RENEWABLE ENERGY CERTIFICATES:

AN OVERVIEW

presentation by

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OUTLINE

- *Renewable Energy Certificates* (*RECs*)
- *REC* purchase mechanisms
- *US* energy markets with renewable output players
  - *REC* compliance markets
  - voluntary markets
- *Renewable Energy* (*RE*) tracking systems in the *US*
- *REC* arbitrage
- *REC* status

RENEWABLE ENERGY CERTIFICATES

Source: https://resource-solutions.org/wp-content/uploads/2017/08/RPS-and-Voluntary-Markets.pdf

RENEWABLE ENERGY CERTIFICATES (*RECs*)

- The *REC* – also known as the *green tag* or *renewable energy credit* – is a tradable but non–tangible *energy commodity* that provides proof of the production of 1–*MWh* electricity from a renewable resource
- Every *RE* resource receives compensation for its generation from two revenue streams: the energy is compensated from sales into either the *organized electricity markets* or via *power purchase agreements* (*PPA*s) and the sale of the *REC*s representing that energy production receives a separate payment

RENEWABLE ENERGY CERTIFICATES (RECs)

electricity

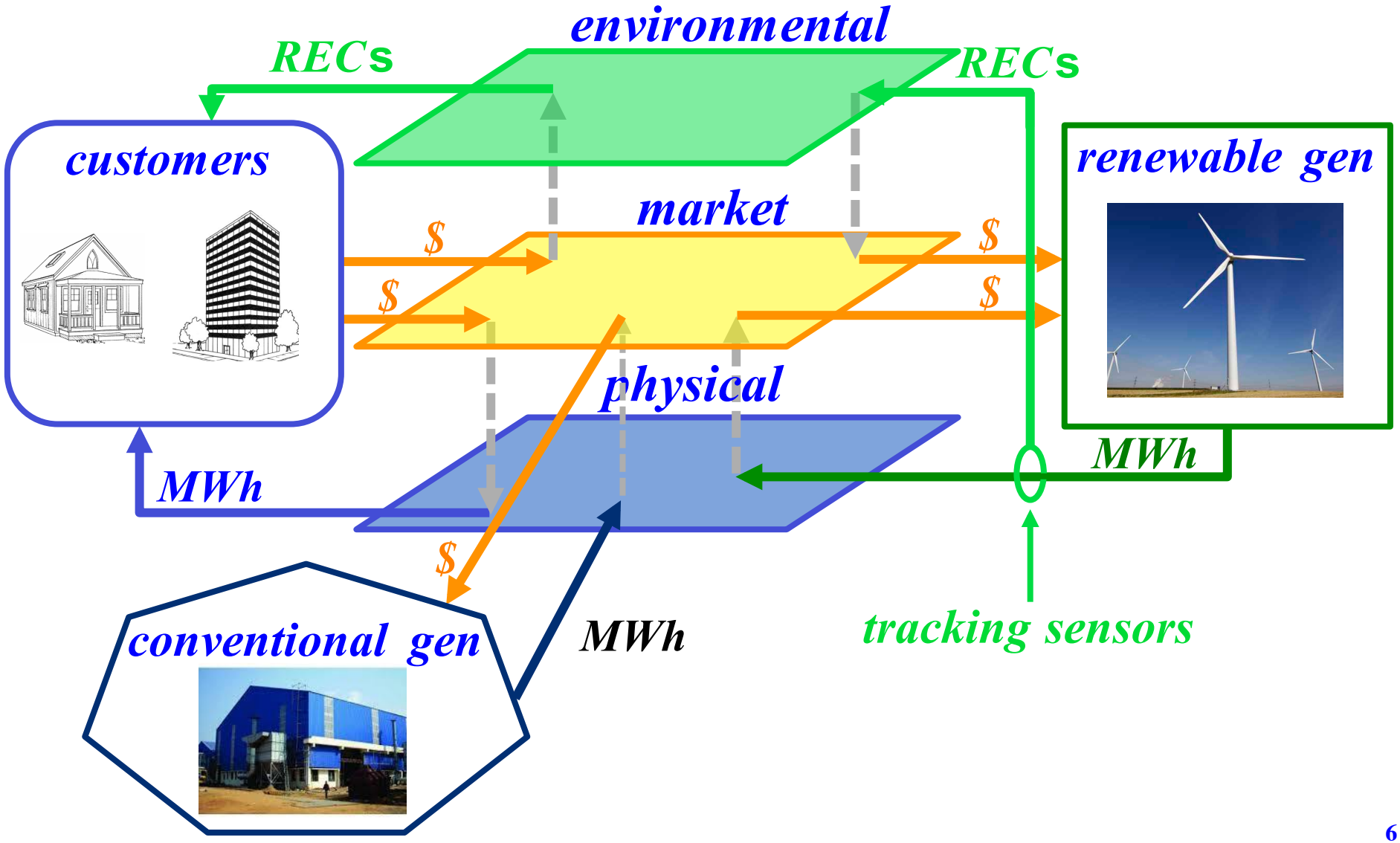
+

right to claim the consumption of renewable energy

MWh

RECs

ENERGY, RENEWABLE ENERGY AND *RECs*



RECs AND THE ENVIRONMENT

- The *RECs* convey the environmental benefits of the renewable–resource–generated electricity and, under a *tracking mechanism*, provide the direct accounting needed to certify the jurisdictional *Renewable Portfolio Standard* (*RPS*) goals are met
- The *RECs* provide auditable proof of the *RE* produced and injected into the grid

RECs

- The produced *RE* and the *RECs* may be sold separately and to different buyers
- The green energy consumption and the proof of the production may be in different jurisdictions
- The prices of *RECs* vary from one jurisdiction to another and their use across different states are subject to the non–uniform rules of the states
- *RECs* provide buyers and sellers flexibility in the trade of *RE consumption proofs* across state borders

RECs

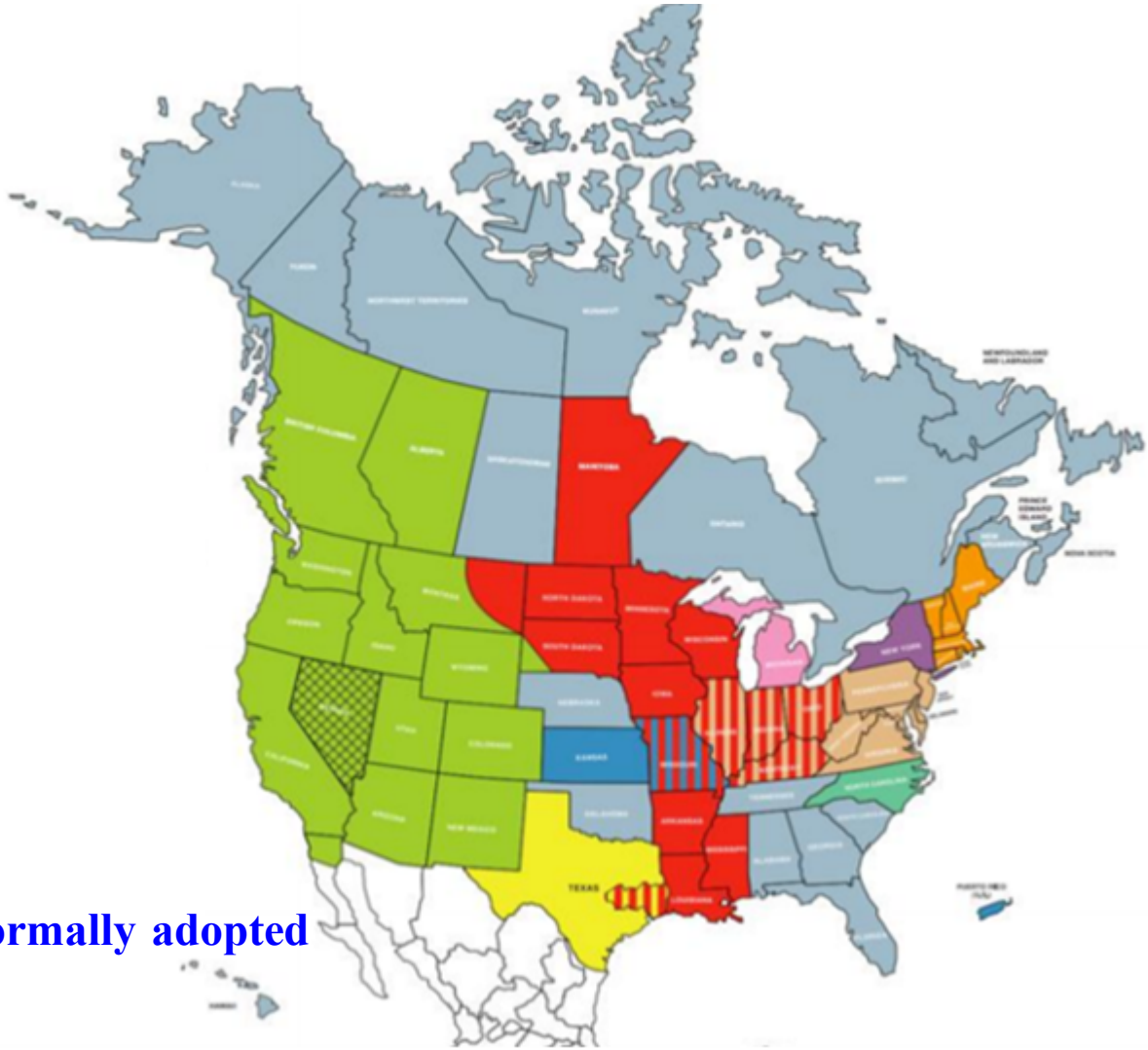
- ***RECs*** **provide the means to account for, track and assign ownership of consumed** ***RE*** **and constitute the legal instrument to certify** ***US RE usage*** **claims**
- ***US*** **has several regional tracking systems that issue** ***RECs*****, monitor their deployment and certify that no** ***RE*** **resource generation has multiple** ***RECs*** **issued for the same** ***MWh***

