Layer of State & City Innovation
- EU Policy Ecosystem (Taminiau)
 - EU Green Deal (2020) + REPowerEU (2022)
 - Polycentric Layer of State & City Innovation
- Learning from U.S. and EU Experience (Byrne)

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FOUNDATION FOR
RENEWABLE
ENERGY &
ENVIRONMENT
freefutures.org

EVEN THE WEALTHY CANNOT AFFORD TO SLOW-WALK NOW

BILLION DOLLAR DISASTERS – U.S. DAMAGE COSTS (2005-2021)



Winter Storms: ~\$ 41 Billion



Droughts & Wildfires: ~\$243 Billion



Flooding & Erosion: ~\$375 Billion



High-Intensity Storms: ~\$943 Billion

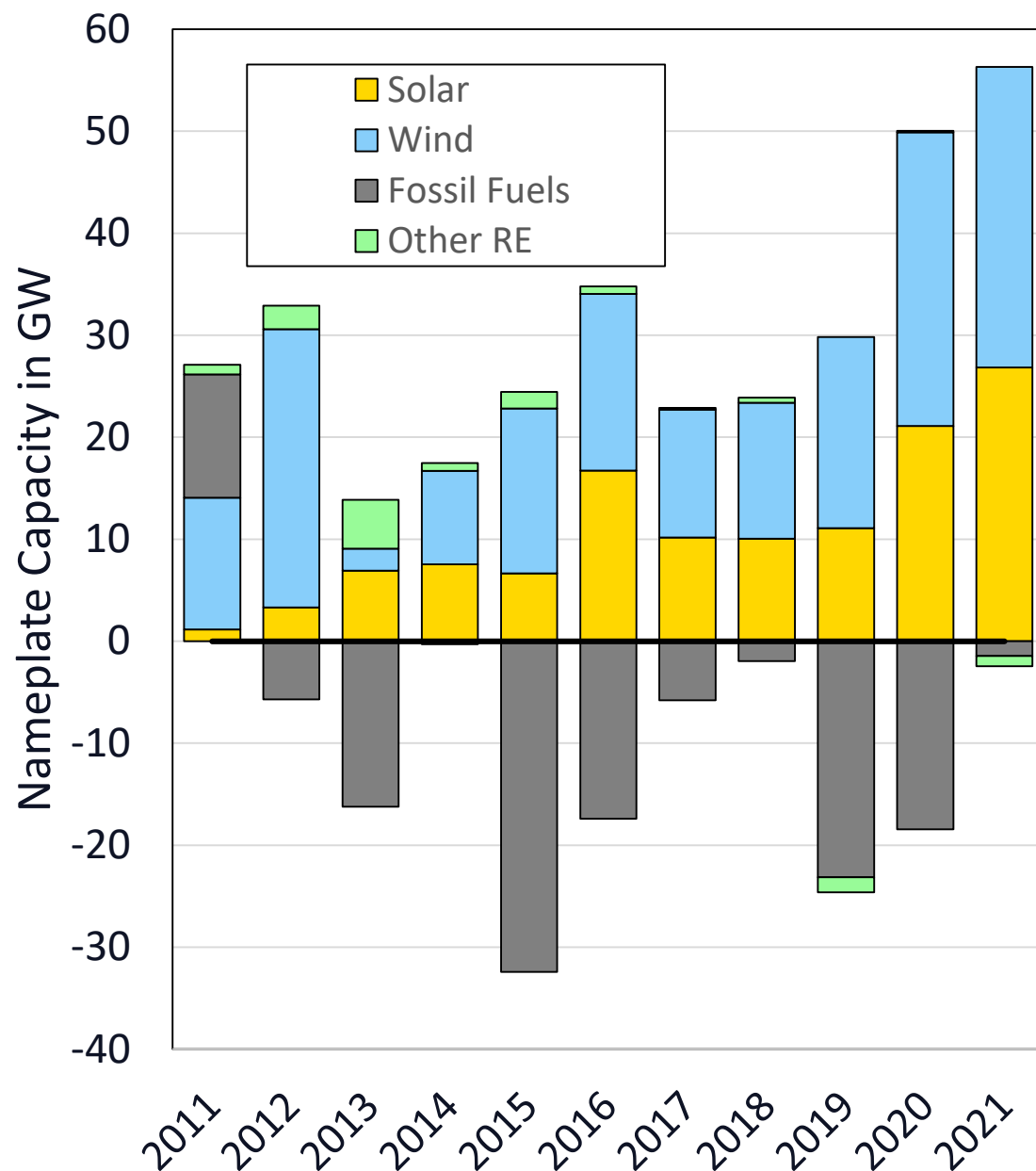
16-YEAR COST TO U.S. \$1.6 TRILLION

U S P O L I C Y E C O S Y S T E M

U.S. ELECTRIC POWER SECTOR MARKET GROWTH (2011-2021)

Nameplate Capacity in GW

- Solar and wind are fastest growing sources of new energy supply
- Increasingly, new large-scale solar and wind energy facilities are co-located with battery storage
- Substantial fossil fuel capacity retirements, especially coal-fired power plants
- Projections indicate an acceleration of the above processes



