

TECHNOLOGY

Edison's Pearl Street Station

The first power plant began operations in NYC.

NJ PJM Interconnection Established

First regional grid in NJ.

Nuclear Power Plants

Expansion of nuclear power plants as a baseload energy source, reducing dependence on fossil fuels.

USA, First Commercial Gas Turbine Combined Cycle Power Plant

First combined-cycle gas turbine plant began operation, improving efficiency in electricity generation.

Digital Relays

Digital relays were introduced for more efficient grid monitoring, reducing transmission losses.

First Offshore Wind Farm- Denmark

Denmark inaugurated the world's first offshore wind farm, Vindeby, with a capacity of 5 MW. This marked the beginning of offshore wind energy utilization.

Horns Rev 1

Denmark commissioned Horns Rev 1, one of the first large-scale offshore wind farms with a capacity of 160 MW, setting a precedent for future developments.

Electric Vehicles (EVs)

First widespread deployment of electric vehicles (EVs), beginning with Tesla's Roadster and early hybrid models like the Toyota Prius.

11GW- Offshore Wind Installation Capacity

Offshore wind installations worldwide reached a total capacity of over 11 GW

Average Size of Turbines Grows

The average size of newly installed offshore wind turbines grew to 6.8 MW

Data Centers and Energy Demand

Growth of data centers and AI-related computing led to increased electricity demand, requiring grid expansions and efficiency improvements.

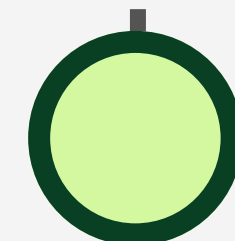
Data Center Electricity Usage

Total yearly data center electricity usage climbed to 176 TWh, enough to power ~16.5 million homes.

Solar Energy Production

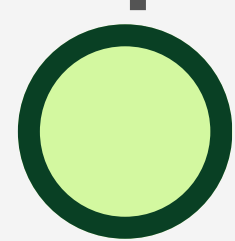
Solar energy accounted for 7% of New Jersey's total in-state electricity generation.

1882

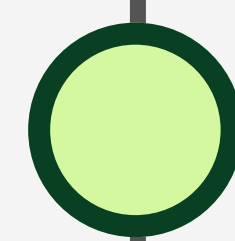


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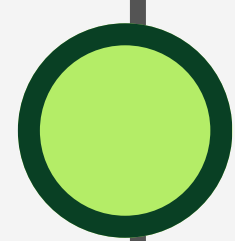
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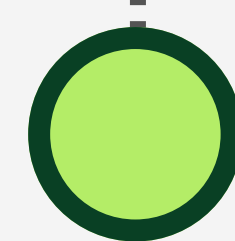
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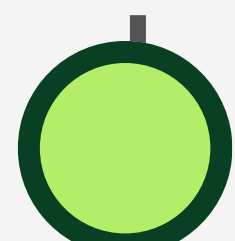
1950-1970'S



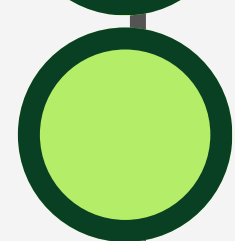
1950'S



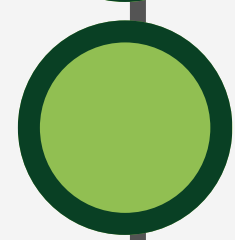
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1965



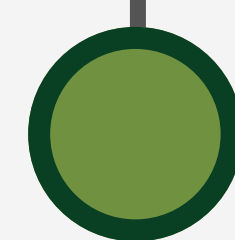
1980



1980'S



1990'S



1991



2000'S



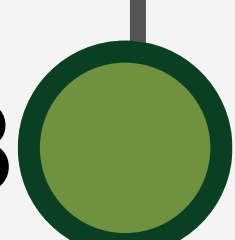
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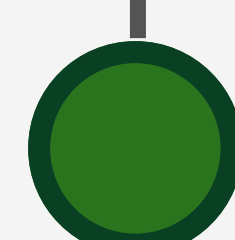
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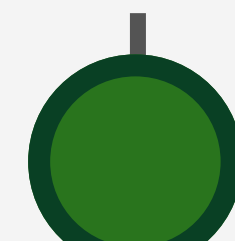
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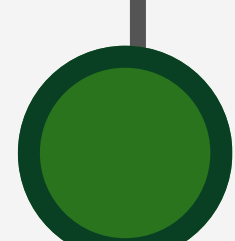
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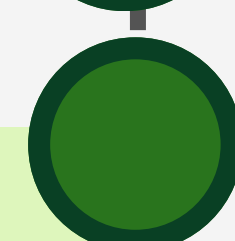
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2016



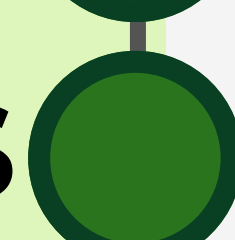
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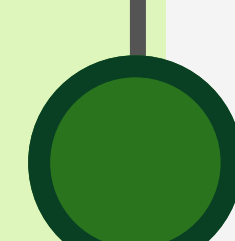
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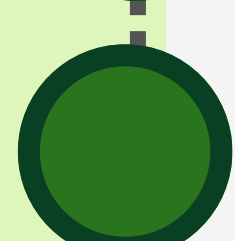
2020'S