RECs

- Tracking systems provide the information system that allows *RECs* to be traded and used correctly, as if it were a tangible commodity
- Each tracking system allows a *REC* to be used for a specified time window prior to its expiration
- The tracking system retires *RECs* once they are used and a retired *REC* cannot be sold, donated or transferred to any other party

REGIONAL *RE* TRACKING SYSTEMS IN NORTH AMERICA

- ERCOT
- MIRECS
- M-RETS
- NAR
- NC-RETS
- NEPOOL-GIS
- NVTREC
- NYGATS
- PJM-GATS
- WREGIS
- No tracking system formally adopted



Source: https://resource-solutions.org/wp-content/uploads/2017/08/RPS-and-Voluntary-Markets.pdf

REC EVOLUTION TIMELINE

year	*venue*	*development*
1983	*IA*	first state to adopt a *RE* requirement
1995	*CA*	first mention of the concept of certificate trading
1996	*NH*	first competitive retail green power pilot program
1997	*CA*	introduction of environmental certification standards for voluntary *RE* products; Green-e launched
1998	*CA, MA & RI*	electricity markets open to retail choice

REC EVOLUTION TIMELINE

year	*venue*	*development*
1998	*CA*	*APX* is the first wholesale green power market
1998	*MA*	*AllEnergy Marketing Company* sells the first unbundled retail *REC*
1999	*TX*	first *RPS* with *REC* trading for compliance
2001	*TX*	establishment of the first *REC* tracking system
2006	*US*	*SunEdison Renewable Ventures* pioneers the solar *PPA*
2012	*US*	*Federal Trade Commission* updates *Green Marketing Guidelines* with added clarifications for making provable *RE* claims

US RECs MARKETS

- There are two types of *REC* markets in the *US*:
  - the *RPS* compliance or *involuntary* markets; and
  - the *voluntary* markets
- Involuntary markets serve to meet the need to prove *RPS* compliance: entities buy *RECs* to meet compliance with state *RPS* in involuntary markets
- *RECs* are bought voluntarily for other purposes in voluntary markets

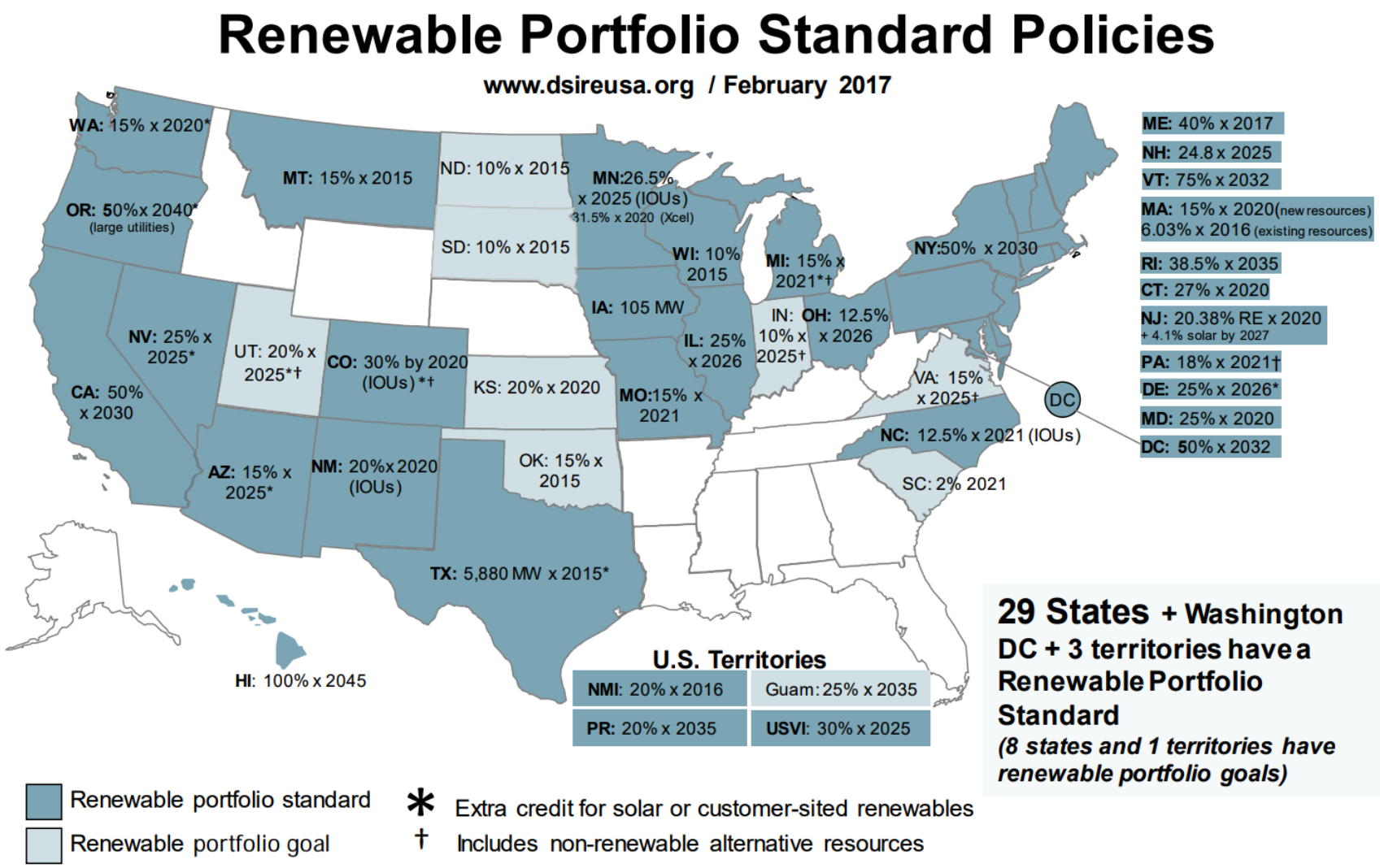
US RPS COMPLIANCE MARKETS

- Involuntary markets originate as a result of policy decisions, such as the adoption of a state *RPS*
- *RPS* targets are typically imposed on electricity providers and may also include additional criteria, such as economic and job growth
- *REC*s are purchased to prove compliance claims of entities subject to *RPS* targets
- Price distortion issues may arise in involuntary markets due to its intrinsic regulatory nature