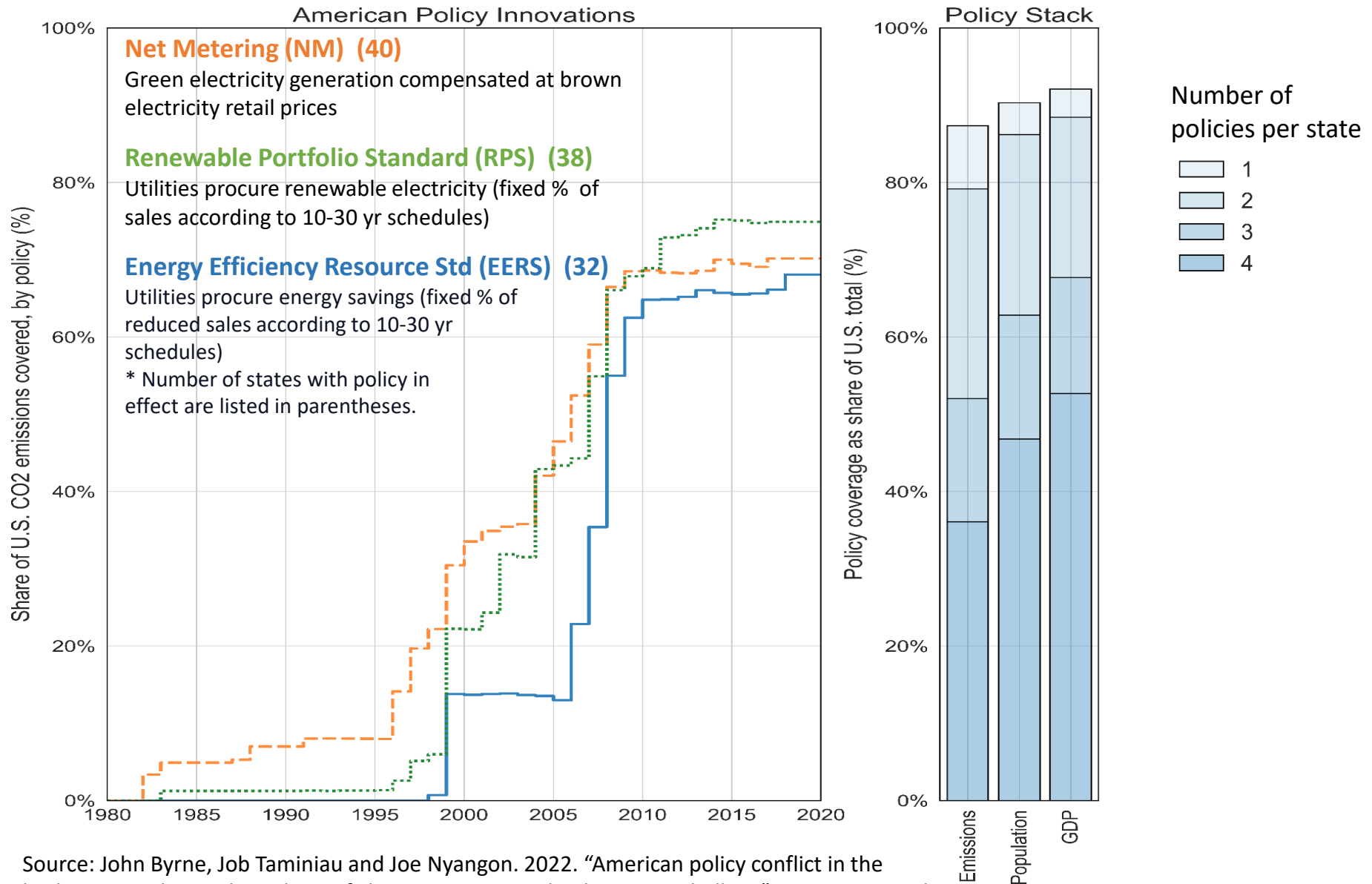
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President Biden's Inflation Reduction Act (IRA) (2022)

- “Historic” Legislation (1st to pass in 20 yrs)
- Largest climate & energy policy spend in U.S. federal history ~\$400 billion
- ~42% GHG emission reduction by 2030

Clean Electricity Tax Credits, \$161 Billion
Air Pollution, Transportation, and Infrastructure, \$40 Billion
Individual Clean Energy Incentives, \$37 Billion
Clean Manufacturing Tax Credits, \$37 Billion
Clean Fuel and Vehicle Tax Credits, \$36 Billion
Conservation, Rural Development, and Forestry, \$35 Billion
Building Efficiency and Electrification, \$27 Billion
Other, \$14 Billion

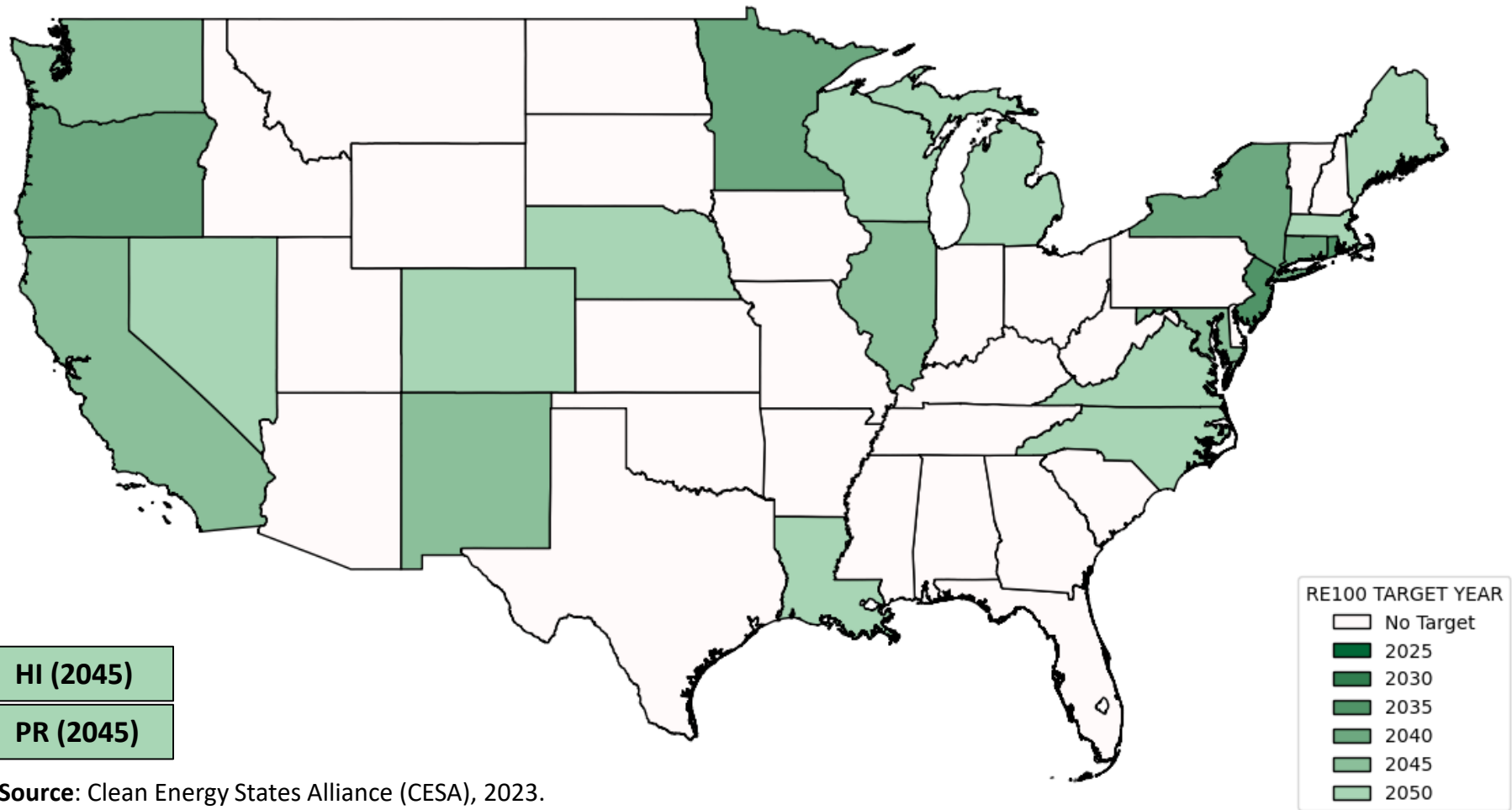
U.S. “POLYCENTRIC” LAYER OF ACTION



Source: John Byrne, Job Taminiau and Joe Nyangon. 2022. “American policy conflict in the hothouse: Exploring the politics of climate inaction and polycentric rebellion.” *Energy Research & Social Science*: <https://doi.org/10.1016/j.erss.2022.102551>