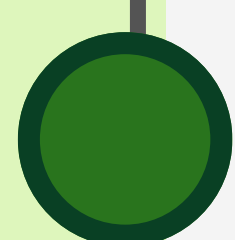
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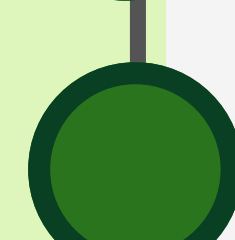
2023



2023



2023



Alternating Current (AC)

AC enabled efficient long-distance electricity transmission and dramatically increased grid demand.

USA, First Commercial Gas Turbine Power Plant

Air-conditioning (AC)

Widespread adoption of air conditioning (AC) increased residential and commercial electricity demand, straining power grids.

Great Northeast Blackout

Supervisory Control and Data Acquisition

Early SCADA (Supervisory Control and Data Acquisition) systems improved grid automation and reliability.

Wind and Solar Power Growth

Spurred by state-level renewable portfolio standards and federal tax incentives.

Expansion of Smart Grid Technology

This enabled more efficient energy distribution and real-time monitoring.

Offshore Wind Capacity Surpasses 1GW

Total installed offshore wind capacity worldwide surpassed 1 GW, showing growing investment in the sector.

Data Center Electricity Usage

Yearly data center electricity usage climbed to 58 TWh.

Block Island Wind Farm

The U.S. launched its first offshore wind farm in the Block Island Wind Farm, with 30 MW of capacity off the coast of Rhode Island.

AI, Machine Learning, and IoT

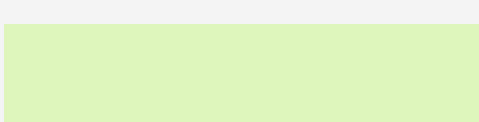
Integrated AI, machine learning, and IoT into grid operations, improving real-time energy management.

Global Offshore Wind Capacity

Global offshore win capacity surpassed 34 GW.

Data Centers- 4.4% of Total U.S. Electricity

Data centers accounted for ~ 4.4% of total U.S. electricity and are expected to consume ~ 6.7 - 12% of total U.S. electricity by 2028.

 = Murphy Administration

DEMOGRAPHY & INFRASTRUCTURE

US-1 Completed

Trenton & New Brunswick Turnpike.

1803

1854

Railroad to Atlantic City

Railroad to Atlantic City opened, expanding tourism and influencing settlement patterns in NJ.

1951

NJ Turnpike Completed.

Garden State Parkway

Garden State Parkway opened, accelerating population growth along NJ's coast and increasing energy demand.

1955

1960'S

Suburban Expansion

Suburban expansion led to rising residential electricity consumption.

De-industrialization and Decentralization

The economy transformed toward services and away from manufacturing, and businesses moved to the suburbs and offshore. Energy demand shifted away from industrial toward commercial and residential users.

1980'S

1990-
2000'S

Population Growth

Population growth in suburban areas increased demand for electricity, leading to expanded transmission infrastructure.

Data Centers

The rise of data centers increased industrial electricity consumption, requiring enhanced grid resilience.

2000'S

Electric Vehicles (EVs)

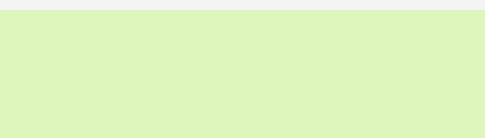
Expansion of EV charging networks and electrification policies continues to reshape urban planning and energy consumption.

2020'S

2024

Publicly Available EV Charging Ports

The US now has over 192,000 publicly available EV charging ports, with approximately 1,000 new ports added per week.

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ADAPTATION

NEW JERSEY

USA

Waterfront Development Act

The Waterfront Development Act passed to regulate and control development along the state's valuable waterfront areas by creating a permitting process requiring developers to obtain the state's approval before undertaking any construction or dredging activities in waterfront areas.

NJ Beach Erosion Commission

Established, formalizing beach replenishment as a long-term strategy.

Hurricane Donna

Killed 2 people and caused significant damage through storm surge and high winds.

Nourishment Projects

Large-scale nourishment projects became a consistent part of the state's adaptation strategy.

Hackensack Meadowlands Reclamation and Development Act

Hackensack Meadowlands Reclamation and Development Act passed, regulating wetland development to balance urban growth and ecological preservation.

Wetlands Act

Required mapping and delineating all coastal wetlands, ensuring oversight of water-adjacent developments.

Coastal Area Facility Review Act

CAFRA was enacted to regulate industrial and residential development along NJ's coastline, ensuring environmental protection and controlling land use. Initially focused on large-scale industrial sites, its scope expanded over time to include major residential projects. CAFRA has played a critical role in shaping coastal development, requiring permits and comprehensive environmental reviews for new projects.

Coastal Management Strategy

NJDEP submitted the state's first Coastal Management Strategy, integrating climate resilience into state planning.

