



READINESS FOR HOURLY: U.S. RENEWABLE ENERGY TRACKING SYSTEMS

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JUNE 15, 2023

Purpose: This report is intended to be a resource for stakeholders interested in learning more about the capabilities and plans of existing U.S. renewable energy certificate (REC) tracking systems to track more granular (i.e., hourly) data. It is not the intention for this report to argue for or against instituting requirements for tracking systems to track electricity generation on an hourly basis. Rather, this report is an overview of the current readiness of established U.S. REC tracking systems to track on an hourly basis, based on interviews with the system operators.

About CRS: CRS is a 501(c)(3) nonprofit that creates policy and market solutions to advance sustainable energy.

For more information, please visit www.resource-solutions.org

Executive Summary

- Although hourly tracking cannot be implemented nationwide immediately, the majority of the existing U.S. REC tracking systems estimate a short phase-in period of 1–2 years once the decision to implement hourly tracking has been made (see summary table on page 26)
- WREGIS, which covers the western U.S., provided the longest estimate of 3-5 years. Receiving support from state and federal agencies could help accelerate the timeframe closer to 3 years
- Three U.S. tracking systems currently have the capability to track hourly data. Hourly tracking, trading, and retirement capabilities vary by system, and their functionality is evolving
- In regions without hourly functionality, manual processes could be used in the interim, combined with retirement of monthly certificates in the tracking systems
- The main challenges/obstacles to hourly tracking that system administrators identified included costs, interactions with state renewable portfolio standard (RPS) compliance programs, low demand for hourly tracking, stakeholder engagement processes, and data availability

Executive Summary (cont.)

- Equitable funding solutions for system upgrades are needed for single-state tracking systems
- Coordination with state regulators in states with RPSs will be important in order to avoid overprocurement and added costs
- Stakeholders interested in hourly tracking in states without hourly functionality can engage with the regional tracking system to support implementing this new functionality
- Engagement with state public utility commissions (PUCs) could be helpful for interested stakeholders to consider to encourage PUC approval of hourly tracking
- Regardless of the readiness of existing U.S. tracking systems to implement hourly functionality, they are credible, reliable, and widely used systems
- The RECs that the systems track are essential for verifying the delivery and/or use of renewable electricity

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Background

Stakeholder Interest and Opportunities for Hourly Matching

- There is increased market interest in 24/7 hourly-matched renewable electricity products as a mechanism for decarbonizing electricity purchases
- Different types of stakeholders are interested in matching their electric load with clean electricity generation on an hourly basis, including companies, federal agencies, and hydrogen producers
 - Federal agencies are pursuing hourly-matched clean electricity products for their own facilities to comply with Executive Order 14057
 - Rules for hydrogen production tax credits under Section 45V in the Inflation Reduction Act are currently being determined by federal agencies. These agencies are considering whether electrolytic hydrogen made with clean electricity should be required to match electric load to hydrogen production on an hourly basis.