A New American Transformative Policy -- Inclusion

(23 States, Washington DC and Puerto Rico have adopted 100% Renewable Energy Standards)



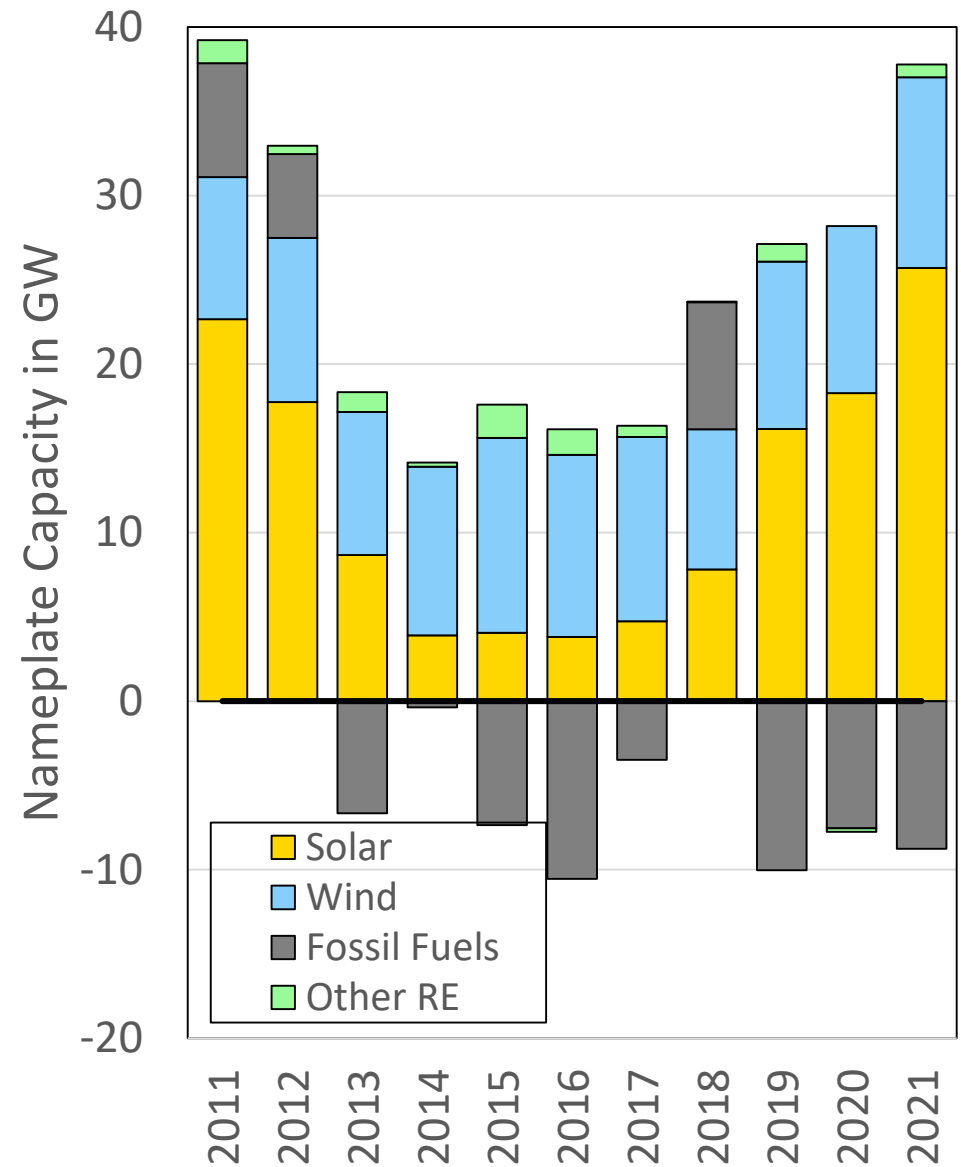
Source: Clean Energy States Alliance (CESA), 2023.

EU POLICY ECOSYSTEM

EU ELECTRIC POWER SECTOR MARKET GROWTH (2011-2021)

Nameplate Capacity in GW

- Solar and wind fastest growing sources of new energy supply
- Invasion of Ukraine by Russia has caused adoption of a new policy platform – REPowerEU
- Substantial fossil fuel capacity retirements, especially coal-fired power plants and, recently, natural gas plants
- Projections indicate an acceleration of the above processes