NJ Coastal Management Program

NOAA approved NJ's Coastal Management Program (CMP), making it one of the first states to establish a CMP.

NJ Shore Protection Master Plan

The NJSPM was released, promoting a regional approach to shore protection.

Freshwater Wetlands Protection Act

NJ adopted the Freshwater Wetlands Protection Act, consolidating and integrating state wetlands protections into the CMP.

Shore Protection Stable Funding Act

NJ enacted the Shore Protection Stable Funding Act, allocating \$15 million annually for beach nourishment.

December Nor'easter

The December Nor'easter hit NJ, killing 19 and causing \$750 million in damage through coastal flooding and high winds.

NJ Blue Acres

NJ Blue Acres program was established, part of NJ's Green Acres program to address flood-prone properties.

Coney Island Beach Replenishment

The first use of beach replenishment, reflecting early coastal adaptation efforts.

American Shore and Beach Preservation Association

Founded as an organized effort to combat erosion, a serious coastal problem.

Beach Erosion Board

Formed to investigate erosion on coastal and lake waters and to protect shores.

Public Law 71-520

Authorized the U.S. Army Corps of Engineers to conduct shore erosion studies with state collaboration.

Nourishment Projects- CA

Large nourishment projects were initiated in California as part of wartime harbor dredging (e.g., San Diego Harbor deepening).

Beach Erosion Control- NC

First federally funded Beach Erosion Control project at Carolina Beach, North Carolina.

Flood Insurance Rate Maps

FEMA released Flood Insurance Rate Maps (FIRMs), maps of flood-prone areas to guide insurance rates, zoning laws, and development restrictions.

Coastal Zone Management Act

CZMA was enacted, providing federal support for coastal management, including beach nourishment.

Executive Order 11988

Executive Order 11988 required federal agencies to minimize floodplain development.

Executive Order 12127

Established FEMA, consolidating federal emergency functions into a single agency.

Superfund Act

Superfund Act (CERCLA) addressed hazardous waste sites, imposing cleanup responsibilities on polluters.

Community Rating System (CRS)

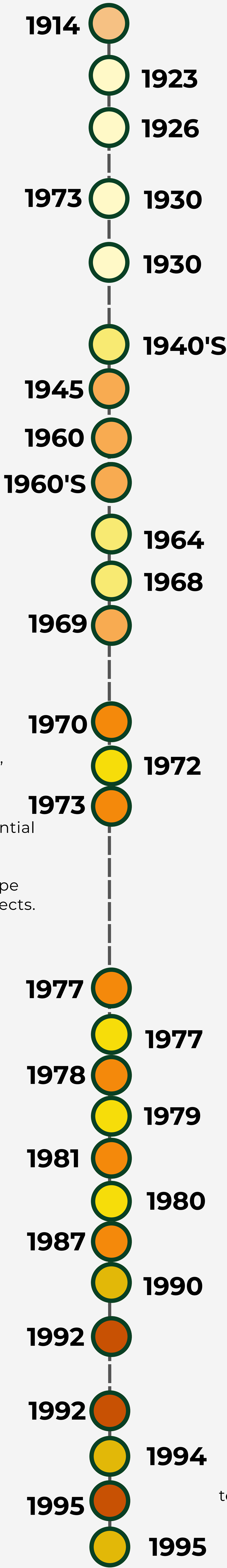
FEMA established the CRS program, rewarding communities that go beyond minimum NFIP requirements in floodplain management with discounts on flood insurance premiums.

Executive Order 12898

Executive Order 12898 on Environmental Justice aimed to achieve environmental protection for all communities and address disproportionate adverse effects.

50-Year Protect Life Cycles

U.S. Army Corps of Engineers mandated 50-year project life cycles for federally funded beach nourishment projects.



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Coastal Blue Acres Program

Established the Coastal Blue Acres Program: funds the buyout of storm-damaged properties for conservation.

Hurricane Floyd

Resulted in 7 fatalities and caused \$250 million in damage, primarily due to record flooding.

Hurricane Irene

Killed 10 people and caused \$1 B in damage from flooding and winds.

Hurricane Sandy

Killed 43 people and caused \$36.8B in damage through severe storm surge and high winds. To this day, it is the 3rd most destructive storm to ever strike the U.S., only behind Hurricanes Harvey and Katrina.

Beach Nourishment Projects

Post-Hurricane Sandy, beach nourishment projects increased across the shore. according to the beach nourishment database from Western Carolina University. In the two decades preceding Hurricane Sandy (1992–2012), New Jersey averaged approximately \$59.1 million (adjusted to 2024 USD) annually on beach nourishment, placing roughly 3.8 million cubic yards of sand per year. After Sandy, from 2013 to 2024, these figures rose dramatically: annual expenditures increased to about \$138.7 million (2024 USD), and sand placement nearly doubled to an average of 8.08 million cubic yards per year. This marked increase underscores the profound influence of Hurricane Sandy on New Jersey's coastal resilience investments and strategies.

Resilient Coastal Communities Initiative

NJ CMP established the Resilient Coastal Communities Initiative to enhance adaptation efforts.