US RPS COMPLIANCE MARKETS

- Since *RE* targets and the associated penalties for non–compliance are officially imposed on the electricity providers, *RE* suppliers know their customers' *willingness to pay*
- *REC* supply limitations also may contribute to the exercise of market power by *RE* sellers in various compliance markets
- Consequently, the *REC* prices may reach high levels without the provision of a more economic alternative for the energy provider than payment of the *RPS* non–compliance penalties

US RPS COMPLIANCE MARKETS

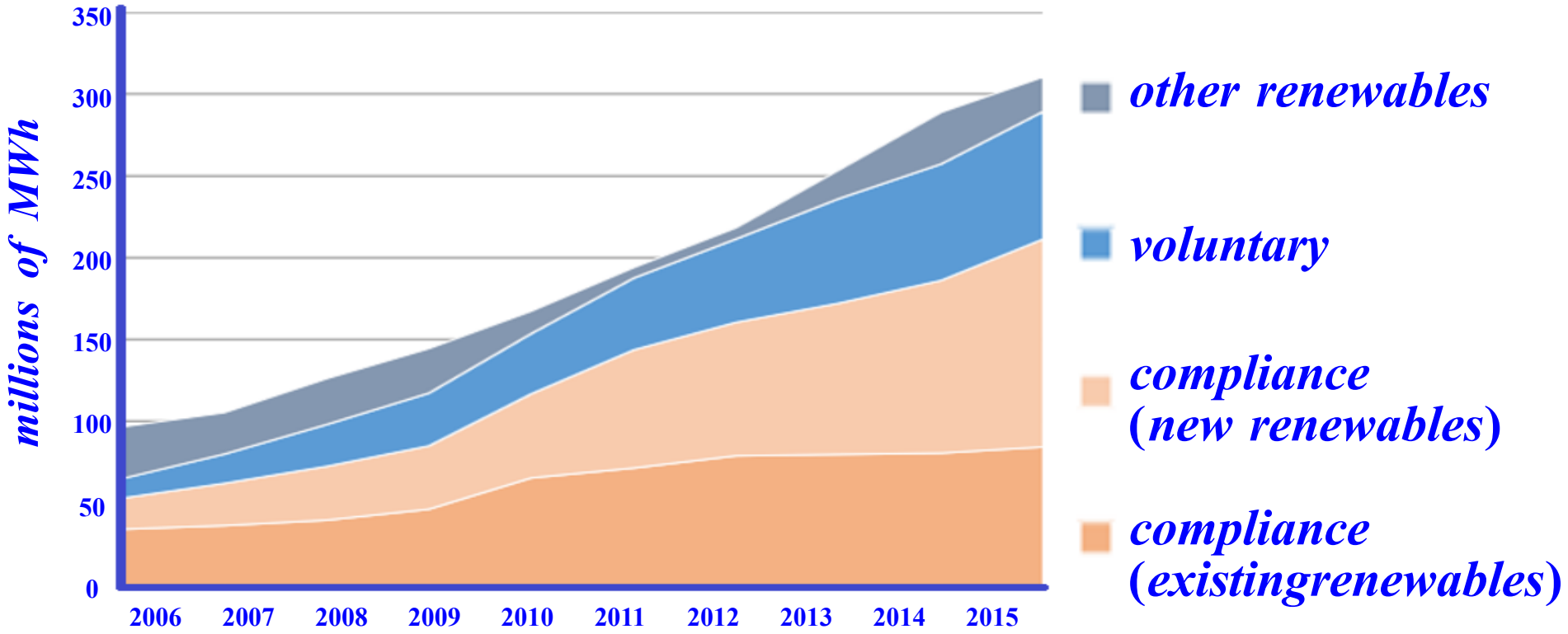


Source: http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/03/Renewable-Portfolio-Standards.pdf

US VOLUNTARY MARKETS

- Consumers, wishing to support *RE* development or to prove claims of *RE* consumption, purchase *RECs* in voluntary markets
- Prices are driven by consumer preferences over specific *RE* types and there is little, if any, price distortion
- Participants in *RPS* compliance markets may purchase additional *RECs* in voluntary markets to further drive the push towards sustainability
- Voluntary market prices, typically, tend to be below those in compliance markets

COMPLIANCE AND VOLUNTARY MARKETS SALES HISTORY



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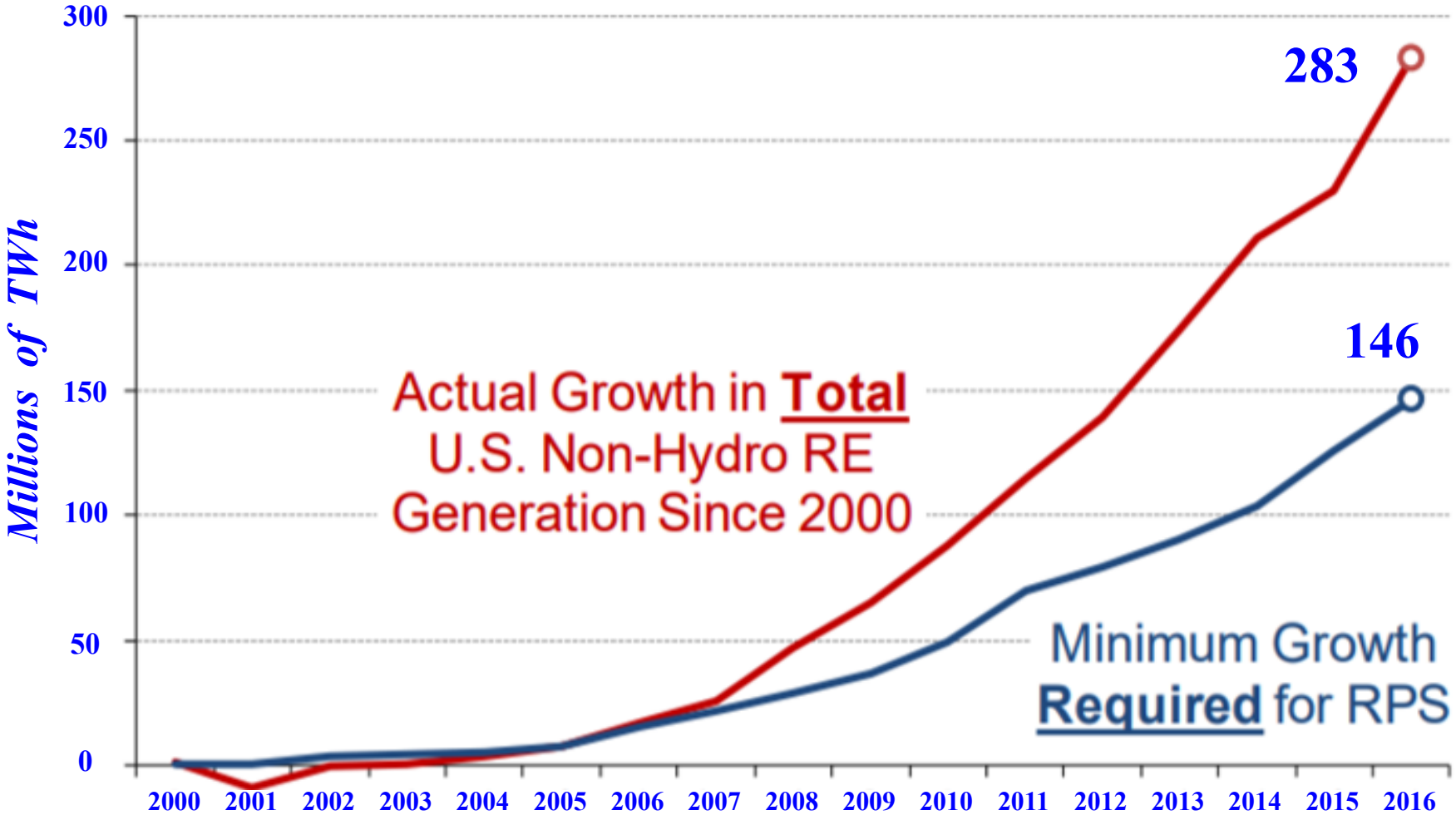
US NON–HYDRO *RE* GENERATION GROWTH



