

Voluntary Renewable Energy Markets 101

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CELEBRATING  20 YEARS / 1997-2017



Outline

- Renewable Energy Basics
- What are RECs?
- Compliance and Voluntary Markets
- How Consumer Protection Benefits the Market

Renewable Resource Types

- Solar
- Wind
- Geothermal
- Biomass
- Hydroelectric

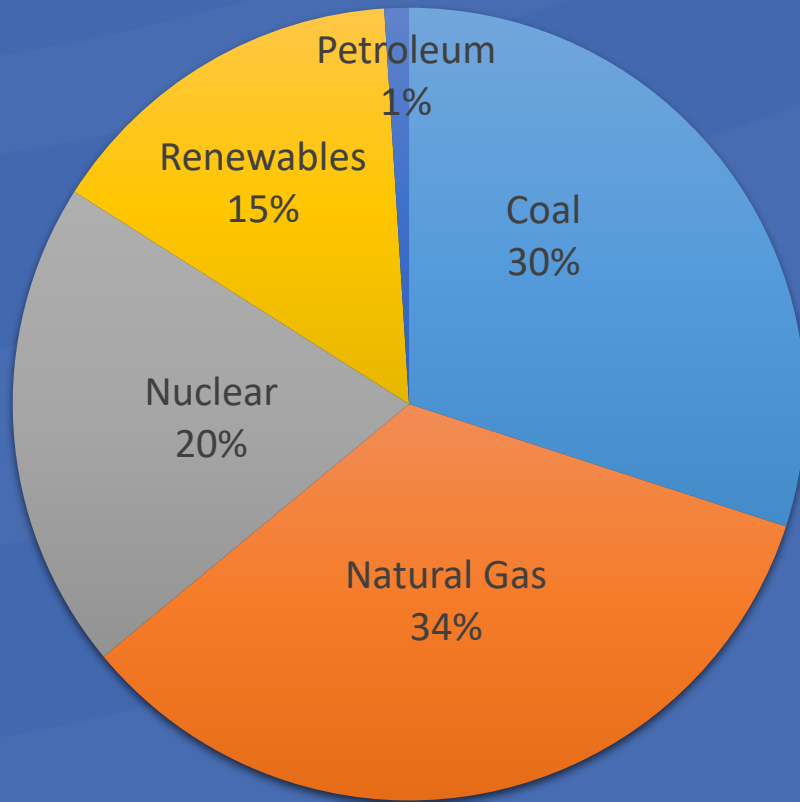


Baseload vs. intermittent resources

Measuring capacity vs. power

2016 US Electricity Generation by Source

Total: 4.1 billion MWh

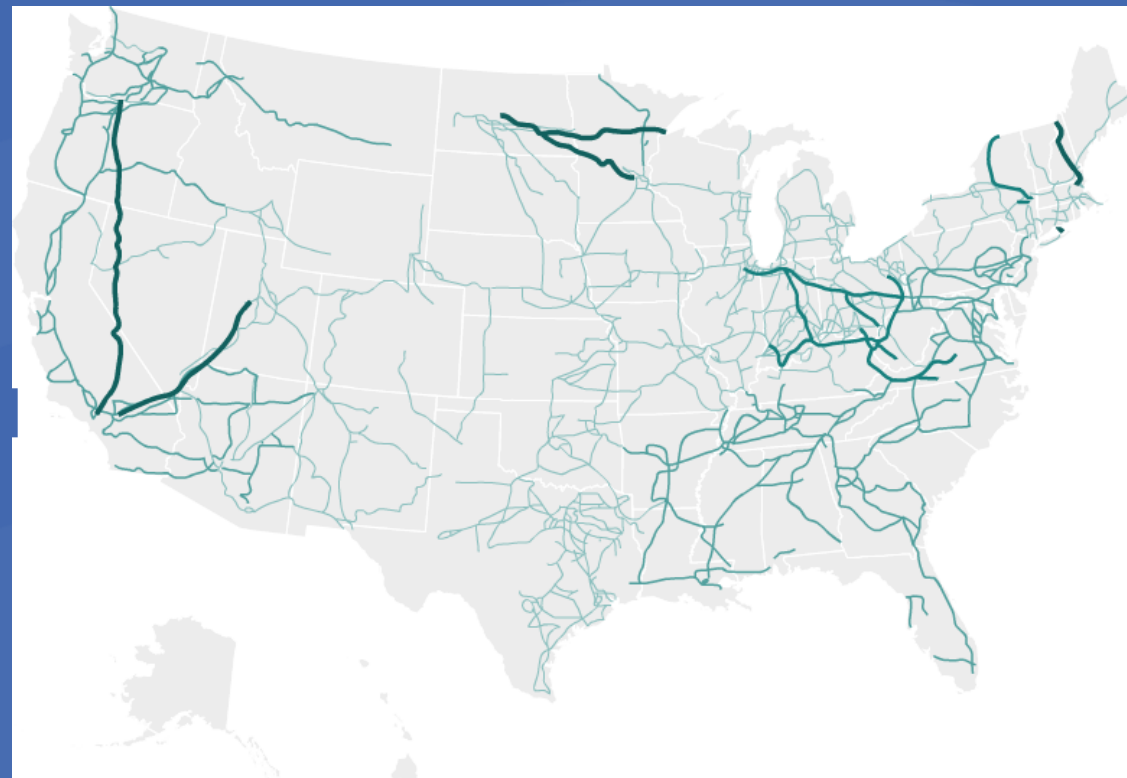


- Hydro: 6.5%
- Wind: 5.6%
- Biomass: 1.5%
- Solar: 0.9%
- Geothermal 0.4%

www.eia.gov

Electricity Grids