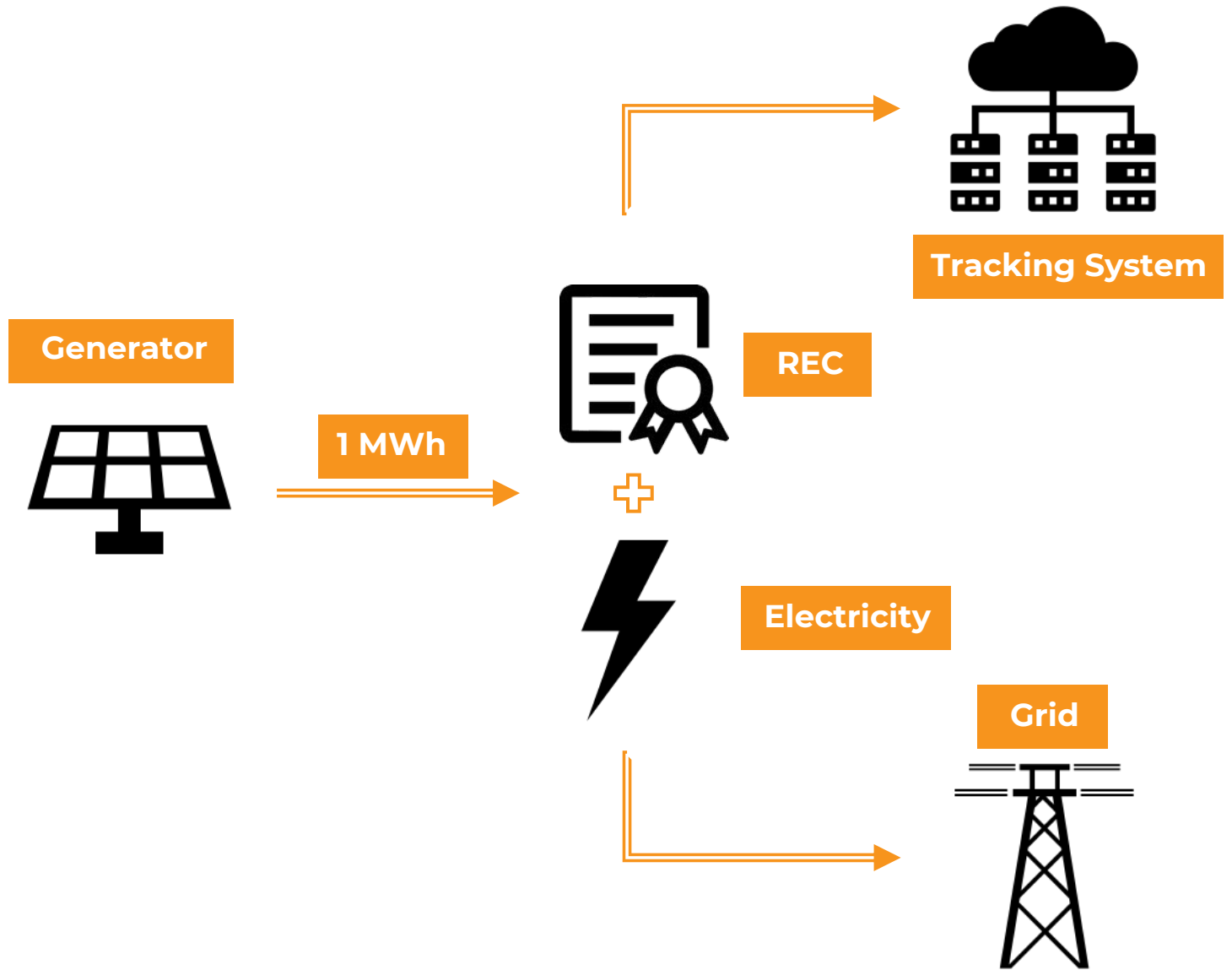
Progress and Examples

- Several large technology companies with data centers (e.g., Google, Microsoft, and Iron Mountain) are pursuing 24/7 clean energy goals
 - Google contracted with AES in Virginia, Silicon Valley Clean Energy in California, and Nevada Power Company in Nevada to provide carbon-free energy matched on an hourly basis
 - Microsoft partnered with Constellation and AES for hourly-matched, carbon-free energy
 - Iron Mountain partnered with RPD Energy for 24/7 matched carbon-free electricity
- Other load serving entities (LSEs) are pursuing hourly-matched clean or renewable electricity programs, including Peninsula Clean Energy in California, Duke Energy in North Carolina, Entergy Arkansas, Xcel Energy in Colorado, and Georgia Power Company
- M-RETS and NAR completed hourly tracking pilots with customers
- EnergyTag created a standard for energy attribute tracking systems to track granular (i.e., hourly) certificates

Introduction to U.S. REC Tracking Systems

Renewable Energy Certificates (RECs)

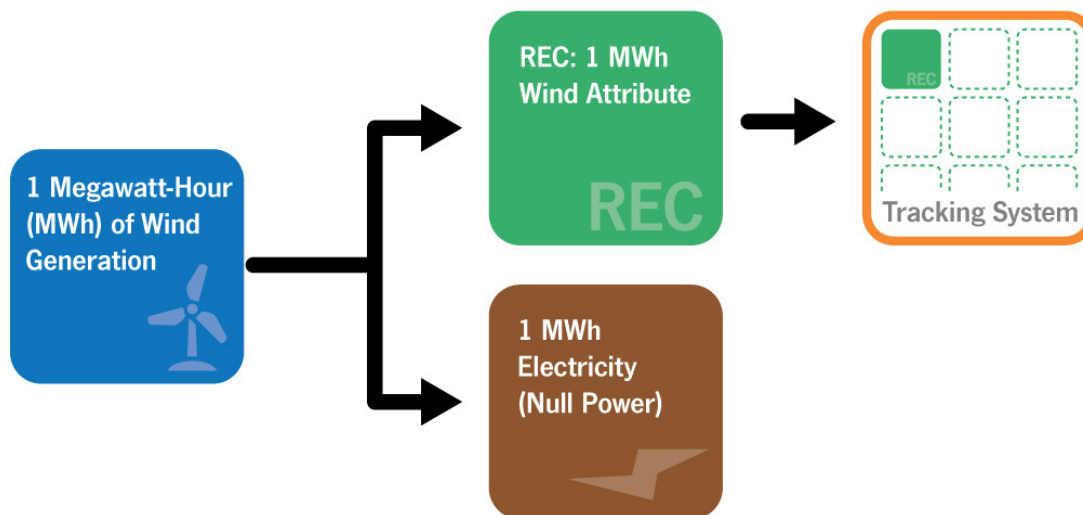
1 REC represents the renewable attributes of 1 MWh of renewable energy generation



Introduction to Tracking Systems

Tracking Systems are electronic databases with basic information about each MWh of renewable power generated in the region.

- Certificates can be transferred among account holders much as in online banking
- Unique identification numbers are assigned for each megawatt hour of renewable electricity generated.