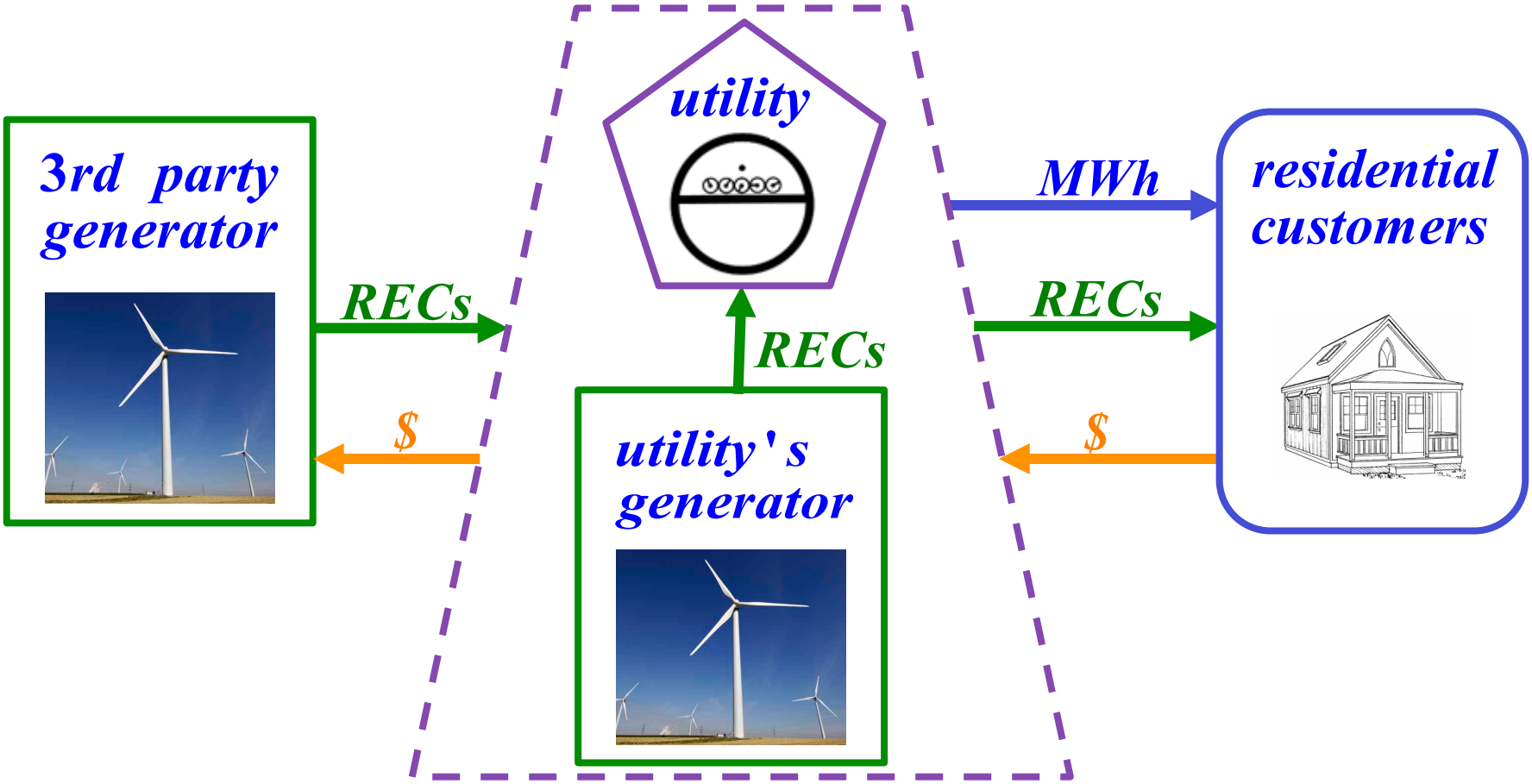
Source: https://emp.lbl.gov/sites/default/files/2017-annual-rps-summary-report.pdf

THE *7 REC* PURCHASE MECHANISMS

- Utility Green Pricing
- Utility Renewable Contracts
- Competitive Suppliers
- Unbundled *RECs*
- Community Choice Aggregations
- *PPAs*
- Community Solar

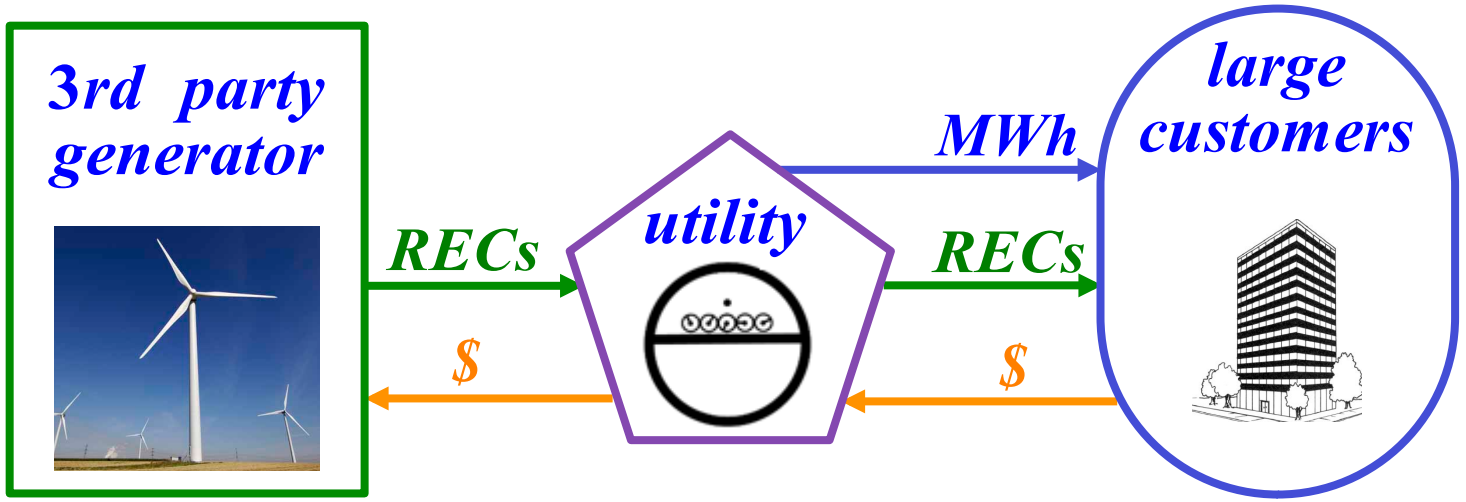
UTILITY GREEN PRICING

A customer procures green electricity through a supplemental fee above the monthly utility bill.



UTILITY RENEWABLE CONTRACTS

Customers procure *RE* from their utility via *bilateral contracts* or special tariffs; such arrangements are, typically, made over a longer term period.

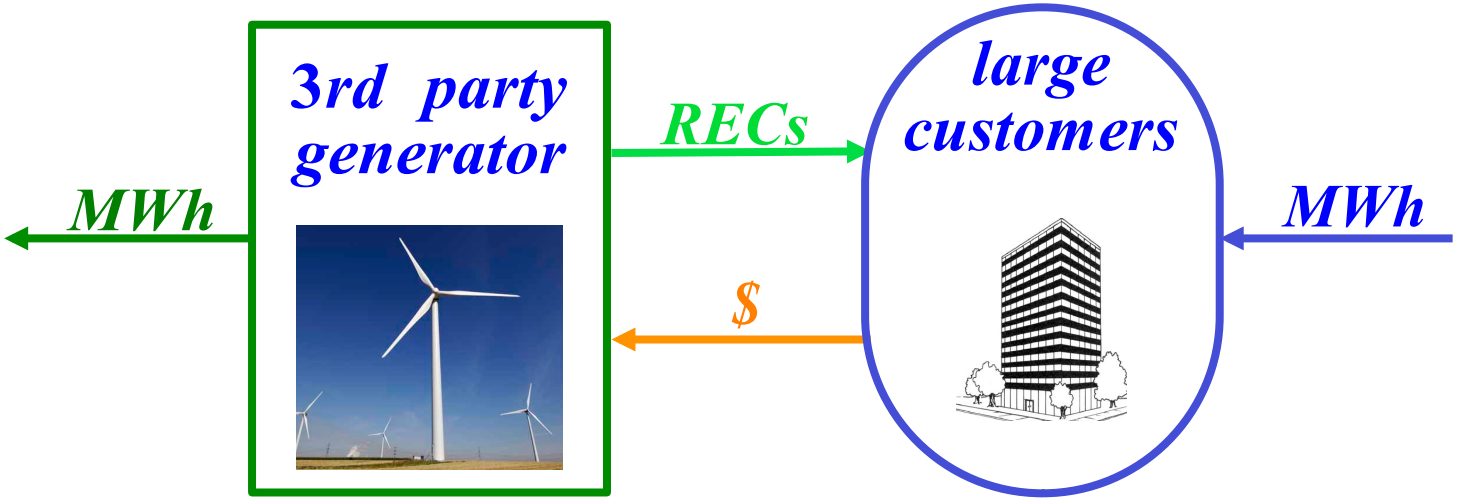


COMPETITIVE RETAIL SUPPLIERS

- Utility customers in competitive retail electricity markets may opt to purchase *RE* from an *alternative retail electricity supplier*
- Such a supplier is selling *RECs* to the customers as there exists no mechanism to supply directly *green electricity* to the customers