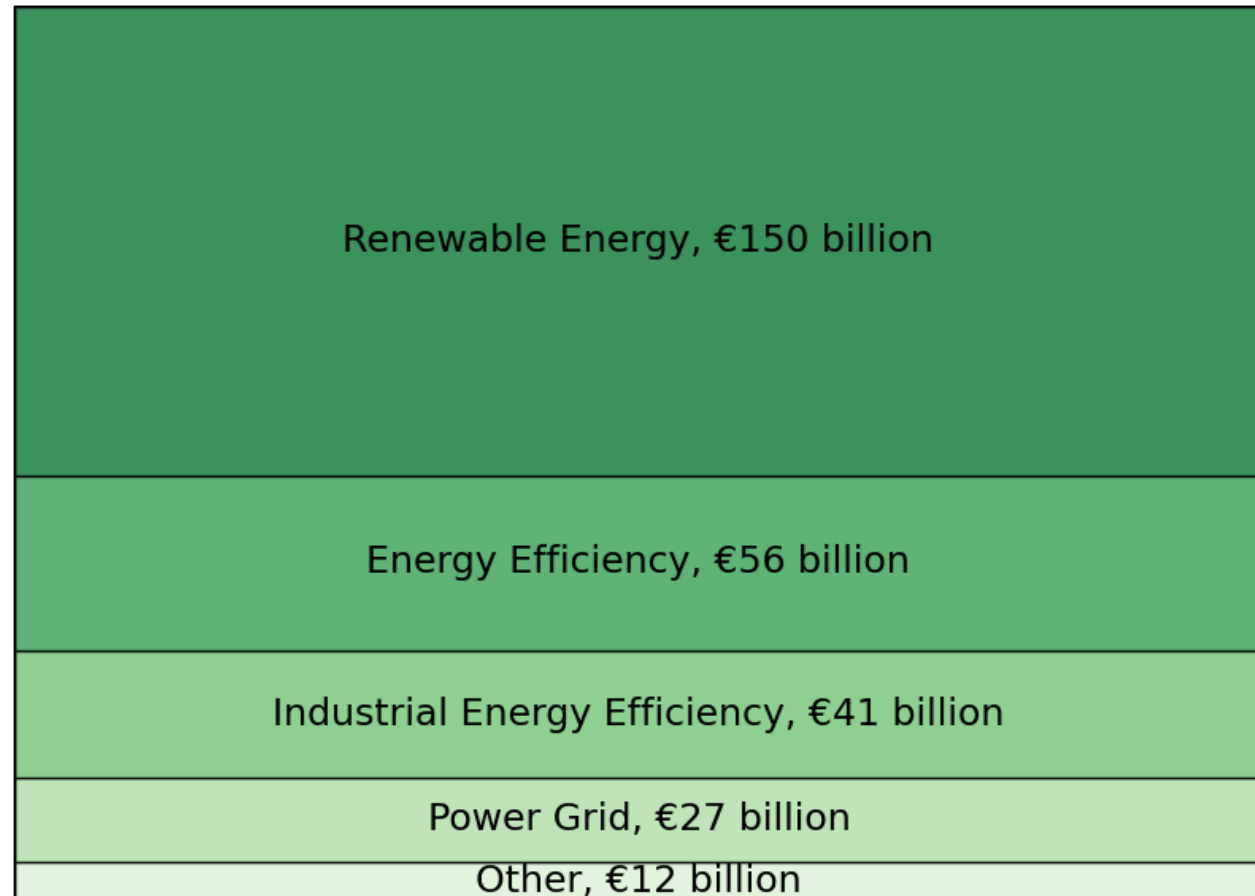
Sources: Eurostat NRG_INF_EPC and NRG_INF_EPCRW; Solar Power Europe (2023); WindEurope (2023); Global Energy Monitor (2023).

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The European Green Deal + REPowerEU

- EU's Green Deal is the Union's 'enabling framework' and envisions:
 - €1 trillion in private and public spending
 - 45% RE supply and 55% GHG reduction by 2030
- By 2050: EU intends to be the 1st climate-neutral continent

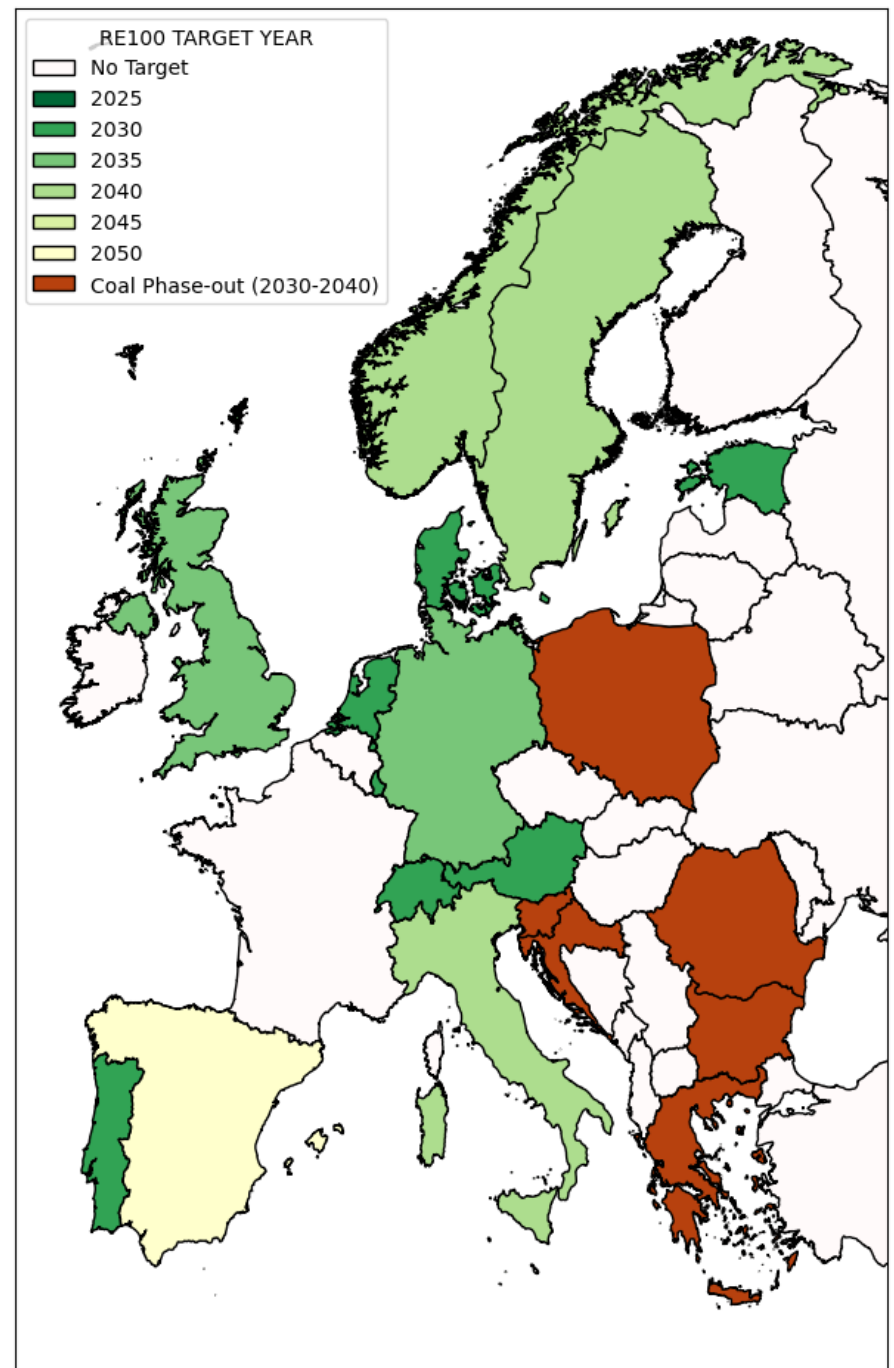
REPowerEU Accelerates Energy Decarbonization of the Union
Funding includes: (2022-2027)



100% RENEWABLE ENERGY AND COAL PHASE-OUT PLANS WIDELY ADOPTED ACROSS EUROPE

- 14 EU nations have formally adopted 100% renewable energy targets in the electric power sector
- Eastern European nations focusing on coal phase-out effort

Sources: REN21 Renewables 2022 Global Status Report (<https://www.ren21.net/gsr-2022/>), EMBER Renewable Energy Target Tracker (2022) (<https://ember-climate.org/data/data-tools/european-renewables-target-tracker/>).