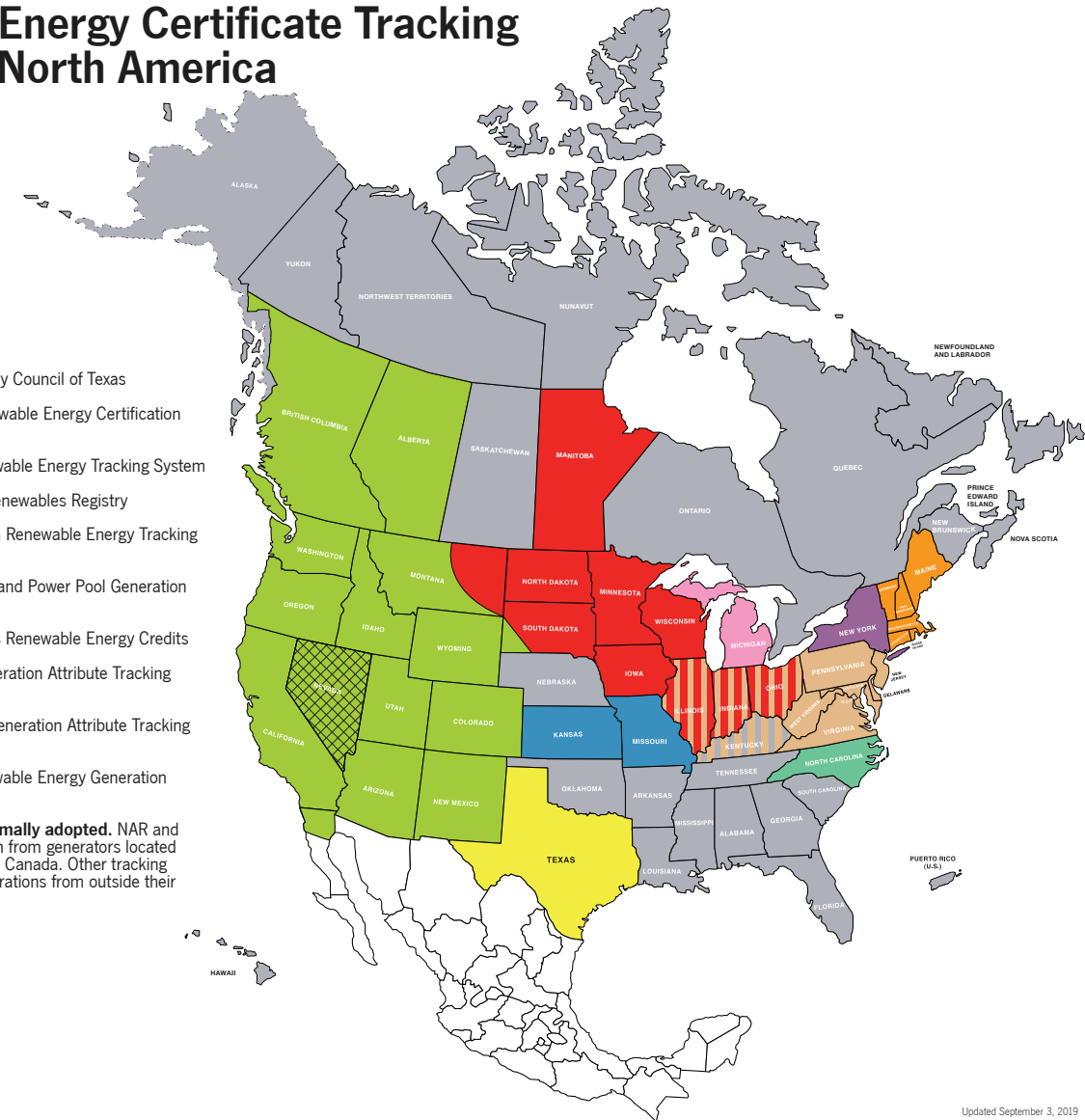
Introduction to Tracking Systems

- Credible, regional tracking systems are used throughout North America
- There is full coverage for the U.S. The states shaded in gray do not have a state renewable portfolio standard (RPS). NAR and M-RETS track RECs in these states.

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
-  **PJM-GATS:** PJM EIS's Generation Attribute Tracking System
-  **WREGIS:** Western Renewable Energy Generation Information System
-  **No tracking system formally adopted.** NAR and M-RETS allow registration from generators located anywhere in the U.S. and Canada. Other tracking systems may allow registrations from outside their geographic territory.