- Regional transmission systems
- Coordination by RTOs & ISOs
- Interstate trading
- DER, storage, microgrids
- Electron differentiation



Renewable Energy Certificates

RECs are the
"environmental
attributes" of renewable
energy generation

$1 \text{ MWh} \rightarrow 1 \text{ REC}$



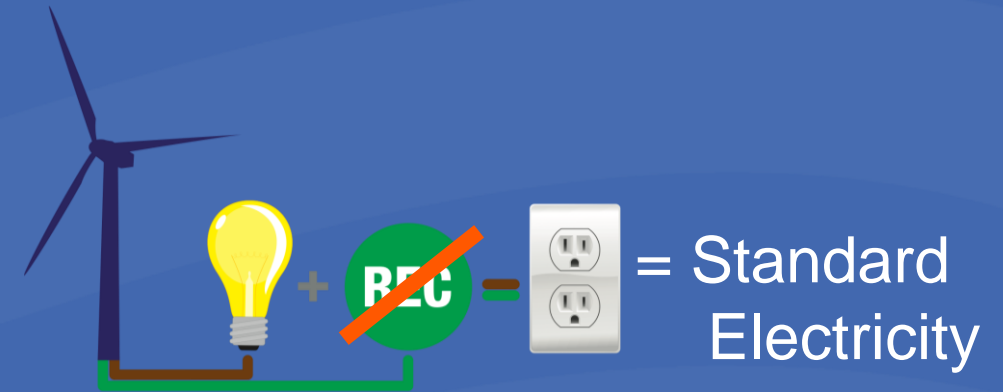
RECs are needed to:

- Allocate and claim use of renewable generation on a shared grid
- Avoid double counting and double claiming
- Create a national market for renewable energy



Null Power

- Unspecified power that results when RECs have been sold elsewhere
- Has the attributes of the residual mix after specified power purchases have been removed

