Prepared for the Renewable Thermal Collaborative by:

RENEWABLE THERMAL COLLABORATIVE

D|G/A David Gardiner and Associates

Issue Brief: *What renewable electricity markets can tell us about the future of renewable thermal energy*

Energy used for heating and cooling is responsible for nearly half of global energy use and 39% of energy-related greenhouse gas emissions.[1] Therefore, it would seem obvious that renewable thermal energy has the potential to drastically curb US carbon emissions while supporting job creation and economic growth. Additionally, on top of their commitment to renewable electricity, corporations are realizing that in order to meet their ambitious emissions and renewable energy goals, they must include renewable heating and cooling options to achieve their sustainability objectives.

In fact, there is significant corporate interest in pursuing renewable thermal technologies. Steve Skarda, the Global Climate and Energy Leader at Proctor & Gamble reported that P&G has set a goal of sourcing 30% of their energy from renewable sources by 2020, yet only "about 25-30% of [Proctor & Gamble's] energy is electricity so if we were going to get to 30% renewable, we had to do something in thermal."[2]

Yet, unlike renewable electricity, a number of barriers have kept the renewable thermal market stagnant. However, the introduction of renewable thermal energy into state Renewable Portfolio Standards (RPSs) could present the push the market needs to overcome these barriers. Therefore, the key question is will the introduction of renewable thermal to state RPSs spark a market growth?

Let's take a few steps back to explain why this answer is not quite simple.

Putting aside some of the technical barriers around applications and heating requirements, some of the biggest barriers are from a lack of public and practitioner awareness, high capital and operating costs, and a lack of policy attention directed toward renewable thermal. However, much-needed political attention toward renewable thermal is beginning to emerge, albeit slowly, which has the potential to address the non-technical barriers.

Current market barriers for renewable heating and cooling technologies:

- **Geography:** thermal energy cannot be transmitted over long distances, therefore the resources for energy production must be found on or near-site. This is not always geographically possible, particularly for technologies such as solar and geothermal.
- **Technology:** technology does not yet exist to meet all thermal energy demands, particularly those requiring extremely high temperatures.
- **Awareness:** renewable thermal energy has not received extensive publicity leaving potential buyers in the dark regarding their options.
- **Cost:** Renewable thermal energy is not a cheaper alternative in most cases. Natural gas prices are low in the US; therefore, switching to renewable options typically increases operating costs.
- **Policy:** There has been minimal policy effort to date supporting renewable thermal energy. Political action can work to mitigate the other barriers.

How quickly is this newfound policy attention toward renewable thermal developing? Currently, 29 states plus Washington D.C. and 3 U.S. territories have adopted electric RPSs, and these programs are responsible for roughly half of the US renewable electricity growth since 2000.[3]

---

[1] IEA Implementing Agreement for Renewable Energy Technology Deployment (IEA-RETD), 2015, "Waking the Sleeping Giant" (http://iea-retd.org/wp-content/uploads/2015/02/RES-H-NEXT.pdf).
[2] GreenBiz, Video: "The Renewable Thermal Collaborative – One Year In" (https://www.facebook.com/GreenBiz/videos/1849752708472501/).
[3] National Conference of State Legislatures, Jul. 7, 2018, "State Renewable Portfolio Standards and Goals" (http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx).

Of those 29 states, thirteen states and the District of Columbia include renewable thermal in their RPSs.[4] But will the introduction of renewable thermal energy into state Renewable Portfolio Standards be enough to push the renewable thermal market beyond its barriers? To get a better picture of how RPSs have impacted overall renewable deployment, we look to the relationship between renewable electric compliance and voluntary markets (i.e. renewable electricity developed for state RPSs vs. projects developed outside of state requirements during the same time period) to get a baseline of the relationship.