Updated September 3, 2019

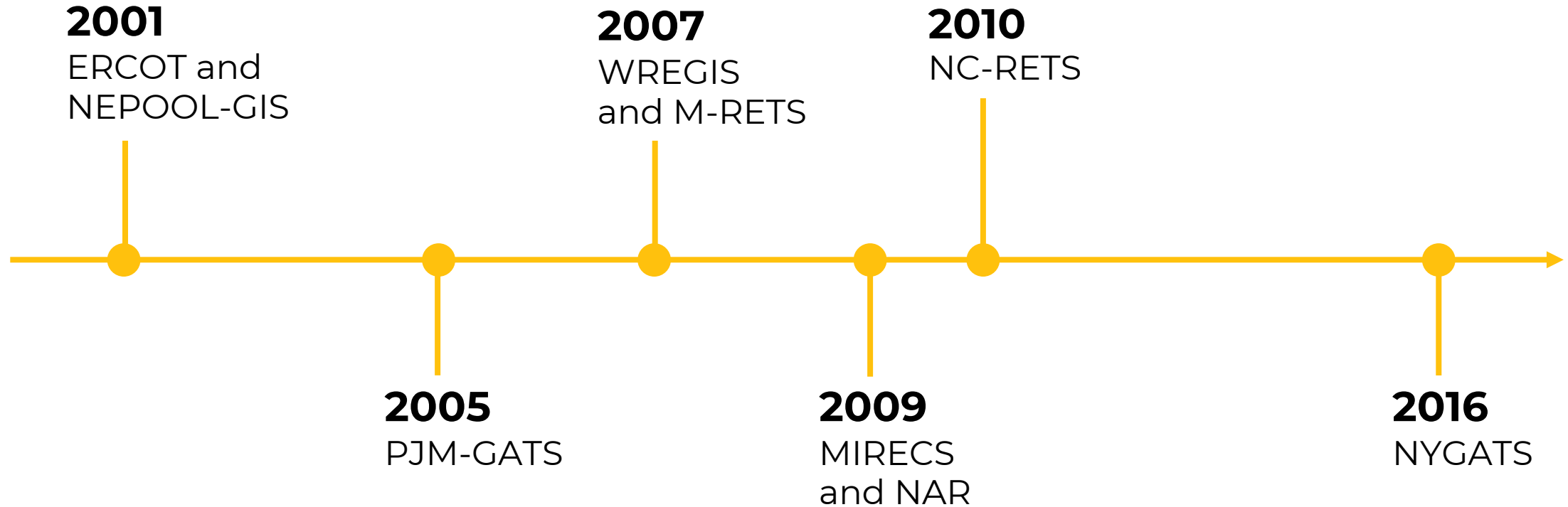
Existing Tracking Systems

- All of the tracking systems have similar functionality for tracking renewable electricity
 - The fields in tracking systems operate on a common framework
 - The only exception is NVTREC, which has limited functionality and is primarily used to track station service and parasitic load in Nevada for the Nevada RPS. Small residential solar facilities that are not aggregated are also tracked by NVTREC, but those certificates are not currently being traded or used by renewable energy market participants. WREGIS also covers the state of Nevada, and NVTREC is not used for the voluntary market. Because of its limited functionality and overlapping coverage with WREGIS, NVTREC is not covered in this report.
- Facilities are listed publicly, and the tracking systems coordinate to avoid double registering of generation assets

Existing Tracking Systems

- To avoid double counting of issued and traded certificates towards specific uses, state and voluntary certification programs require the use of specific “retirement reasons” when each certificate is retired/cancelled in the system
- Tracking systems are generally policy neutral; they track what users want them to track and/or what regulators require them to track
- Regardless of the granularity of vintages (e.g., quarterly, monthly, hourly) these systems track, RECs are essential for verifying the delivery and/or use of renewable electricity

Tracking System Launch Timeline



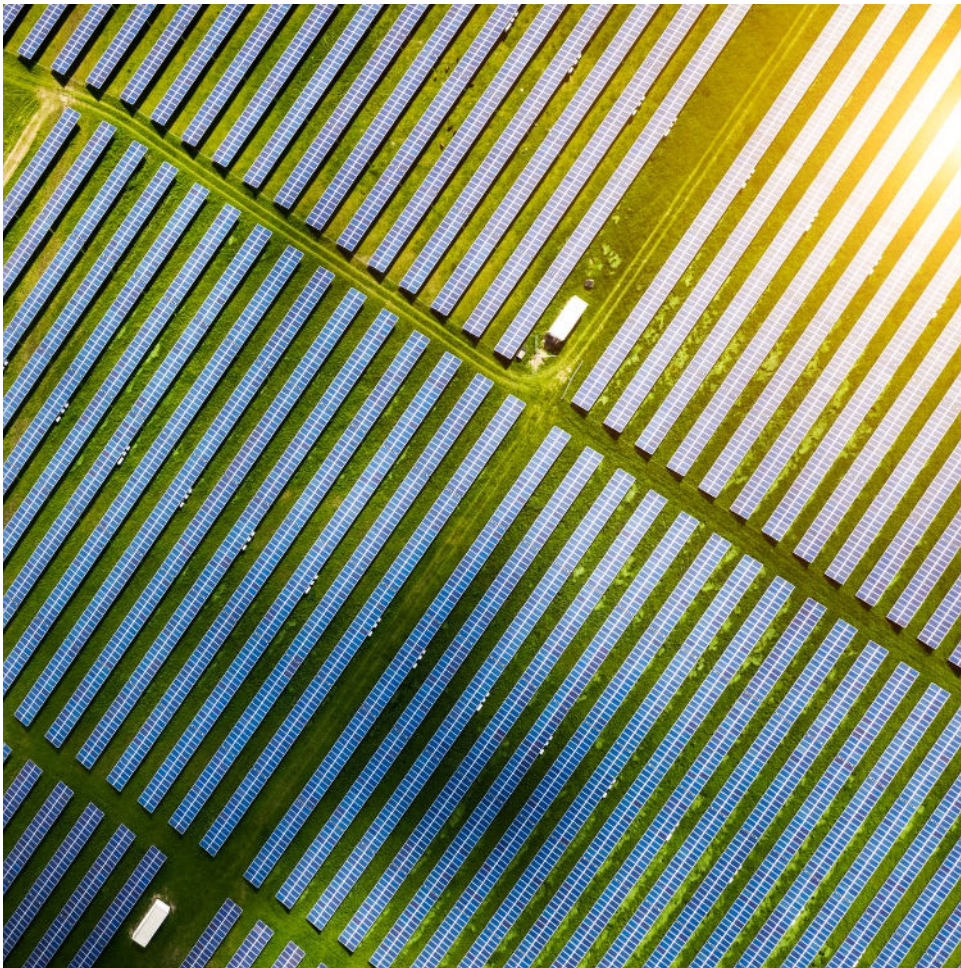
These credible tracking systems have been in operation for many years. The latest tracking system was launched 7 years ago.