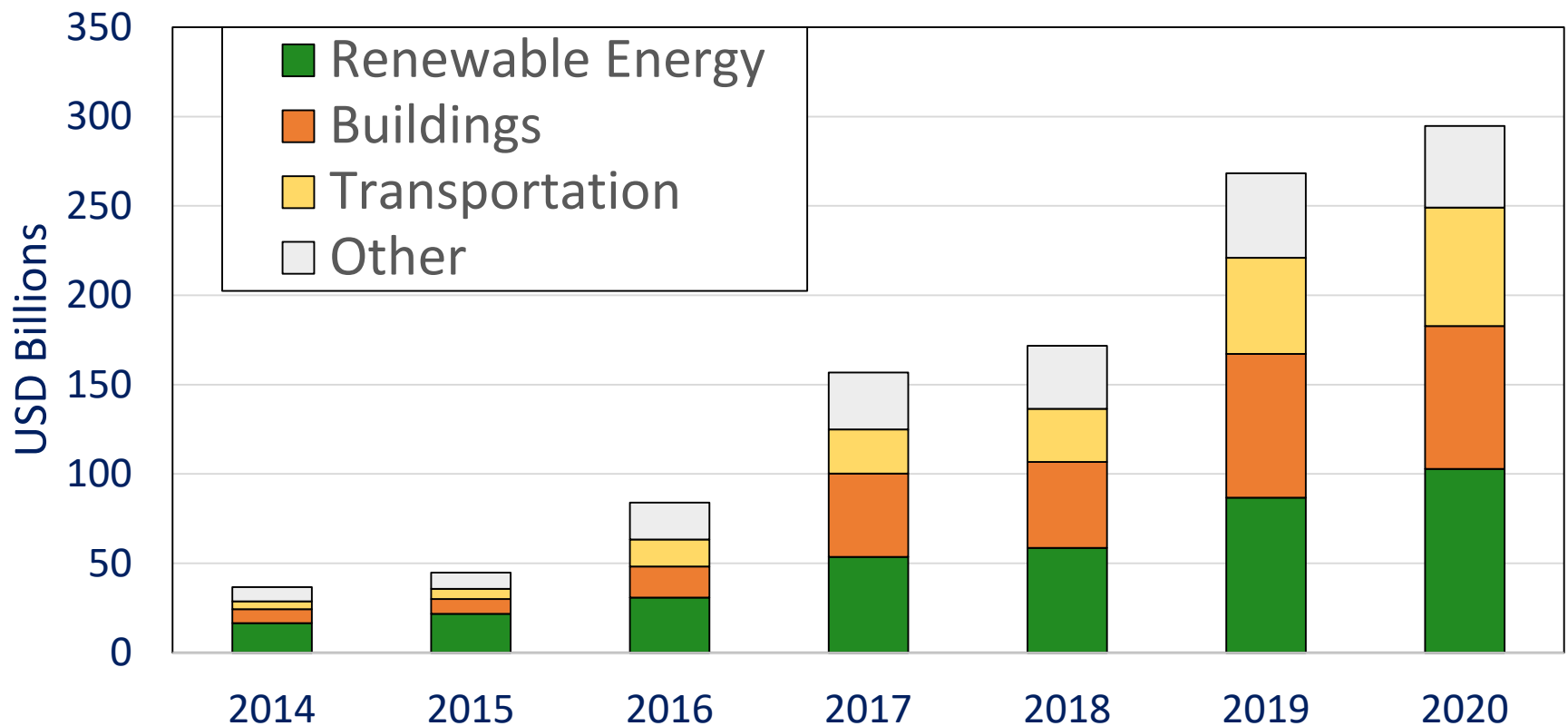


A POSSIBLE AGENDA

BASED ON US & EU EXPERIENCE

LESSON

Global Green Bond Market Active in Renewable Energy, Buildings, and Transportation Sectors

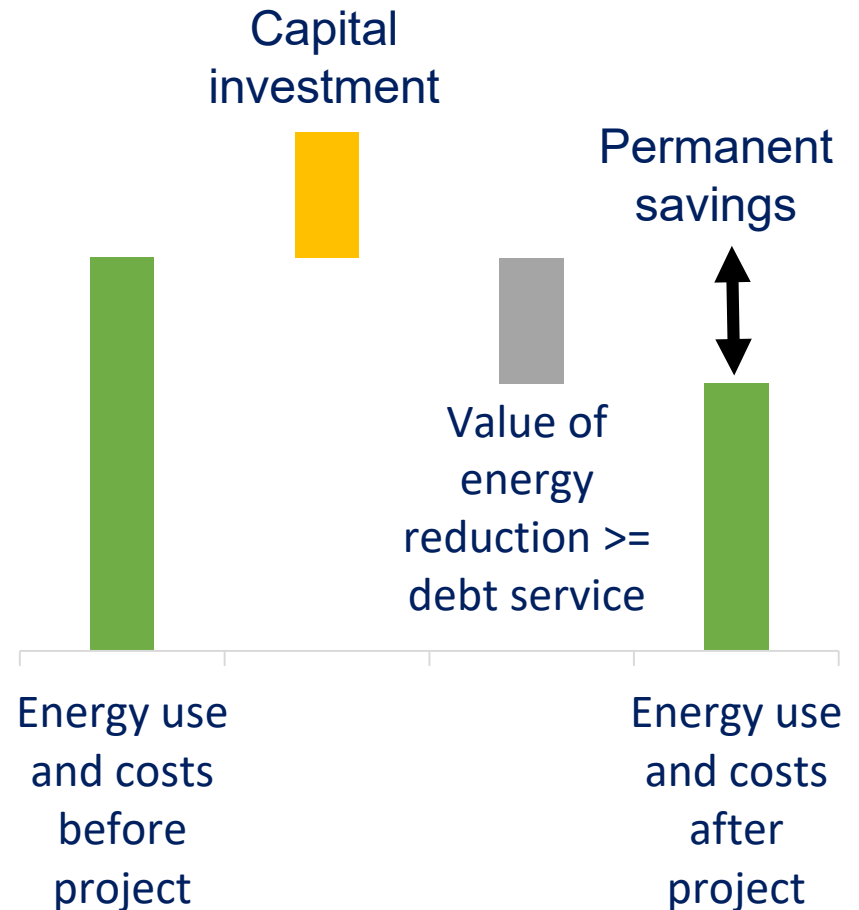


Source: Climate Bonds Initiative (CBI) (2023). (<https://www.climatebonds.net/market/data/#use-of-proceeds-charts>)

SUSTAINABLE ENERGY UTILITY (SEU) BOND FINANCING

Self-Financing as a Basis for Capitalization

- Bond financing strategy for permanent energy savings
- Savings match or exceed all capital and program costs
- Attract low-cost capital at scale