Beach Nourishment Projects

From 1989-2018, \$1.5 billion was spent on beach nourishment, \$50 million per year.

Executive Order No. 89

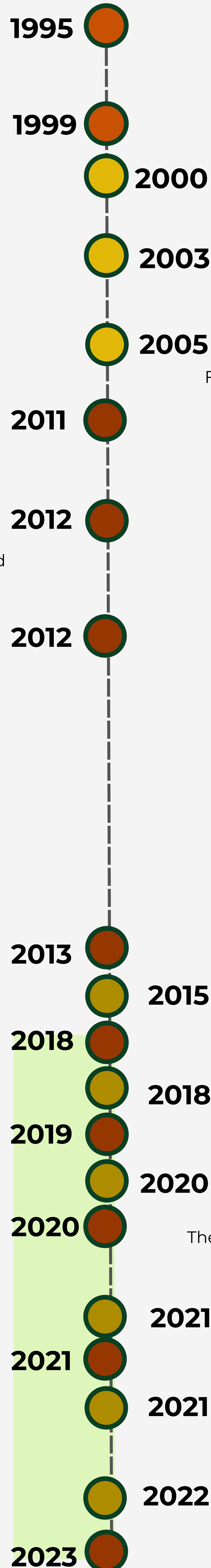
Created the Climate and Flood Resilience Program within the Department of Environmental Protection and the Interagency Council on Climate Resilience, including 16 agency representatives who assist the Chief Resilience Officer to develop a Statewide Climate Change Resilience Strategy.

Executive Order No. 100

Executive Order No. 100 established the Protecting Against Climate Threats (NJ PACT) program, aiming to reduce emissions & adapt to climate change.

Hurricane Ida

Led to 27 fatalities and caused \$8–10B in damage, primarily due to severe flooding and tornadoes.



Disaster Mitigation Act

Required local governments to develop Hazard Mitigation Plans to qualify for federal disaster funding.

FEMA Incorporated into DHS

Following 9/11, FEMA incorporated into the Department of Homeland Security to coordinate disaster preparedness and response agencies.

Hurricane Katrina

FEMA faced significant challenges during Hurricane Katrina, leading to critical evaluations and subsequent reforms to improve disaster response capabilities.

Federal Flood Risk Management Standard

Adopted to improve the resilience of communities / federal assets against the impacts of flooding. It was revoked in 2016 and reinstated in 2020.

Beach Nourishment Projects

A record year for beach nourishment in the U.S., with 60M+ cubic yards of sand placed, particularly in MS, LA, and NJ.

Building Resilient Infrastructure and Communities Program

The BRIC Program aimed to move FEMA from disaster response to proactive prevention by funding pre-disaster mitigation projects (e.g., elevation, seawalls, reinforcing infrastructure).

Consideration of Climate Resilience

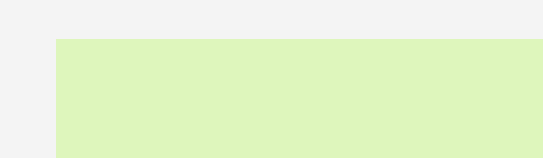
EPA issued Consideration of *Climate Resilience in the Superfund Cleanup Process* for non-Federal NPL Sites.

National Flood Insurance Program

Updated NFIP rating system (Risk Rating 2.0) for premiums based on distance from water, rebuilding costs, and flood frequency.

Repetitive Loss Properties Coverage

To reduce financial losses in the program, FEMA proposed eliminating coverage for repetitive loss properties that flood frequently.

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~\$3 Billion, Beach Nourishment

According to a study from Western Carolina University, almost \$3 billion (2024 USD) has been spent on beach nourishment in New Jersey since it began in 1936, having brought in 240 million cubic yards of sand. This is the equivalent to filling 68 Empire State Buildings completely with sand.

Inland Flood Protection Rule

Significant risk flood areas were better defined and assets were constructed using climate-informed precipitation data.

Public EV Charging Stations

NJ had ~ 1,200 public EV charging stations.

Beach Nourishment Project- OC

A \$73.5 million project began, aiming to deposit 2.1 million cubic yards of sand across various towns in Ocean County.