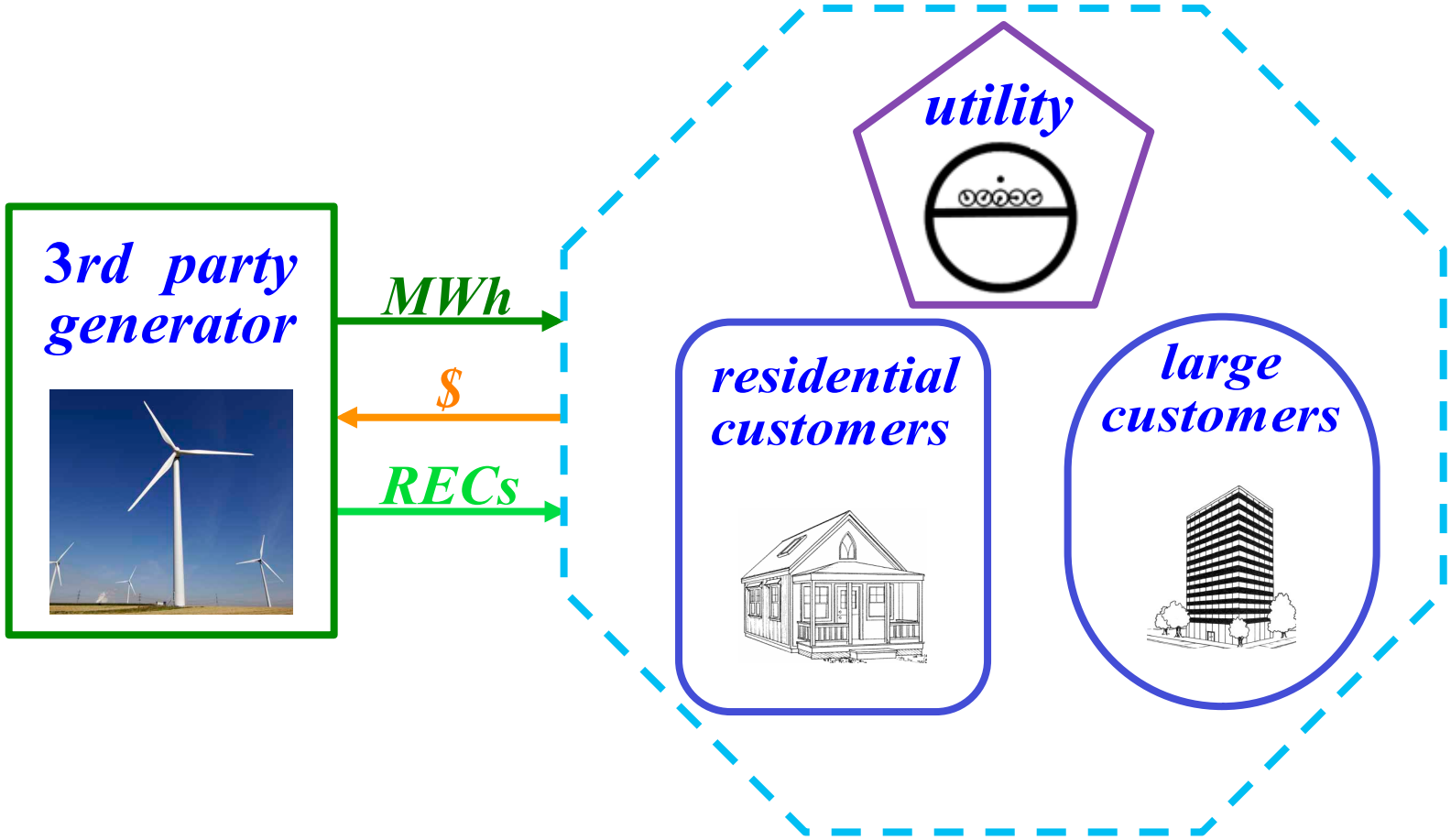
UNBUNDLED *RECS*

***RE* generators may sell electricity and the associated *RECs* to customers as separate, unbundled products.**



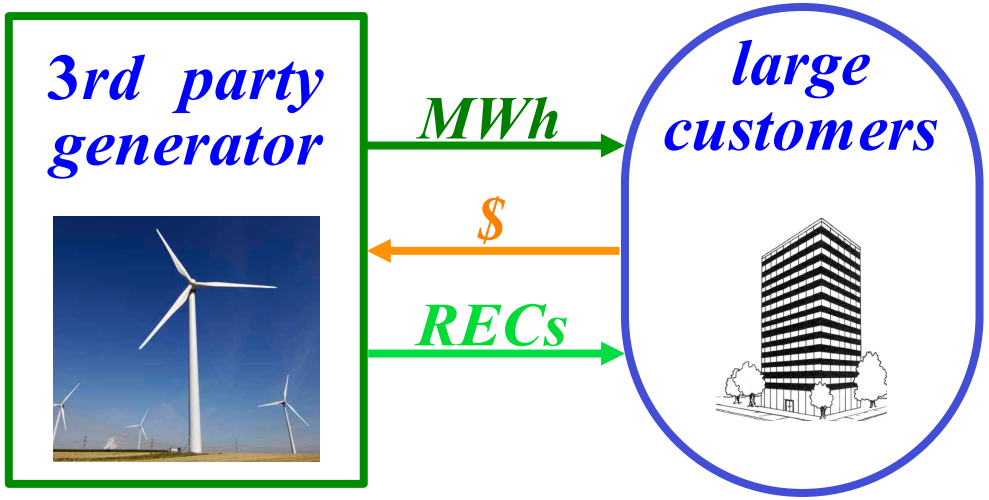
COMMUNITY CHOICE AGGREGATIONS

Communities aggregate their loads to collectively procure *RECs*, just as do other large load customers.



POWER PURCHASE AGREEMENT (PPA)