Users of Tracking Systems Include:

- Generating facilities
- Load serving entities (e.g., utilities)
- Electricity/Certificate marketers and sellers
- Qualified reporting entities (QREs)—report MWh data to the system
- Large electricity buyers
- State/Provincial program administrators (e.g., for RPS compliance, Power Source Disclosure)
- Voluntary program administrators (e.g., Green-e[®] certification program)

Each user type has a unique account type with different abilities and level of access depending on the type of user.

Which Generators Are Being Tracked?



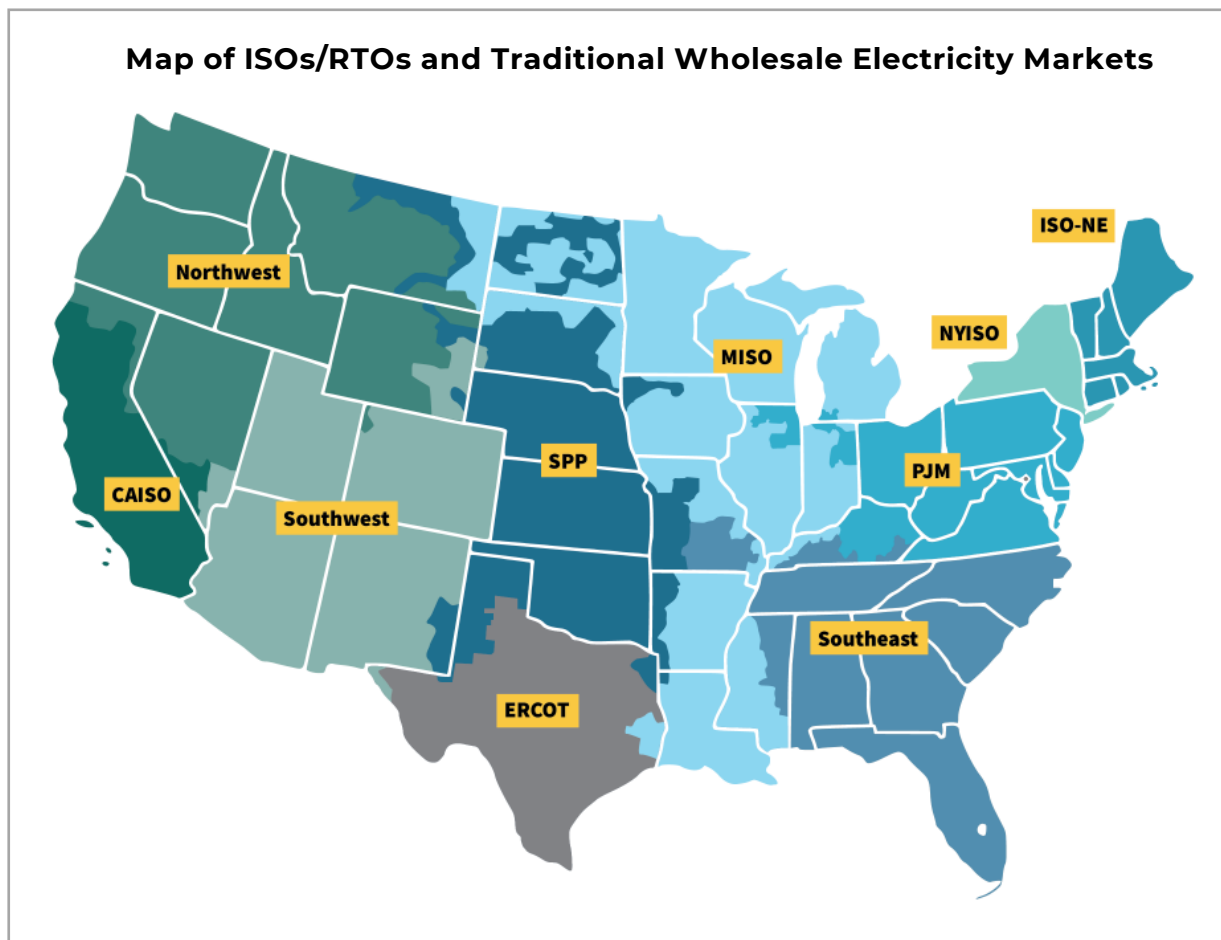
All-Generation Tracking Systems

- Renewables (including large hydro)
- Nuclear
- Fossil Fuels

Renewable Tracking Systems

- Renewables only (including large hydro where relevant markets/programs exist)

Reporting MWh Data



Source: FERC website, "Electric Power Markets"

ISOs/RTOs:

- There are 7 independent system operators (ISOs) and regional transmission organizations (RTOs): CAISO, ERCOT, ISO-NE, MISO, NYISO, PJM, SPP
- ISOs/RTOs directly report MWh data to the tracking systems

Traditional wholesale electricity markets (Northwest, Southeast, Southwest in the map to the left) comprise *many* **balancing authorities (BAs) and vertically integrated utilities** that can report data to the tracking systems

Other independent qualified reporting entities (QREs) can also report MWh data

Self-reporting (typically only appropriate for small facilities < 1 MW)