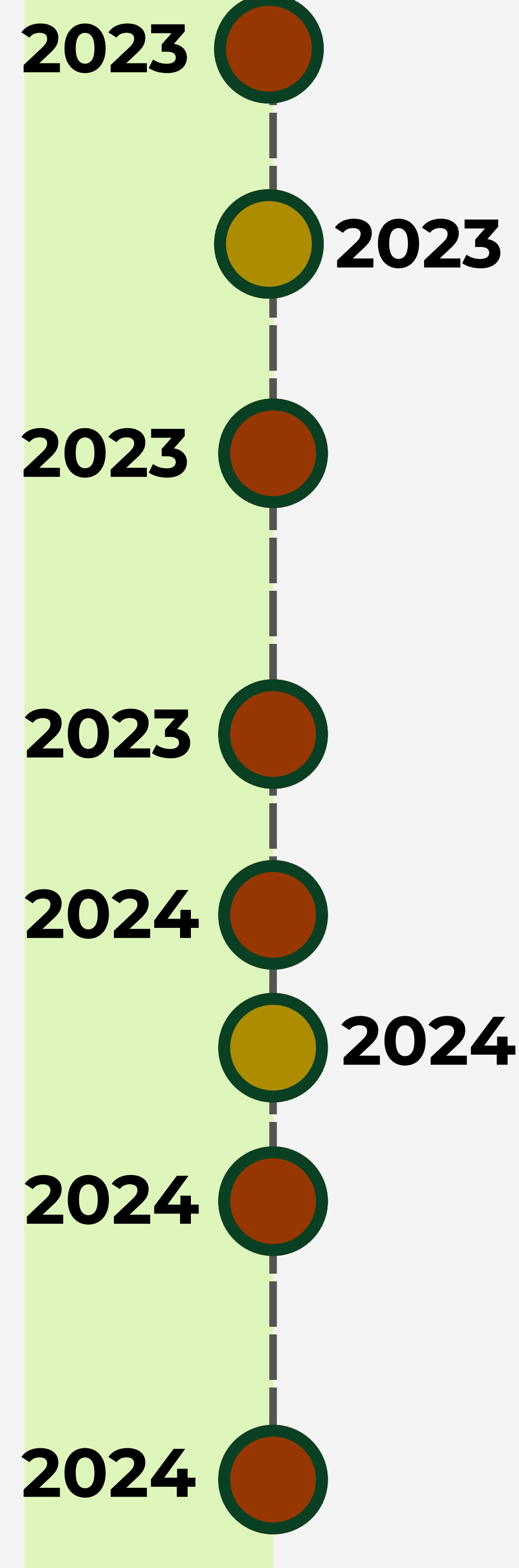
Flood Disclosure Law

NJ's Flood Disclosure Law (Flood Risk Notification Law) required sellers/ landlords to disclose flood risk information to potential buyers/ tenants.

Protecting Against Climate Threats & Resilient Environments and Landscape Rule

Is proposed and once adopted would:

- Adjust coastal Flood Hazard Areas to reflect rising sea levels and related storm surges, extending areas that must comply with the rules further inland and requiring buildings to have higher first-floor elevations, flood-proofing and higher roads.
- Create an Inundation Risk Zone to address risk for residential buildings and critical structures proposed in permanent or daily inundation areas due to rising sea levels.
- Improve water quality and reduce flooding by adding sound stormwater management practices in areas where stormwater is not adequately managed.
- Support renewable energy by balancing habitat conservation with infrastructure demands.
- Improve State alignment with FEMA's National Flood Insurance Program (NFIP).
- Improve DEP permitting processes to track authorizations and permits from the start of construction to the completion of the project.

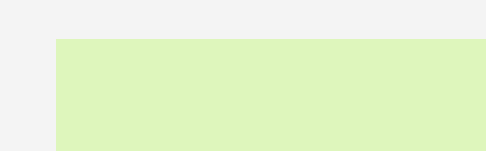


Conducting Climate Vulnerability Assessments at Superfund Sites

U.S. EPA Engineering Forum issues paper *Conducting Climate Vulnerability Assessments at Superfund Sites* that can be used at contaminated sites managed under other cleanup programs.

FEMA Federally Funded Building Protection

FEMA published a final rule requiring agencies to prepare for and protect federally funded buildings and projects from flood risks. More specifically, it required agencies to determine specific federal building or project dimensions—that is, how high, how wide, and how expensive a building or project should be—to manage and mitigate any current or potential flood risks.

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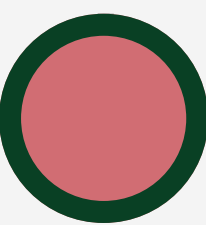
MITIGATION

NEW JERSEY USA

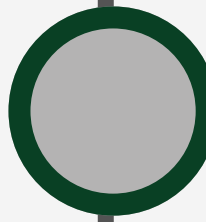
NJ Air Pollution Control Act

Passed to monitor and control air pollution, setting emission limits for industrial sources and introducing the requirement for pollution control technologies.

1954



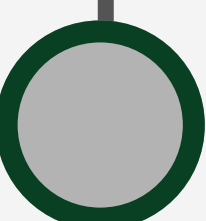
1955



Air Pollution Control Act

Marked the first federal involvement in air pollution research, laying the groundwork for future regulation.

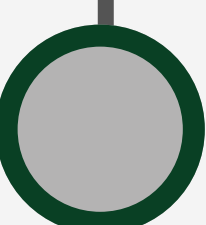
1970



Environmental Protection Agency

Nixon created the EPA, a unified regulatory body to combat pollution, enforce compliance, and conduct scientific research on environmental health.

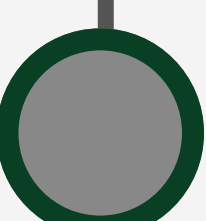
1970



Clean Air Act

One of the most sweeping environmental laws in U.S. history. It (1.) gave the federal government unprecedented authority to regulate air pollution and set legally enforceable emissions standards; (2.) established the National Ambient Air Quality Standards (NAAQS), requiring states to implement measures to meet federal air quality goals; (3.) introduced technology-based pollution controls for major industries, spurring the development of scrubbers, catalytic converters, and emissions-reduction strategies in power generation and transportation.