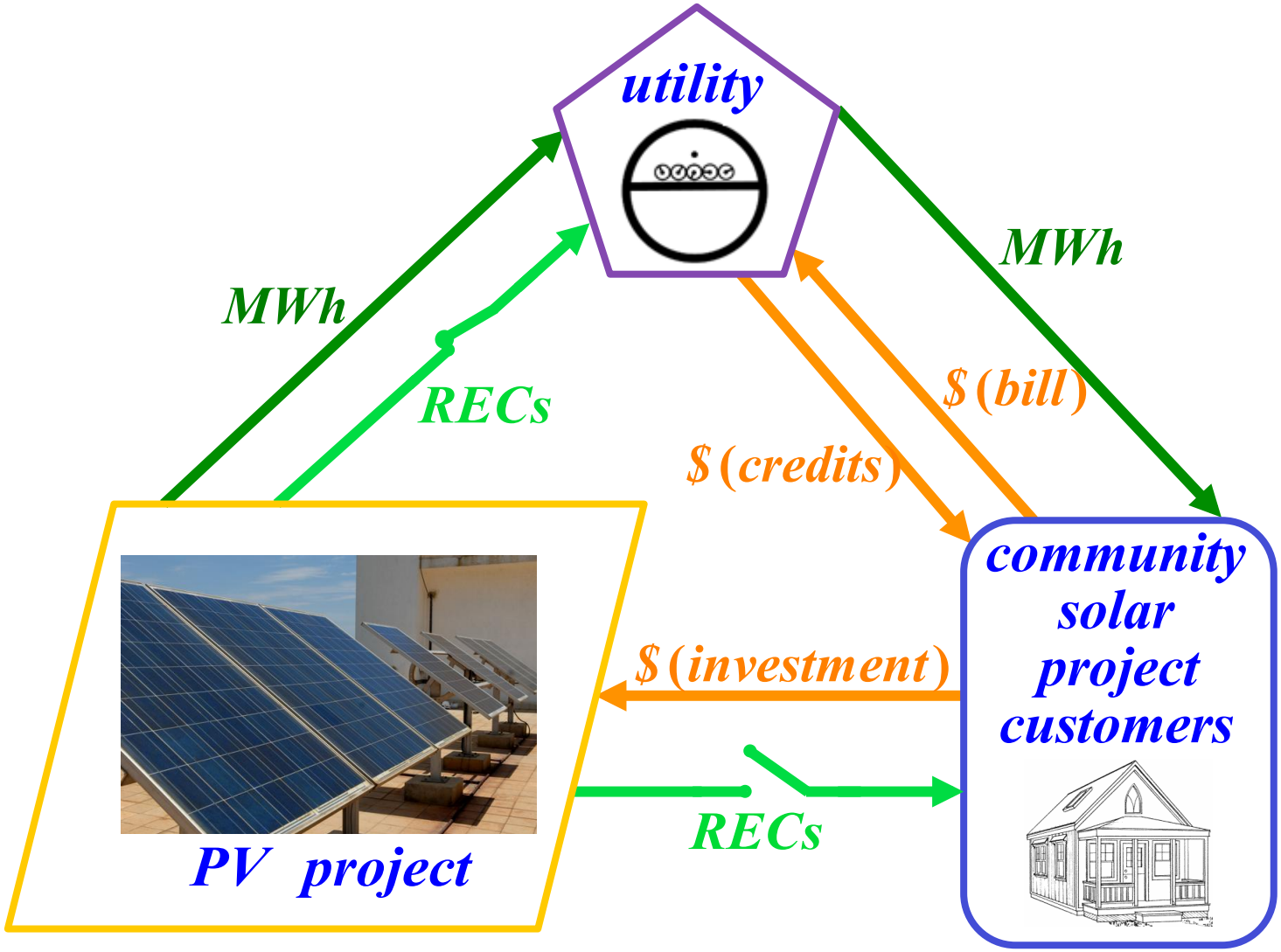
Contracts for the delivery of the output of renewable resources to meet the load of a customer are made for a specified period and under agreed terms.



COMMUNITY SOLAR PROJECTS

- Utility customers buy a subscription in a shared solar project owned by either a third party developer or the utility itself
- The subscription provides customers with credits for their share on their utility statements
- Typically, the utility remains the holder of all the *RECs* so as to meet its *RPS* requirements

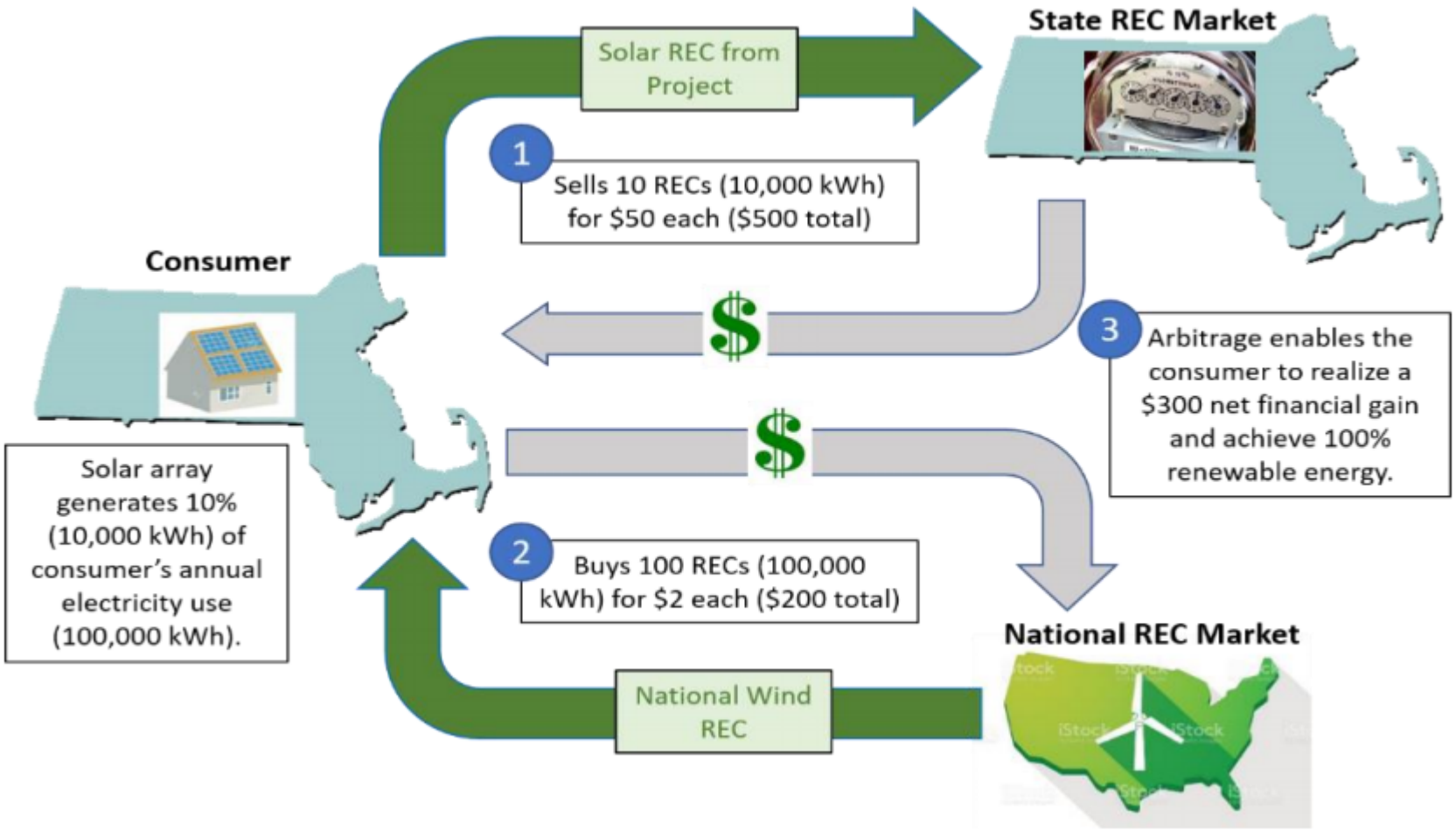
COMMUNITY SOLAR



REC ARBITRAGE

- A *RE* project whose *REC*s are highly priced may sell its *REC*s outright and replace them with *REC*s purchased at a much lower price
- Based on such a price difference between the *REC*s, the *RE* project becomes even more *profitable* with no the need to give up green energy claims