TRANSFORMATIVE SUSTAINABLE ENERGY PROJECT

US CONTEXT

- Project:** 4-campus College in Pennsylvania 's capitol (completed March 2023)
- Mission:** Modernize energy and water infrastructure serving more than 40 buildings (many were built in the 1960s)
- Upgrades:** Comprehensive LED lighting retrofit
HVAC upgrades
Water conservation systems
Building automation
Rooftop and parking lot canopy solar plant serving more than 20% of the 4-campus electricity demand
- Funding:** Municipal bond borrowing of \$11+ million technology investment
Repayment from
+ \$13.5 million Guarantee of Savings over 15 years
(20% annual energy & water bill savings)
+\$1.6 million Guarantee of Savings (solar power purchase agreement at a price always below the incumbent utility tariff for 15 years)
- Contractor:** Top-rated international energy engineering & construction firm active in 100 countries with annual revenue of \$31 billion

Dr. John Byrne, FREE's president: "A triple bottom line project: it saves energy and water using much better technology that will lower College costs for at least 15 years; it provides jobs and economic activity to the region; and it demonstrates the importance of sustainable infrastructure."

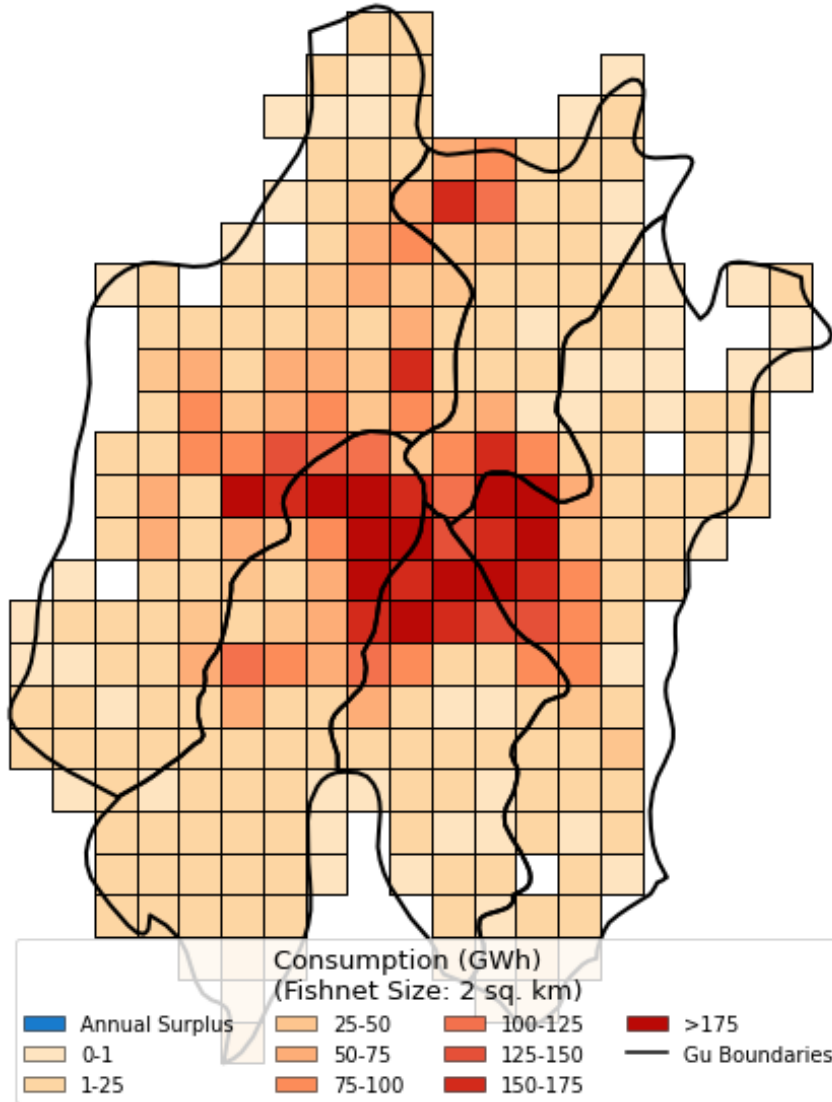
DR. JOHN BYRNE, FREE'S PRESIDENT

“A triple bottom line project: it saves energy and water using much better technology that will lower College costs for at least 15 years; it provides jobs and new business to the region's economy; and it proves that environmental improvement and economic development can be compatible policy goals.”

DAEJEON SUSTAINABLE CITY

Saving + Solar Strategy

Sources: Byrne et al. (2019). Benchmarking Korea's '3020' Renewable Energy Plan and Quantifying 'Smart Energy City' Assets using a Case Study of Daejeon. Final Report to Korea Institute for Energy Research (KIER). See also Taminiau et al. (2021). Infrastructure-scale sustainable energy planning in the cityscape: Transforming urban energy metabolism in East Asia. *Wiley Energy and Environment*.



DAEJEON CONSUMPTION BASELINE

- Daejeon total electricity use (all uses) 2018: **~9.7 TWh**
- High levels of electricity use in central Daejeon
- Annual cost: **495 million USD**