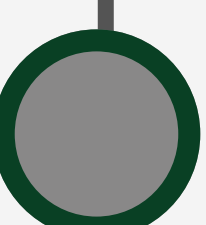
1975



Energy Policy and Conservation Act

Established CAFE standards for vehicle fuel efficiency in response to the oil embargo.

1975



Energy Conservation and Production Act

Introduced the national model energy code, minimum efficiency regulations for buildings (e.g., insulation, lighting, HVAC systems, ventilation, and renewable energy integration).

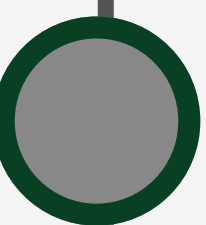
1977



U.S. Department of Energy

Its establishment consolidated federal energy programs.

1978



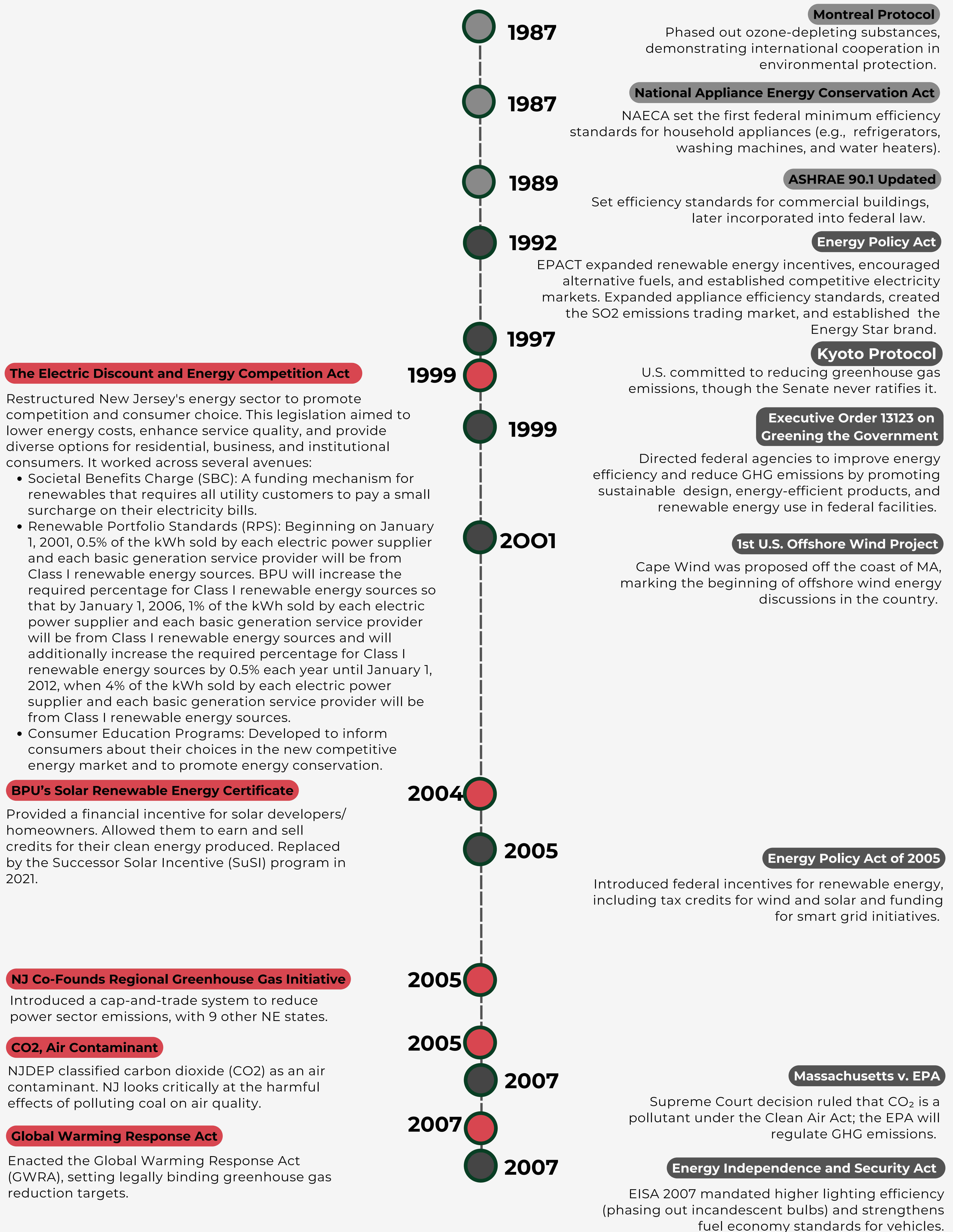
Public Utility Regulatory Policies Act

It introduced competition into the electric utility industry -which vertically integrated monopoly utilities had traditionally dominated- by requiring utilities to buy power from independent producers at avoided cost rates. It paved the way for independent power producers (IPPs) and laid the groundwork for the eventual deregulation of electricity markets in the 1990s. It became one of the most important laws driving renewable energy adoption in the U.S. and set a precedent for competitive electricity markets, renewable energy investment, and decentralized power generation.