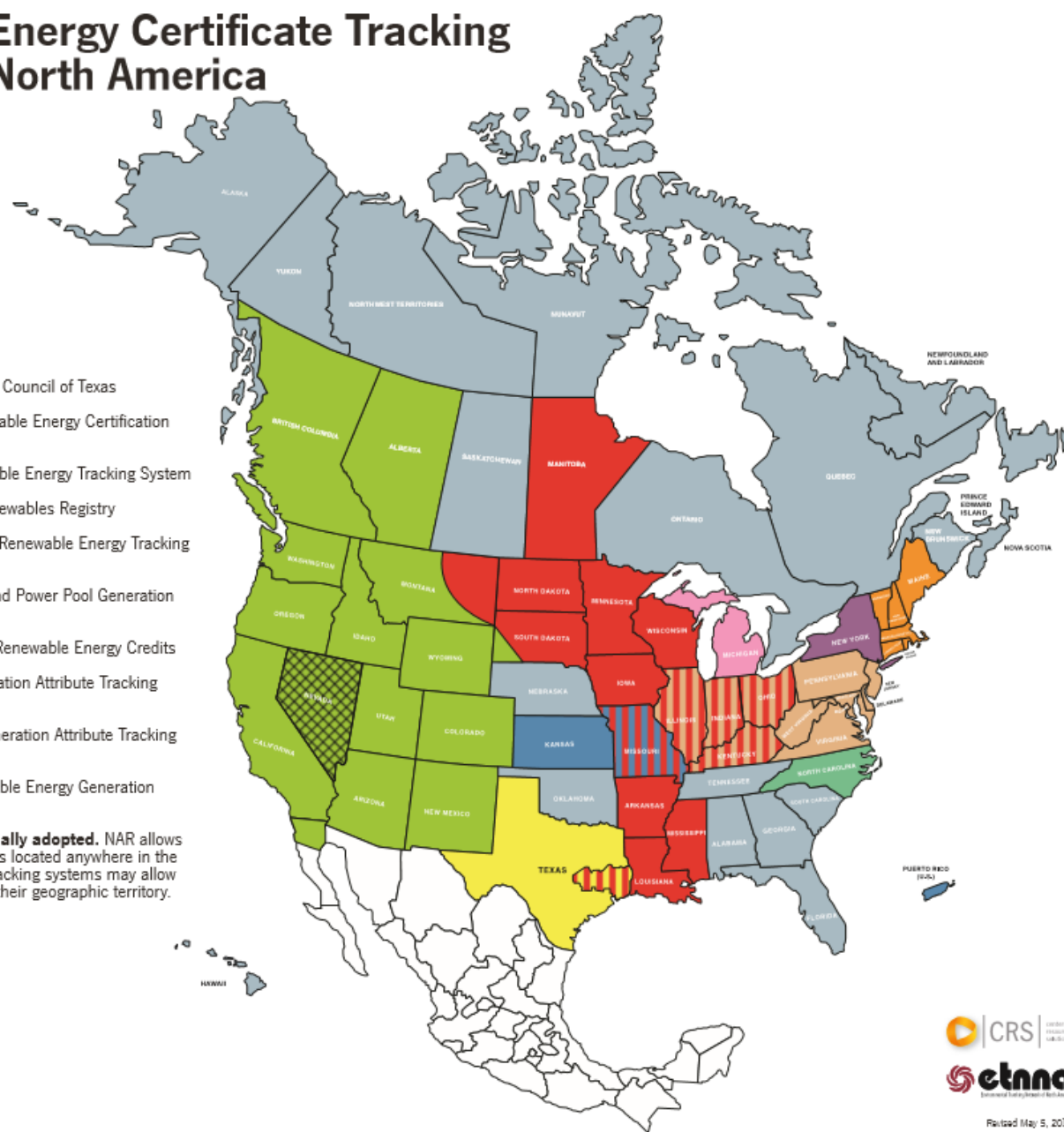


“Null power claims are REC-less!”