REC ARBITRAGE : EXAMPLE



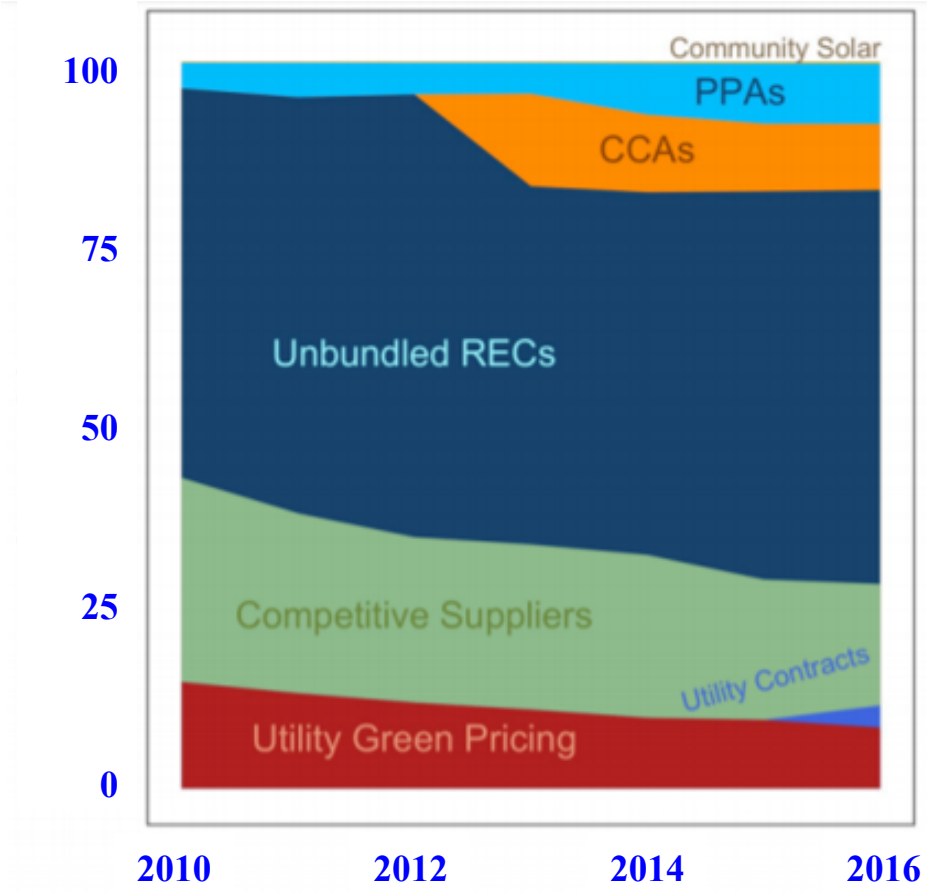
Source: https://www.epa.gov/sites/production/files/2018-01/documents/gppwebinar-1-17-18_kent.pdf

US REC STATUS

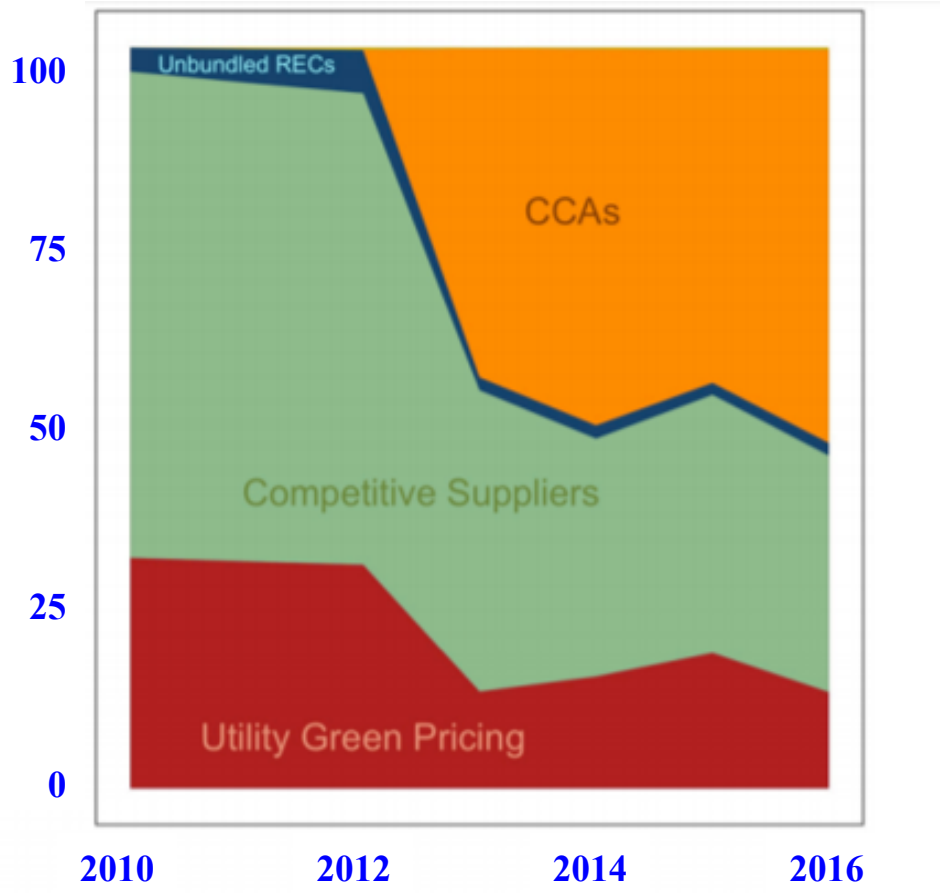
- Over 6 million customers procured *RECs* in 2016 – a 45% increase over the customer number in 2015
- 95 million *MWh* of *RECs* were purchased in voluntary markets in 2016 – a 19% increase over the 2015 purchase volume
- Unbundled *RECs* account for over half of the *REC* purchases and are held by large non–residential customers to meet their *RE* goals

REC EVOLUTION

share of MWh sales (%)



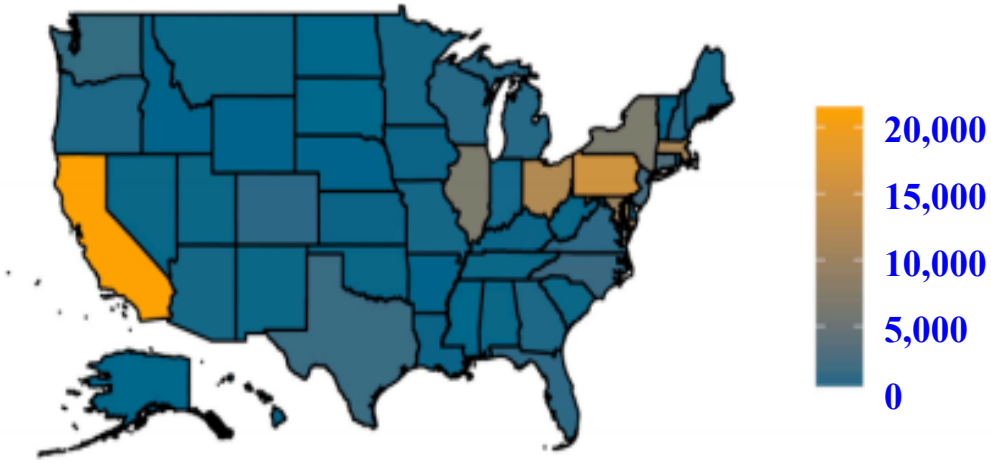
share of customers (%)



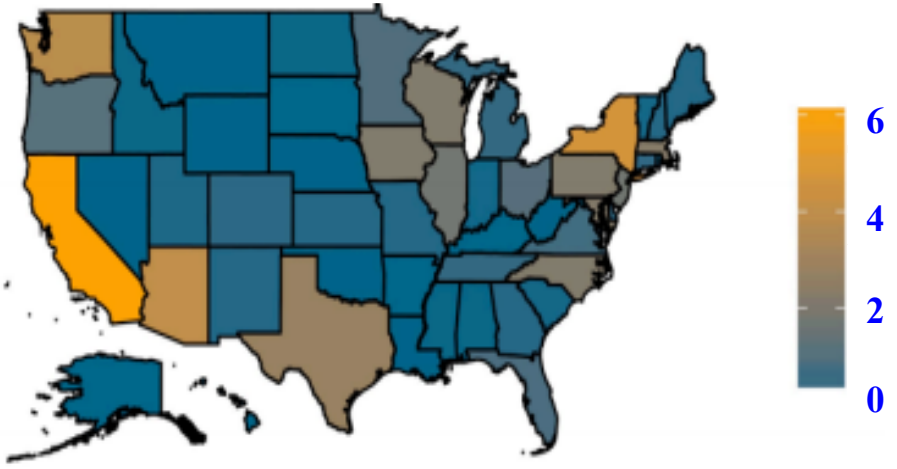
Source: https://www.nrel.gov/docs/fy18osti/70174.pdf

2016 UNBUNDLED *REC* STATUS

unbundled RECs number of customers



unbundled RECs state of origin (million MWh)