MITIGATION

NEW JERSEY

USA



MITIGATION

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USA

Regional Greenhouse Gas Initiative

The first auction for the Regional Greenhouse Gas Initiative (RGGI) generated proceeds that successfully used market forces to set a price on carbon.

The Offshore Wind Economic Development Act

Advised the BPU to establish a program for Offshore Wind Renewable Energy Certificates (ORECs) to incentivize offshore wind facility development.

Solar Energy Advancement and Fair Competition Act

The Solar Energy Advancement and Fair Competition Act is signed, amending EDECA and compelling the BPU to adopt an RPS that requires no less than 306 GWh of solar power be generated in 2011, with the annual minimum increasing each year until 2026, when at least 5,316 GWh of solar power must be generated.

RGGI Withdraw

NJ withdrew from RGGI.

Sulfur Limit

Established maximum allowable sulfur content in various fuel oils.

Executive Order No. 8

Directed all State Agencies with responsibilities under the OWEDA to fully implement the act, with a goal of obtaining 3,500 MW from offshore wind by the year 2030.

Clean Energy Act (ECA) Passed

A landmark law aimed at accelerating the state's transition to renewable energy. It significantly increased NJ's RPS, mandating 50% of electricity to come from renewable sources by 2030 and requiring 5.1% of electricity sales from solar by 2021. The law also expanded energy efficiency programs, introduced a cost cap on ratepayer increases, and set the foundation for offshore wind development, targeting 3,500 MW by 2030.

Executive Order No. 92

Raised NJ's offshore wind goal from 3.5 GW by 2030 to 7.5 GW by 2035 – more than double the initial goal.

Energy Master Plan

First released in 1991, NJ's EMP evolved into a blueprint for achieving a 100% clean energy economy by 2050. The 2019 EMP emphasizes:

- Offshore wind: 11 GW by 2040.
- Solar energy: Equitable community solar programs.
- Energy efficiency: Residential and commercial decarbonization.
- Transportation electrification: EVs and charging infrastructure incentives.

Rejoin RGGI

Rejoined the Regional Greenhouse Gas Initiative (RGGI).

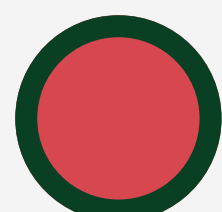
HFC/GHG Prohibition

A new law (P.L.2019, c.507) prohibited certain products and equipment such as propellants, vending machines, and consumer refrigeration units from containing hydrofluorocarbons (HFCs) or other greenhouse gases.

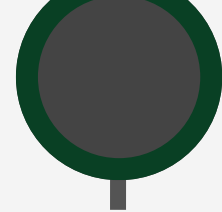
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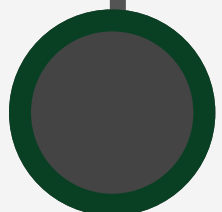
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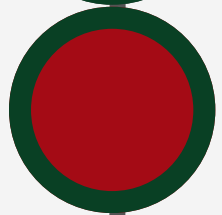
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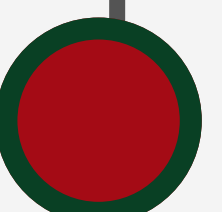
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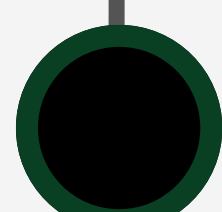
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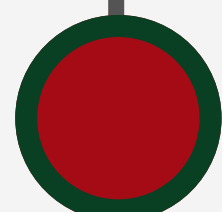
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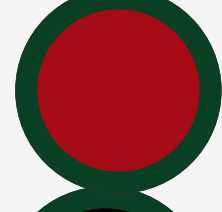
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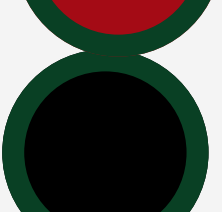
2012



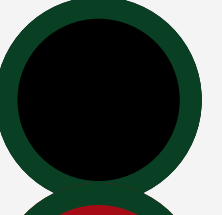
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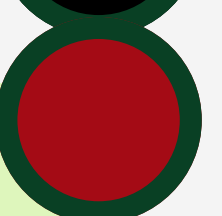
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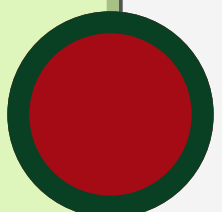
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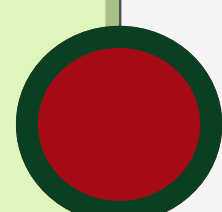
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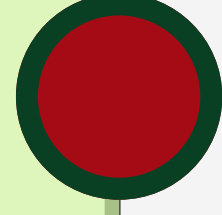
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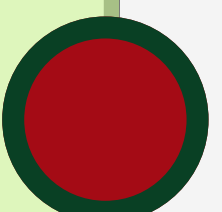
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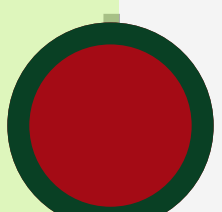
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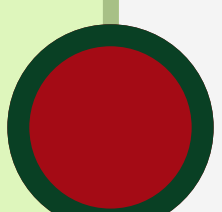
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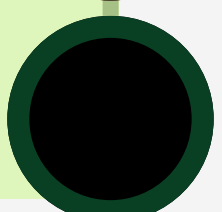
2020



2020



2022



American Recovery & Reinvestment Act (ARRA)

Included a historic \$90 billion investment in clean energy, jumpstarting large-scale renewable projects, battery storage, and EV infrastructure.