Renewable Energy Certificate Tracking Systems in North America

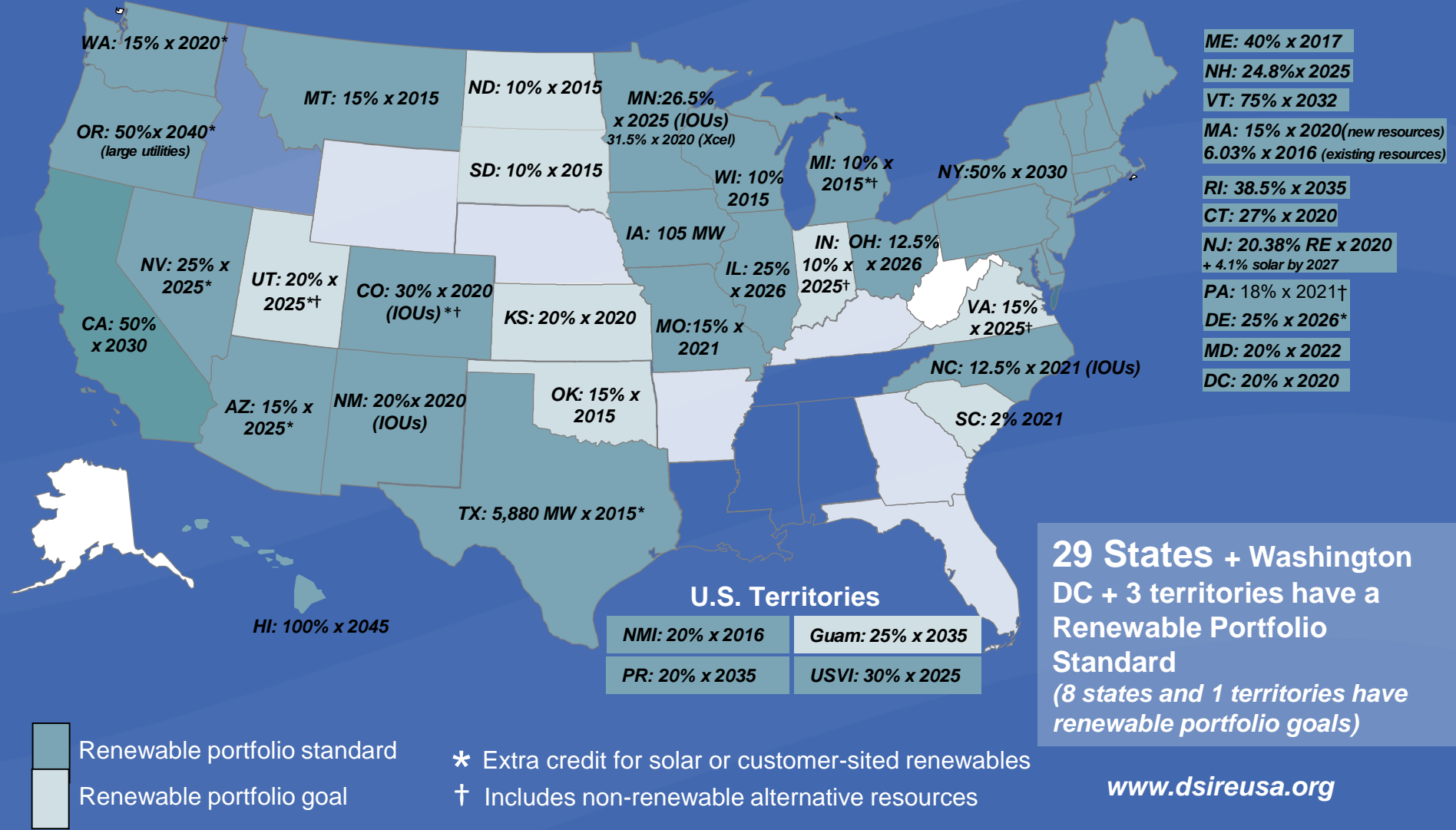
KEY

- ERCOT:** Electric Reliability Council of Texas
- MIRECS:** Michigan Renewable Energy Certification System
- M-RETS:** Midwest Renewable Energy Tracking System
- NAR:** North American Renewables Registry
- NC-RETS:** North Carolina Renewable Energy Tracking System
- NEPOOL-GIS:** New England Power Pool Generation Information System
- NVTREC:** Nevada Tracks Renewable Energy Credits
- NYGATS:** New York Generation Attribute Tracking System (in development)
- PJM-GATS:** PJM EIS's Generation Attribute Tracking System
- WREGIS:** Western Renewable Energy Generation Information System
- No tracking system formally adopted.** NAR allows registration from generators located anywhere in the U.S. and Canada. Other tracking systems may allow registrations from outside their geographic territory.



- Renewable energy claims must be substantiated with retired RECs
- Databases are used to track, trade, and “retire” RECs
- Blockchain disruption
- Used for both voluntary and compliance markets

Renewable Portfolio Standards



Green-e Certification

- Consumer protection for voluntary renewable energy and carbon offset purchases
- Benefits of certification
- Chain of custody certification
- Verification Audit
- Marketing Compliance Review