Number of Facilities/Generators

Tracking System	Number of RE Generating Facilities
ERCOT	381
MIRECS	241
M-RETS	3,402
NAR	884
NC-RETS	1,393
NEPOOL-GIS	94,434
NYGATS	1,957
PJM-GATS	364,936
WREGIS	10,140 (includes over 160,000 aggregated distributed generation rooftop solar units)

Current Uses and Markets for RECs

State Compliance Programs

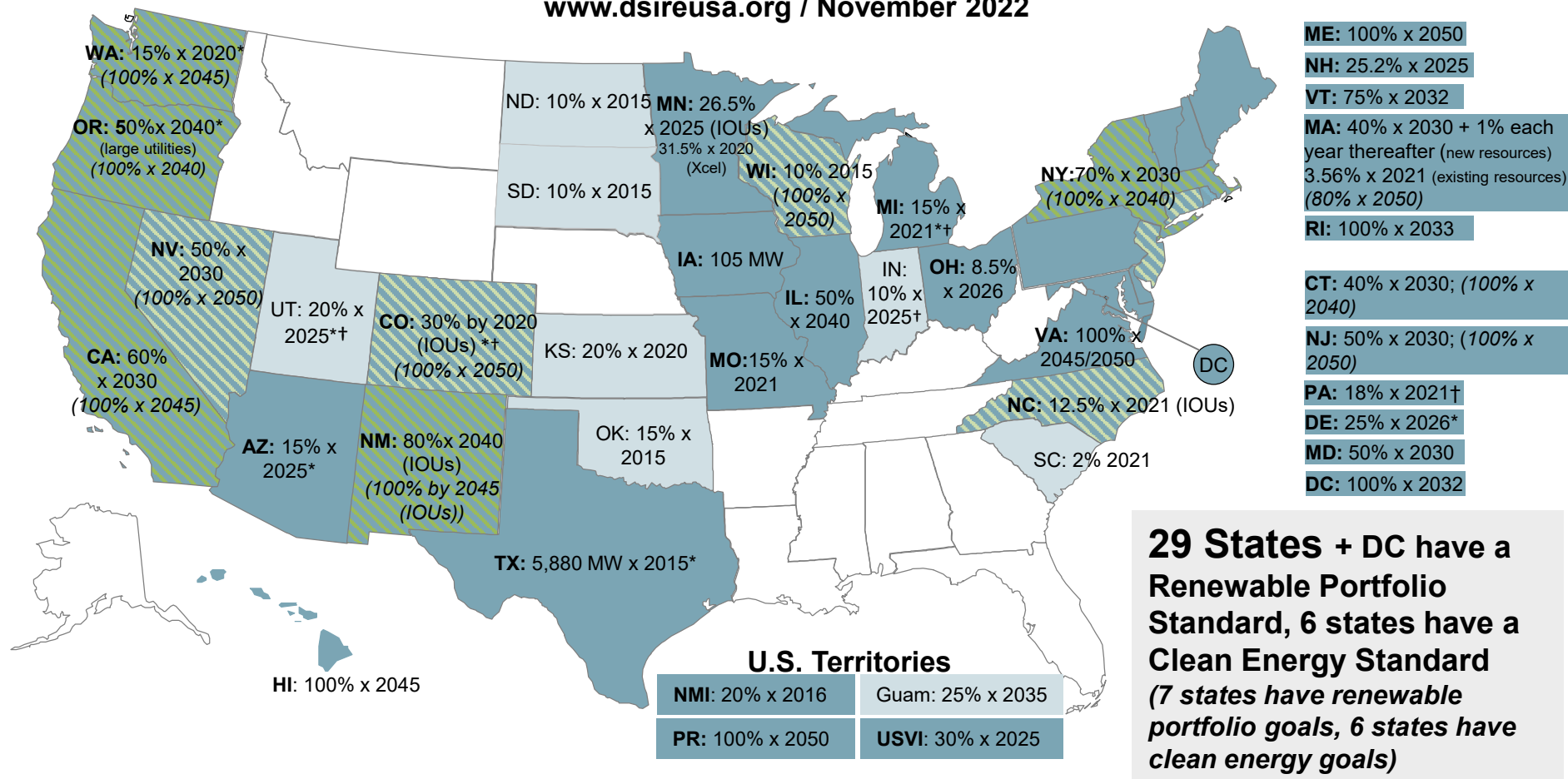
- **Renewable Portfolio Standards (RPSs)**
 - A certain percentage of renewable electricity is required to be delivered by load serving entities (LSEs) to end use customers by a certain date. Most states have interim targets/requirements
 - Except for Texas, all RPS states that use tracking systems currently use **monthly** RECs for compliance
- Other state programs, such as Clean Electricity Standards (CES), Power Source Disclosure (PSD), and electric vehicle programs

Voluntary Market

- Businesses and individuals procure renewable energy that is above and beyond government requirements and compliance programs
- National market. The majority of the voluntary market for RECs and renewable electricity is Green-e[®] Energy certified. Geographic restrictions for bundled (REC + electricity) transactions and utility programs under the Green-e[®] certification program.