DAEJEON SUSTAINABLE CITY

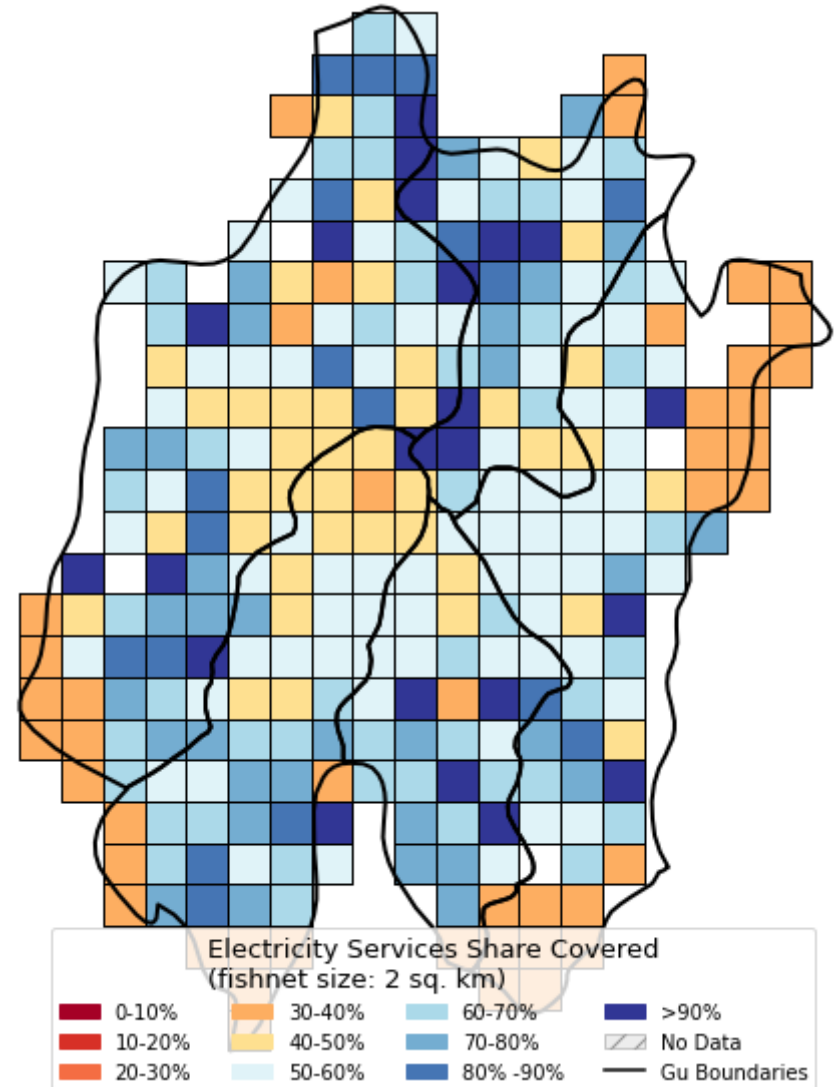
Saving + Solar Strategy

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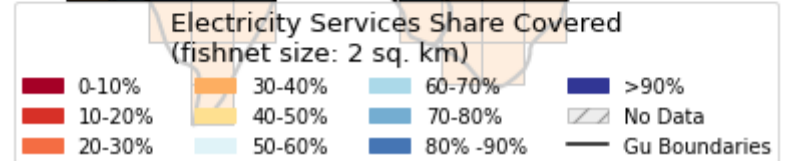
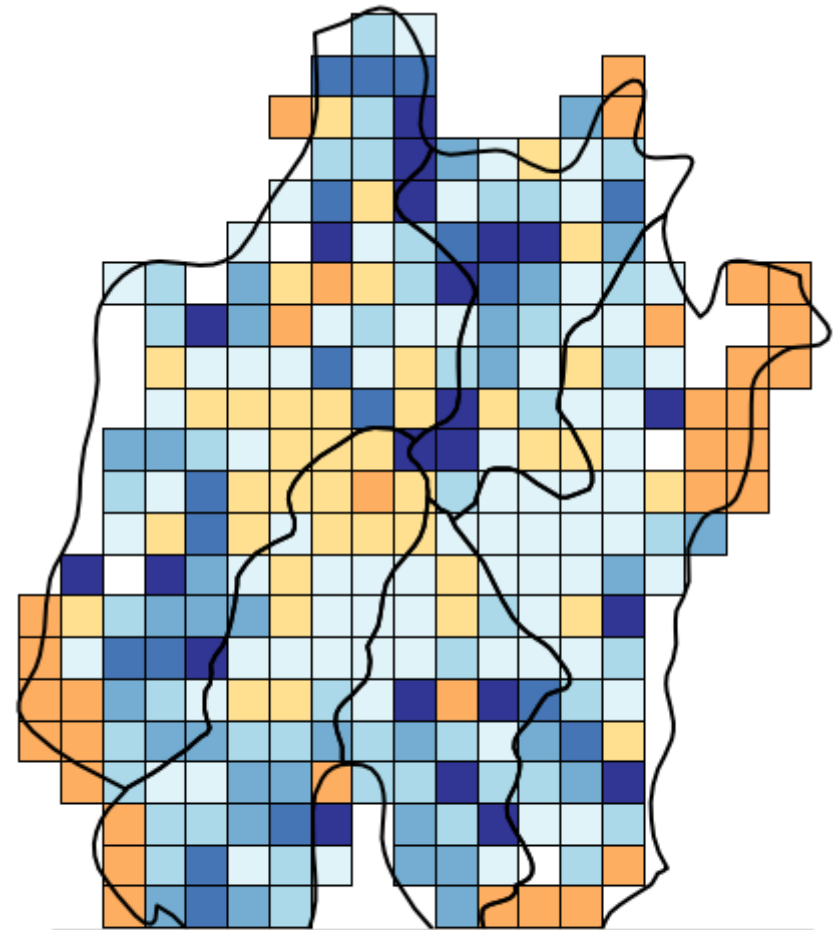
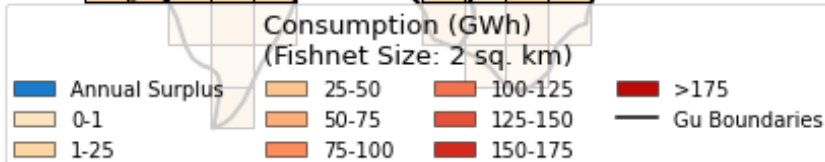
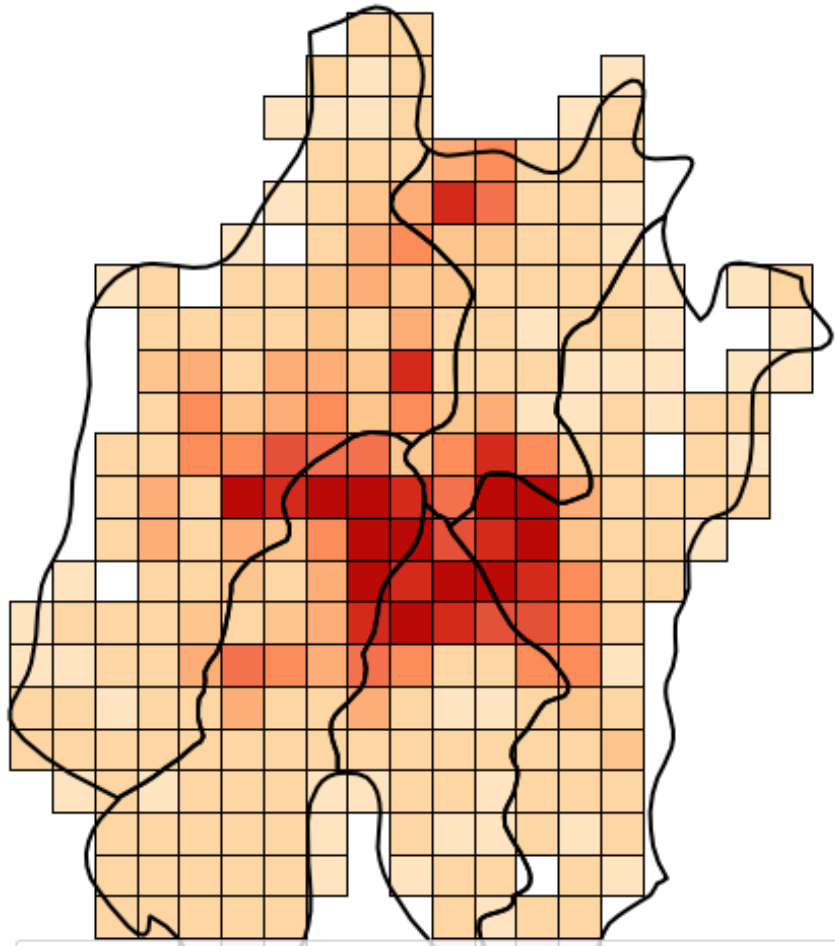
- **56%** of electricity services supplied by a **Saving + Solar** City Strategy
- **~ Half** of the city area would meet at least 50% of its electricity needs from **Sustainable Energy**
- **~15%** of the city could **export power** during much of the year (>80% of annual electricity needs)
- Annual savings > **65 million USD**