Green-e

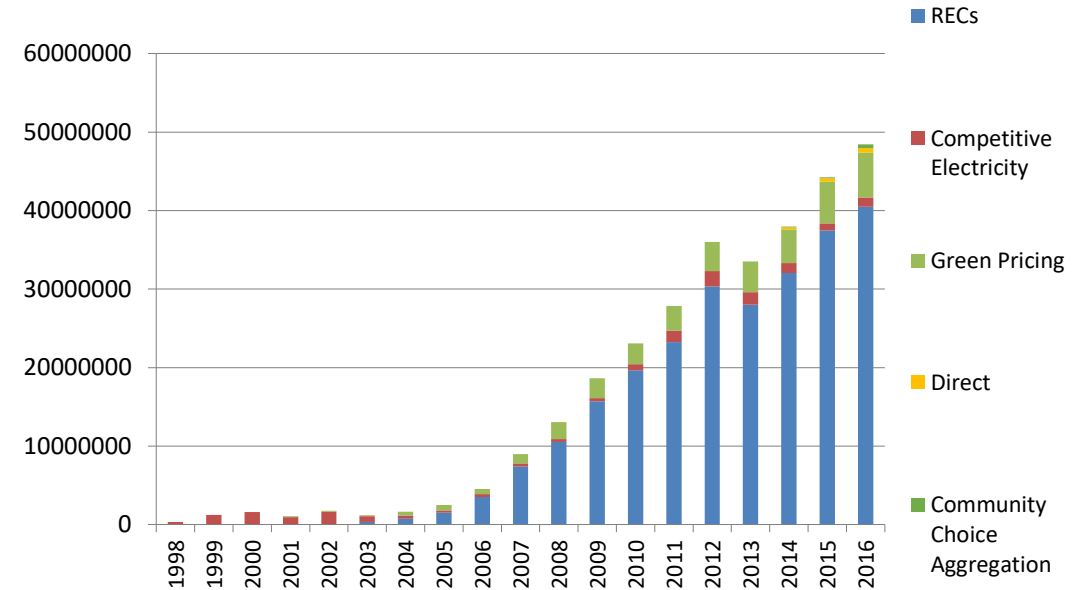
Green-e Eligibility Criteria

- Resource type
- Commercial online date
- Regulatory surplus
- REC Vintage
- Full GHG benefits
- No double counting/claiming/selling
- Geographic restrictions
- State-specific requirements

Green-e Purchasing Options

- Utility Green Pricing & Green Tariffs
- Competitive Electricity Products
- Community Renewables
- Power Purchase Agreements
- Community Choice Aggregation
- On-Site Renewables
- Unbundled REC Products
- Carbon Offsets & CONG

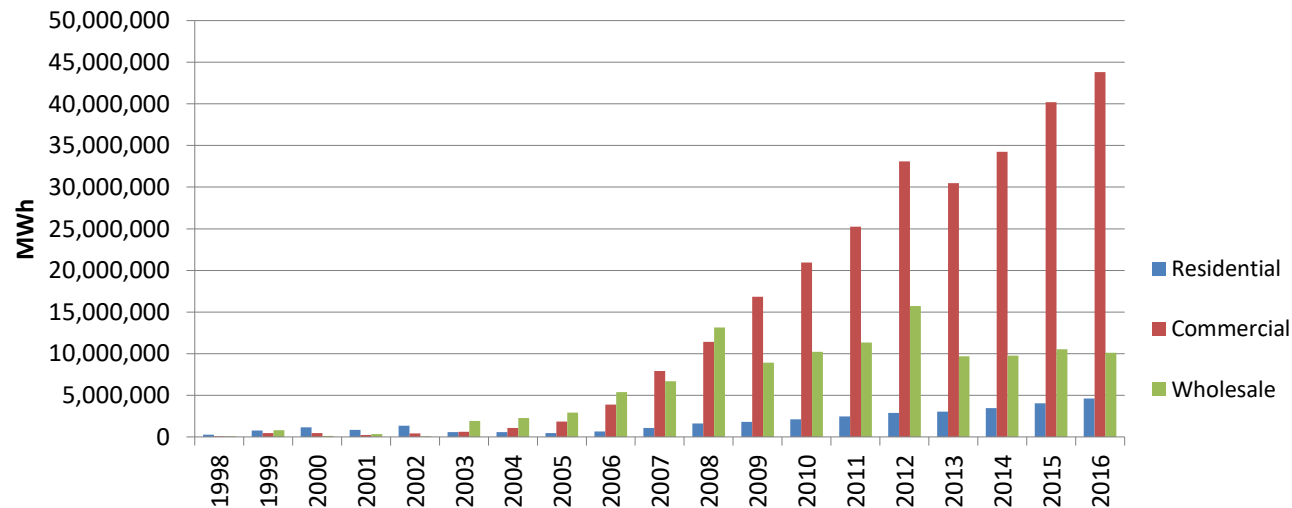
Green-e Energy Certified Retail Sales by Product Type, 1998-2016 (MWh)