Renewable & Clean Energy Standards

www.dsireusa.org / November 2022



Renewable portfolio standard
 Clean energy standard
 Renewable portfolio goal
 Clean energy goal

* Extra credit for solar or customer-sited renewables
 † Includes non-renewable alternative resources

Tracking Systems are Used for U.S. State RPS Compliance

Tracking System	State/Territory RPS Program Compliance	REC Vintage Currently Used for RPS Compliance
ERCOT	TX	Quarterly
MIRECS	MI	Monthly
M-RETS	IA, IL, MN, ND, OH (partial), WI	Monthly
NAR	KS, ME (partial), MO, NC (for out of state facilities), NY (for out of state facilities), PR	Monthly
NC-RETS	NC	Monthly
NEPOOL-GIS	CT, MA, ME (partial), NH, RI, VT	Monthly
NYGATS	NY	Monthly
PJM-GATS	DC, DE, IL, MD, NJ, OH (partial), PA, VA	Monthly
WREGIS	CA, CO, NM, NV, OR, UT (starting 2025), WA	Monthly

Key Findings: Current Status of Hourly Tracking Capabilities

Interviews with Tracking System Operators

CRS conducted interviews with each of the U.S. REC tracking systems in April and May 2023 to learn their status and viewpoints on:

- Current capabilities for tracking granular (hourly at minimum) certificates
- Existing workflows or goals for granular tracking capabilities in the future
 - If none, what drivers are needed to spur such work?
 - If yes, how are they getting the data?
 - If yes, what is their geographic coverage?
- Challenges or obstacles their system faces for implementing hourly certificates
- Types of stakeholders asking them about implementing hourly certificates
- Expected or estimated timeframe to implement hourly RECs (if challenges are overcome)

Stakeholders Interested in Hourly Tracking

Tracking systems identified the following types of stakeholders that have expressed interest in hourly tracking:

- Technology companies (with data centers)
- Green hydrogen producers and stakeholders
- Federal agencies interested in complying with Executive Order 14057 (federal agencies procuring 100% carbon-free electricity matched on an annual basis by 2030, including 50% CFE on a 24/7 basis)
- Utilities or load serving entities (LSEs) that serve the above customer types
- Trade associations representing technology companies (as RE buyers) or green hydrogen producers

Some single-state tracking systems have not had any stakeholders express interest.

Key Findings

Tracking System	Geographic coverage	Resources tracked	Hourly functionality currently available?	Current plans to implement or expand hourly tracking?	Estimated timeline for implementation if system decides to pursue hourly tracking
ERCOT	Single state	RE only	No	No	No timeline given
MIRECS	Single state	RE only	No	No	1–1.5 years
M-RETS	Multi state	RE and Alternative Energy only	Yes (limited functionality)	Yes	Already tracking
NAR	Multi state	RE only	Yes (pilot only)	No (no further plans; still in pilot)	Less than 1 year
NC-RETS	Single state	RE only	No	No	Unknown / No timeline given
NEPOOL-GIS	Multi state	All generation	No	Yes (under review)	1 year
NYGATS	Single state	All generation	No	No	1–2 years
PJM-GATS	Multi state	All generation	Yes (limited functionality)	Yes	Already tracking
WREGIS	Multi state	RE only	No	Yes	3–5 years*

*Timeline could be closer to 3 years if (1) there is full state agency buy-in, (2) clear instructions are received from federal or state agencies, and (3) funding for stakeholder participation is made available.

Hourly Functionality

For the purposes of this report:

- **Full** hourly functionality is defined as having tradeable certificates with an hourly vintage. Individual hourly certificates can be retired. Unlike traditional RECs that are denominated in 1 MWh units, hourly RECs may be fractionalized (i.e., issued in denominations that are not whole MWh units). Some tracking systems choose to use fractionalized MWh units, while others use kWh or Wh (watt-hours).
- **Partial** hourly functionality is defined as having the capability to view hourly data in the tracking system, but individual certificates with an hourly vintage are not fully tradeable between market participants. Retirement functionality may remain with monthly certificates. If hourly certificates are able to be retired, there may be restrictions on the account types that can make those retirements. Buyers cannot choose which individual hourly certificates are retired.

M-RETS Hourly Functionality

Data Sources

- Currently receiving granular data from MISO and SPP (settlement system data)
- Can receive hourly data from other facilities outside of MISO and SPP footprints (self-reported or through a QRE). One facility outside of MISO or SPP has used this option. Cannot track in regions with all-generation tracking (PJM, New England, NY) or WREGIS (unless specifically requested by WREGIS for a particular generator).

Current Functionality

- Can view hourly data within monthly certificates (data visualization)
- Retirement functionality remains with monthly certificates. Hourly certificates are not currently issued, but monthly certificates with hourly data can be retired to make hourly matching claims.

Future plans

- Plan in Q3 or Q4 2023 to create hourly certificates that can be traded separately
- Open to coordinating with other tracking systems to import certificates into M-RETS as a “Granular Certificate Platform” in accordance with EnergyTag procedures

PJM-GATS Hourly Functionality

Data Sources

- Currently receiving data from PJM (settlement system data). Can upload hourly or more granular data.

Current Functionality

- All generators in the PJM settlement system can view hourly (or more granular) data within monthly certificates
- Generators can upload .csv file for hourly retirements or transfers:
 - Generator can retire whole or partial hours' worth of certificates
 - If a generator has a standing order for RECs with one or more parties, they can upload the .csv file to split the MWh for each hour among the buyers. Buyers will only be able to see the hourly data for the RECs they purchased (all buyers receive a percentage related to their standing order; no cherry picking of hours currently allowed).

Future plans

- Plan to allow trading of hourly certificates between users in the future. Need to engage stakeholders first. No timeline yet.