A recent study by the Clean Energy States Alliance found that the renewable electric voluntary purchases and RPS mandated purchases increased in tandem after RPS introductions (see Figures 1 and 2).[5]

Renewable Electric Purchases Mandated by an RPS 2000-2015

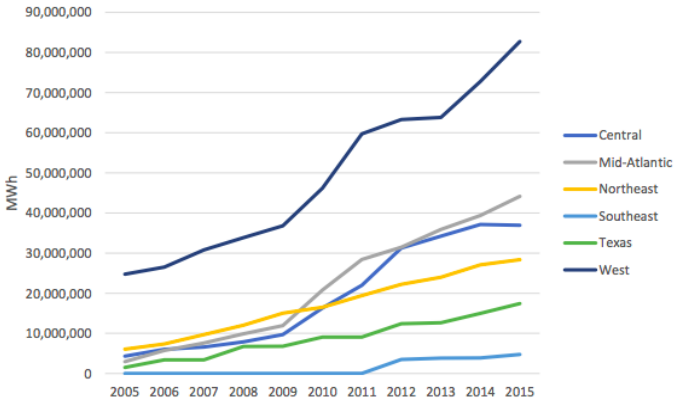

Figure 1: Compliance purchases display an upward trend since 2000 as more states adopt and act upon RPSs. *(Source: Clean Energy States Alliance, 2017)*

Renewable Electric Voluntary Purchases 2000-2015

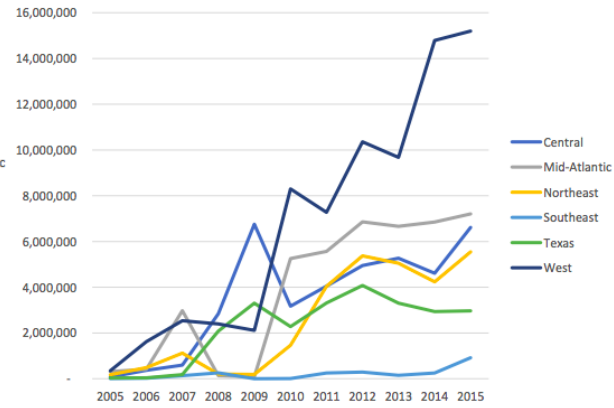

Figure 2: Historic US renewable electricity voluntary purchases have increased in tandem to the compliance purchases. *(Source: Clean Energy States Alliance, 2017)*

This tandem growth can be credited to several factors, including:[6]

- RPSs increase public awareness of renewables;[7]
- RPSs create a necessity for renewable energy sources in the state, increasing access, options, and affordability; and
- The two markets mutually increase investment and support technological and resource advancement including improved metering, support tools, data quality, and increased education.

But can this mutual growth be expected for renewable thermal energy?

First, let's take a look at what differs between electric and thermal compliance markets. As mentioned, thirteen states now include thermal energy in their RPSs, but unlike many electric RPSs, those thirteen policies look far from identical (Figure 3).

---

[4] Clean Energy States Alliance, Jul. 2018, "Renewable Thermal in State Portfolio Standards" (https://www.cesa.org/assets/Uploads/Renewable-Thermal-in-State-RPS-April-2015.pdf).
[5] Clean Energy States Alliance, Jul. 2017, "Two Markets, Overlapping Goals Exploring the Intersection of RPS And Voluntary Markets For Renewable Energy In The U.S." (https://cesa.org/assets/2017-Files/RPS-and-Voluntary-Markets.pdf).
[6] *Id.*
[7] Bird, L. and E. Lokey, 2008, "Interaction of Compliance and Voluntary Renewable Energy Markets" (https://www.sciencedirect.com/science/article/pii/S1040619008000043).

Much of the variation is due to key differences between thermal and electric energy that reduce political consistency:

- **Difficult to quantify:** There is no universal means of quantifying thermal energy because, unlike electricity, it cannot be uniformly measured due to variation in technology. Therefore, for the purposes of state RPS, it must be calculated as kilowatt hours (kWh) displaced or converted from BTUs produced into a kWh equivalent— the accepted method varies state-by-state.
- **No universal value:** Once this unit of measurement is determined, states disagree on how to value a unit of thermal energy. Some states hold them as an electric equivalent, others attribute them to separate carve outs, or give them 'partial credit' by applying them to a lower tier in the RPS compared to renewable electricity sources.