DAEJEON SUSTAINABLE CITY – TRANSFORMED

Saving + Solar Strategy

Sources: Byrne et al. (2019). Benchmarking Korea's '3020' Renewable Energy Plan and Quantifying 'Smart Energy City' Assets using a Case Study of Daejeon. Final Report to Korea Institute for Energy Research (KIER). See also Taminiau et al. (2021). Infrastructure-scale sustainable energy planning in the cityscape: Transforming urban energy metabolism in East Asia. *Wiley Energy and Environment*.



A POTENTIALLY TRANSFORMATIVE POLICY FOR THE KOREAN CONTEXT

3 NEEDS

- PV Development Policy Targeting Building Rooftops and Parking Areas
- Financing to Attract Investors
- An Enabling Framework Inviting Cities and Regional Authorities to Catalyze Local Innovation and Participation

E X T R A S L I D E

LESSON

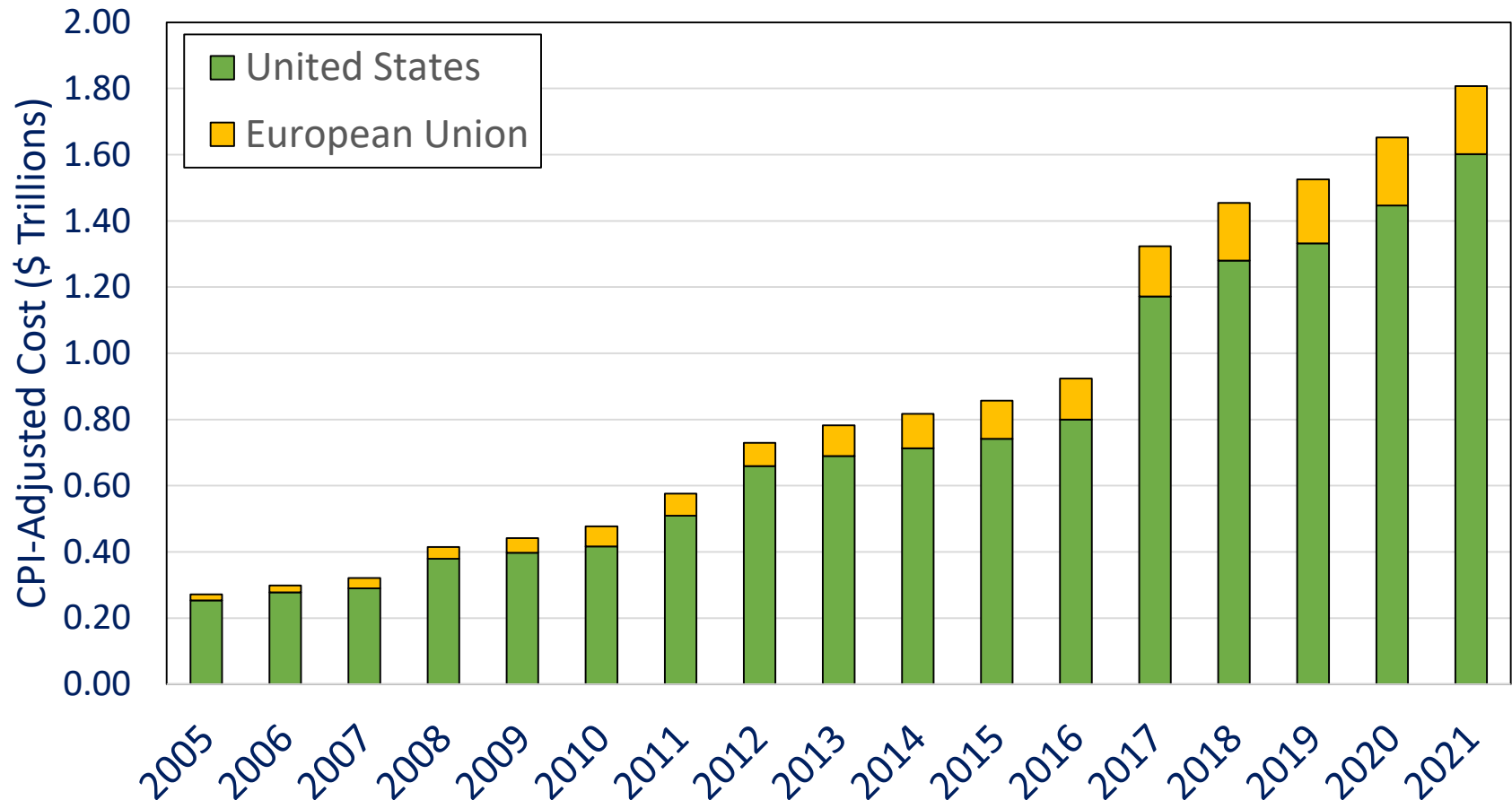
EU Solar Energy Rooftop Initiative (+58 TWh by 2025)

- Ensure that all new buildings are “solar ready”.
- Rooftop solar energy installation compulsory for:
 - all new public and commercial buildings (>250 m²) by 2026;
 - all existing public and commercial buildings (>250 m²) by 2027;
 - all new residential buildings by 2029.

California Rooftop Solar Mandate

- All new single-family dwellings and multi-family dwellings up to three stories high must install solar PV
- Took effect on January 1, 2020
- PV installation needs to be sufficient to cover annual electricity usage
- Community Solar Model created to enable all municipalities to invest in and procure solar PV

COST OF EXTREME WEATHER EVENTS IN THE U.S. AND EU (CUMULATIVE) (2005-2021)



Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023).
<https://www.ncei.noaa.gov/access/billions/>, DOI: 10.25921/stkw-7w73