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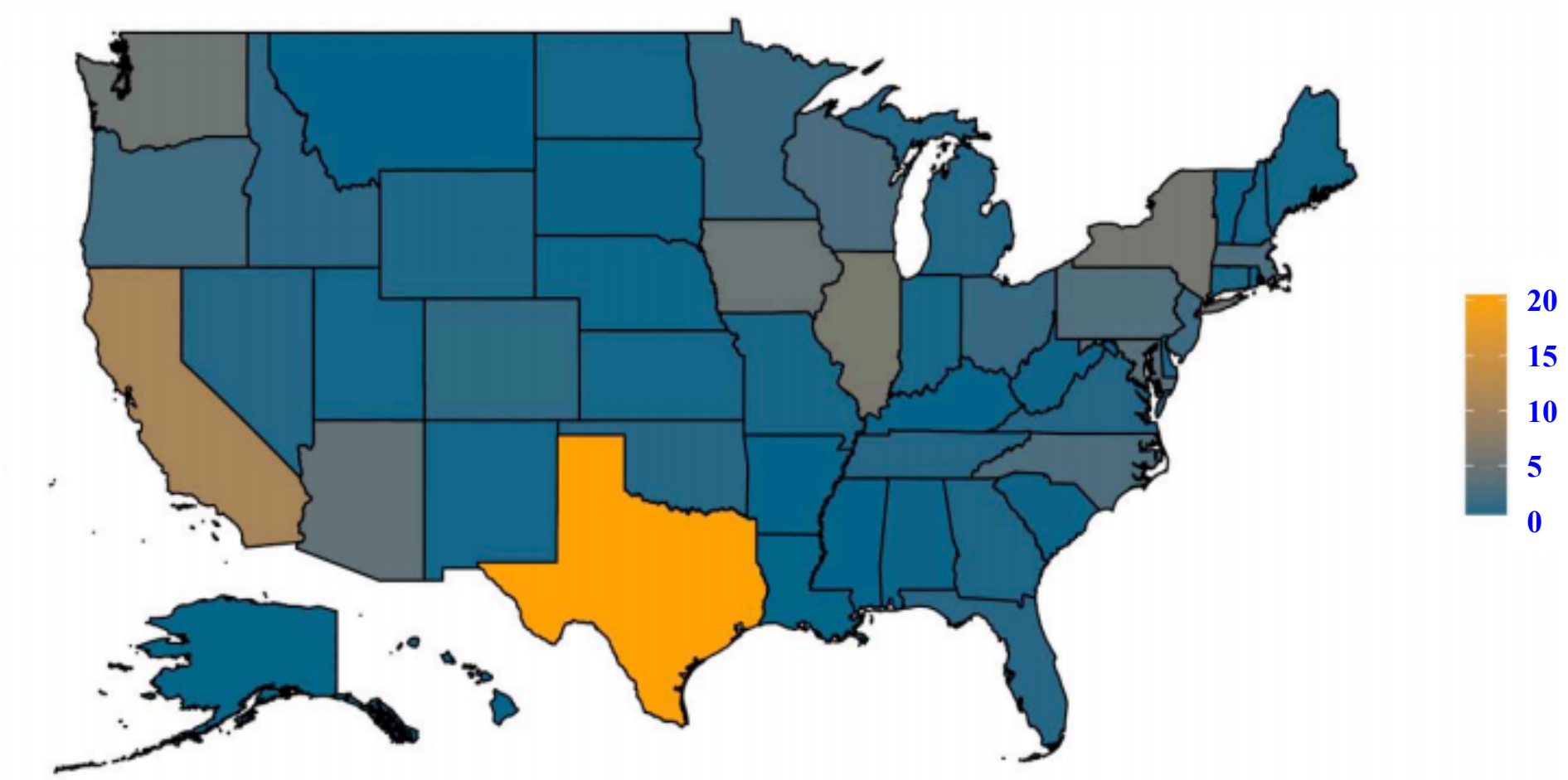
2016 *REC* STATUS

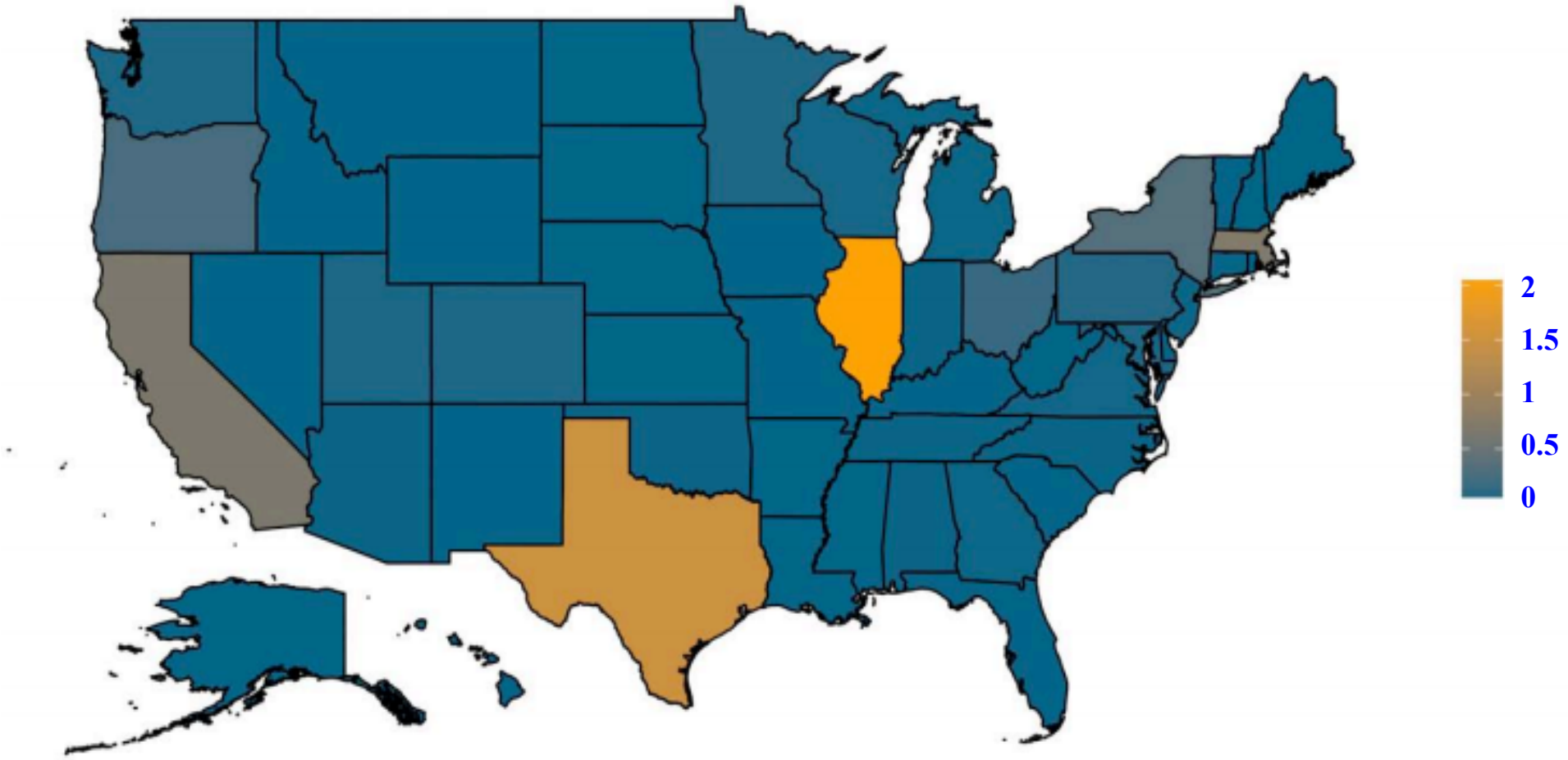
REC state of origin (million MWh)



Source: https://www.nrel.gov/docs/fy18osti/70174.pdf

2016 *REC* STATUS

REC demand (millions of customers)



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CONCLUDING REMARKS

- *RE* demand is considerably higher in states such as *CA*, *IL*, *TX* and *MA*
- *TX*, *CA*, *IA* and *IL* provide the majority of green power generation consumed in the *US*
- *RE* demand will increase as prices decline and new products are introduced
- The *REC* demand will increase over the short term as the desire *to look green* is likely to continue