Waxman-Markey Bill

The most significant U.S. attempt at federal cap-and-trade failed in the Senate.

Commercial Offshore Wind Energy Development Commercial Lease

The U.S. Department of the Interior issued the first commercial lease for offshore wind energy development to Cape Wind Associates, signaling federal support for offshore wind initiatives.

Paris Agreement

Committed the U.S. to reduce GHG emissions 26-28% below 2005 levels by 2025.

Paris Agreement- Withdraw

The U.S. withdrew from the Paris Agreement. In response, states and cities agree to the principles of the agreement. The U.S. would join again in 2021 and withdraw once more in 2025.

Inflation Reduction Act

IRA committed \$369 billion to climate action, renewable energy, EV adoption, and grid modernization.

 = Murphy Administration

MITIGATION

NEW JERSEY

USA

Executive Order No. 315

Set an accelerated target of 100% clean energy by 2035.

Executive Order No. 316

Set a target to install zero-carbon-emission space heating and cooling systems in 400k homes and 20k commercial properties, making 10% of all LMI properties electrification-ready by 2030.

Executive Order No. 317

Directs BPU to plan for the future of the natural gas utility in the state.

Community Solar Energy Program

Community Solar Energy Program is made permanent, permitting community solar projects of no greater than 5 MW on rooftops, carports and other small residential areas.

20M Heat Pumps Pledge

In partnership with other states, NJ pledged to collectively reach 20 million heat pump installations across the coalition by 2030, while ensuring at least 40% of benefits flow to disadvantaged communities.

NJ Rankings

NJ was the nation's 12th-largest producer of electricity from solar energy and ranked 7th in small-scale solar power generation.

ACC II Regulations Adopted

The ACC II regulations are adopted, where 100% of new light-duty vehicle sales will be zero-emission by 2035, with interim targets starting from the 2026 model year.

Residential Heat Pumps

NJ and eight other states signed a pledge to have heat pumps make up 90% of residential heating, air conditioning, and water heating sales by 2040.

Over 5GW of Solar Capacity

New Jersey installed nearly 400 MW of new solar capacity, bringing the state's total installed solar capacity to over 5 GW.

ACT Rule

The ACT rule comes into effect, aligning with CA's standards, when manufacturers must sell an increasing percentage of zero-emission medium- and heavy-duty vehicles annually, aiming for 40% to 75% zero-emission truck sales by 2035, depending on vehicle type.

Energy Master Plan Draft

A draft overview of the NJ Energy Master Plan is presented at a stakeholder meeting on March 13, 2025; with comments due to NJBPU by May 1, 2025.

4T kWh Total U.S. Electricity Consumption

Total U.S. electricity consumption was about 4 trillion kWh, 14 times higher than in 1950

Renewable Energy Sources

Renewable energy sources accounted for approximately 21.4% of the United States' total utility-scale electricity generation. Broken down by source:

- Wind Power: 10.2%
- Hydropower: 5.7%
- Solar Power: 3.9%
- Geothermal: 0.4%

Small-Scale Solar Capacity

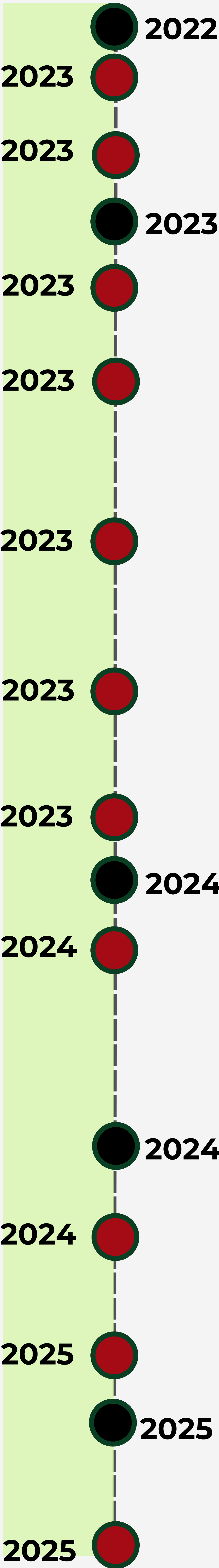
An estimated 55 GW of small-scale solar capacity, which includes residential, commercial, and industrial installations.

Mandatory RPS Policies

29 states and the District of Columbia have implemented mandatory RPS policies.

IRA Funding Paused

Second Trump administration halts IRA funding, suspends offshore wind projects, and prioritizes fossil fuel production.



= Murphy Administration