Figure 3: Renewable Thermal RPSs by State[8]

State	Eligible Technologies	Value within RPS	REC Definition
AZ	Biomass, biogas, solar, geothermal,	Distributed energy resource, 30% requirement	BTU Conversion
DC	Solar	Tier I technology, same as solar electric	BTU Conversion
IN	"Clean energy" thermal resources	Alongside renewable electricity	BTU Conversion
MD	Residential solar water, geothermal, biomass (except wood)	Tier I, solar water eligible for solar carve out	BTU Conversion
MA	Solar, biomass, biogas, geothermal	Alternative Energy Standard (5% by 2022)	BTU Conversion
NV	Solar, geothermal	Renewable resource	BTU Conversion
NH	Solar, geothermal, biomass	Required 2% thermal by 2023	BTU Conversion
NC	Solar, waste heat from biomass	Solar thermal is in solar specific target	BTU Conversion
OR	Biomass electric with thermal byproduct	TRECs	BTU Conversion
PA	Solar hot water and case-by-case	Tier II	kWh Displacement
TX	Solar hot water, geothermal heat pumps, landfill gas	Solar and geothermal are generation offset	kWh Displacement
UT	Solar, geothermal	'renewable resources,' separate from electric	kWh Displacement
VT	All	Tier III	kWh Displacement
WI	All	Non-electric resources (electric displacement)	kWh Displacement

Each state is listed along with the technologies that are eligible, how those technologies are valued within the RPS, and how a unit of thermal energy is calculated.

Additionally, many of the largest physical barriers in the way of renewable thermal growth are not shared by the electric market and therefore must be taken into account as well before a market prediction can be made:

[8] Clean Energy States Alliance, 2018, *supra* note 4.

- **Geography:** With the exception of renewable natural gas (RNG) and renewable electric thermal energy, renewable thermal energy must be created on or near its use sites and cannot be pumped into a grid which creates added costs.
- **Technology:** Not all thermal needs can be met with existing renewable technology, particularly those processes that require extremely high heat.
- **Cost:** Natural gas prices are at all-time lows in the US. In most cases, switching to renewable options comes at a premium.

Although the barriers above appear daunting, it is reasonable to assume that the previously discussed reasons for mutual growth of the renewable electricity market will apply to the thermal market as well. The introduction of thermal into an RPS will require thermal resources to become accessible in that state. This resource expansion will make renewable thermal more readily acquirable for voluntary purchasers. Additionally, by adding thermal into a public policy, potential purchasers may simply become aware that these technologies exist, overcoming the lack of awareness barrier. Lastly, as the two markets continue to grow, they can mutually support one another by investing in technology and resource improvements that will benefit the market at large, increasing the feasibility of renewable thermal propagation.

Additionally, governments can take steps when integrating renewable thermal into RPSs to decrease the impact of remaining barriers and increase the likelihood of overall renewable thermal market expansion. These include:

- **Establishing a common currency/language** to define a unit of thermal energy and its value in an RPS. Simplicity and consistency increase likeliness of market participation—the easier it is, the more likely participation will increase.[9]
- **Develop financial incentives** to provide financiers an incentive to invest and end users an incentive to deploy existing renewable heating and cooling technologies. Unlike wind and solar energy, most renewable thermal technologies do not benefit from the same type of tax credits that helped reduce the technology cost to be on par with existing resources.
- **Increase funding for R&D** which will lead to reduced costs of existing technologies, advance technical applications, and potentially lead to new renewable thermal applications that fundamental shift the thermal energy landscape.

Ultimately, the unique characteristics of renewable thermal energy make the exact interaction between its voluntary and compliance markets difficult to predict. Yet despite this uncertainty, there is plenty of room for optimism—both states and private energy consumers have large incentives to support renewable thermal energy. Continued growth of the private market can be expected as large energy users pursue renewable thermal to reduce their carbon footprints. Likewise, state governments, aiming to diversify their energy portfolios and reduce emissions, are expected to increase interest in thermal energy, sparking RPS expansion. Together this mutually expanded interest will lead to increased awareness and technological expansion, reducing barriers, and supporting renewable thermal energy and propagating its growth across both markets.

Author: Claire Dougherty, Intern, David Gardiner and Associates
For more information about the Renewable Thermal Collaborative, contact info@renewablethermal.org.

[9] Clean Energy States Alliance, 2017, *supra* note 5.