2016 Green-e Retail Sales

- Total Volume: 48 million MWh, 1.3% of US supply
- 963,000 purchasers, including 53,000 businesses

Green-e Energy Certified Sales by Customer Type, 1998-2016 (MWh)

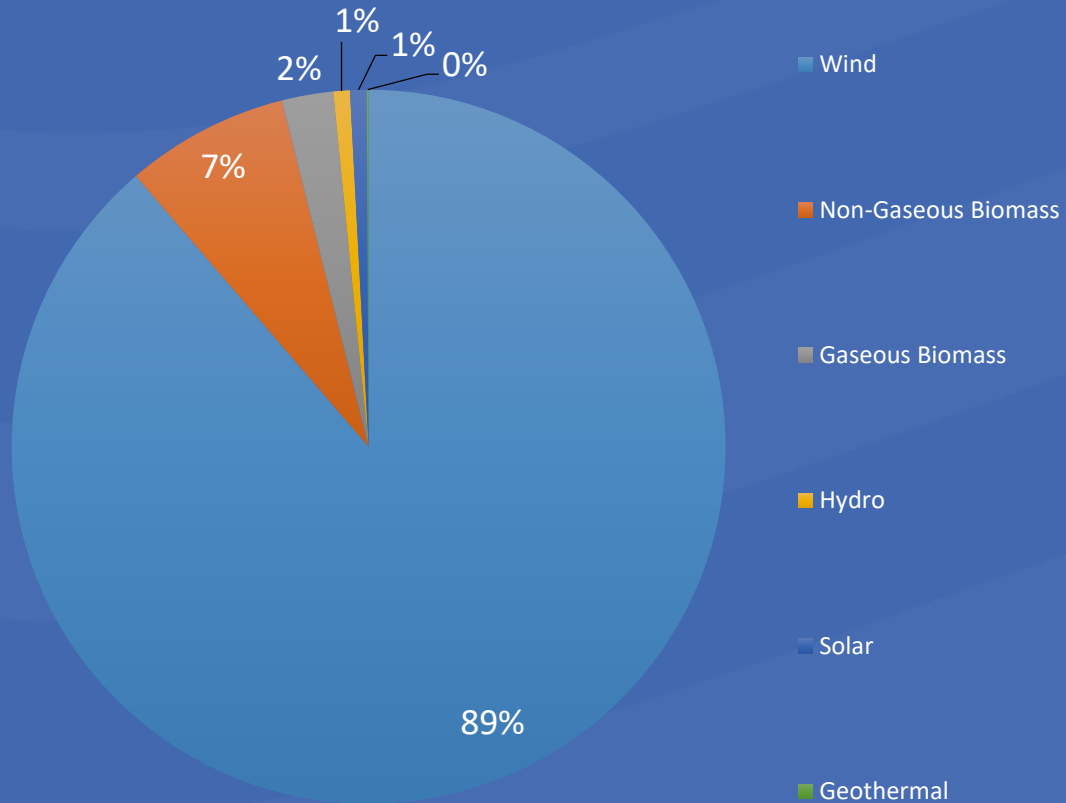


Top 10 States by Retail Sales Volume (MWh) in 2016

State	% of total Sales
CA	12%
NY	9%
TX	7%
WA	7%
AZ	7%
DC	6%
OR	6%
WI	4%
MD	4%
MA	4%

2016 Green-e Supply

Contributions of Renewable Resource Types to Total Green-e Energy Certified Retail Sales, 2016



Top Ten States Supplying Renewable Energy to Green-e Energy Certified Retail Sales by Percent of Total Certified MWh, 2016

State/Province	% of Total
TX	27%
OK	22%
KS	10%
IA	6%
NE	6%
ID	3%
WA	3%
FL	3%
ND	3%
BC	2%

Additional Resources

- What is a REC? video: <http://youtu.be/opJMrzNauFQ>
- RY2015 Green-e Verification Report: www.green-e.org/2015
- Learn more: www.green-e.org/learn
- Find renewable energy products: <http://www.green-e.org/buy>

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