NAR Hourly Functionality

Data Sources

- Currently receiving data from SPP (settlement system data)
- Can receive hourly data from other facilities outside of SPP footprint (self-reported or through a QRE). No facilities outside of SPP have used this option yet. Cannot track in regions with all-generation tracking.

Current Functionality

- In pilot program stage
 - Certificates for a facility can either be issued monthly or hourly. No toggling between data (i.e., facilities must choose whether all their generation will be issued hourly or monthly).
 - Hourly certificates can be retired

Future plans

- No future plans

Tracking Systems with No Current Plans to Add Hourly Functionality



Drivers Identified by Tracking System Operators to Unlock Barriers to Implementation:

- Approval by state PUCs
- Equitable funding solutions
- Significant demand / hearing from more stakeholders that this functionality is needed

Issues and Pathways Forward

Issues Identified by Tracking System Operators

Cost

- All single-state tracking systems identified cost as a barrier
 - One single-state tracking system (NYGATS) is **funded by ratepayers** instead of tracking system users. **They would need to decide an equitable way to fund updates** to the system that might only benefit a small subset of users.
 - One single-state tracking system (ERCOT) is **not allowed to accept additional funding** from a Market Participant that wants to add functionality to the system
- Multi-state systems did not identify cost as a barrier, with the exception of NEPOOL-GIS, which has not yet assessed whether cost is an obstacle or not

Issues Identified by Tracking System Operators

Regulatory Oversight/Goals

- Main purpose for single-state tracking systems is for RPS compliance
- Some single-state tracking systems need **state regulatory approval**

Interactions with State RPS Compliance Programs

- Only monthly (or quarterly for ERCOT) vintage certificates are needed for compliance
- **What if a state will not accept hourly RECs for compliance?**
- If a state has an RPS, LSEs and other entities subject to the RPS should **use the state-approved tracking system** to avoid over procuring renewable energy (and incurring additional cost)
 - For example, if an LSE wants to offer a 100% renewable electricity product matched on an hourly basis to their customer's load, a certain percentage may be subject to the state RPS. If, for example, the state RPS is 25%, the LSE may not want to procure 125% renewable energy spread across 2 different tracking systems (25% in the state-approved system with monthly or quarterly certificates and 100% in a non-state-approved system with hourly certificates).

Issues Identified by Tracking System Operators



Low Demand

- Many tracking systems are not hearing directly from users that want this functionality
- Concern about making a big change to benefit a small number of users

Stakeholder Process Needed

- Figuring out the details of implementation will require an in-depth stakeholder engagement process with the tracking system's users, particularly related to scope

Issues Identified by Tracking System Operators

Data Availability

- Hourly data is typically available for independent system operators (ISOs) and regional transmission organizations (RTOs). However, there is significant load for each tracking system that is not part an ISO/RTO.
 - This is especially true for WREGIS
- Not all metered data outside ISOs/RTOs is available hourly, especially for small generators
- Some Qualifying Facilities (QF) under the Public Utility Regulatory Policies Act (PURPA) contractually do not need to report data more than once a month to the tracking systems
- **Uncertainty about whether vertically integrated utility QREs will have hourly data and/or be willing to share hourly data** with the tracking system (there are already some challenges with getting monthly data from this type of QRE in some states)

Issues Identified by Tracking System Operators

Scale of Data Needed

- Data and certificate issuance needs will increase by orders of magnitude (from 12 data points a year per facility to 8,760 data points a year per facility)
- RECs are currently tracked in whole MWh denominations. Fractionalized RECs would need to be created (kWh or watt-hours)
- Should the system do an opt-in approach for generators or add hourly functionality for all generators?

Other Data Concerns

- How to deal with station service and parasitic load when generation is negative?
- How to handle different time zones within the same tracking system?
- How will import and export data be handled?

Issues Identified by Tracking System Operators

User Confusion

- Several tracking systems expressed concern that users would need to get used to hourly functionality
- Some users already make mistakes with monthly certificates (e.g., retiring incorrect vintages for compliance with RPS, or not actively paying attention to their account and losing RECs to the residual mix process in all-generation tracking systems). Shifting to hourly functionality might be a challenge for them
- Some tracking system operators suggested using monthly matching (instead of annual matching) before phasing in hourly matching

Issues Identified by Tracking System Operators



Integration With Other platforms

- Some tracking system participants use Environmental Management Account (EMA) to manage their REC portfolio across many of the different tracking systems (ERCOT, NEPOOL-GIS, NAR, NC-RETS, NYGATS, MIRECS, PJM-GATS). EMA would need to be updated to accommodate hourly tracking
- APIs to other platforms (e.g., marketplaces for trading) would need to be updated

Pathways to Enable Hourly Tracking in Systems Without Existing Hourly Functionality

1. **Passed by state legislature;** or
2. **Required by state public utility commission (PUC);** or
3. **Stakeholder process**

Each tracking system has a stakeholder process for suggesting and making changes to the system. Here is a typical process:

- Submit a change request to the system
- One or more committees often need to approve a change before it can be implemented. Stakeholders are engaged in the process, and working groups may be formed
- **The oversight body for the tracking system ultimately approves or denies the change request. For single-state tracking systems, the oversight body is typically the state PUC**
- Allocate resources to make the change (note, even if a change is approved by the oversight body, it is not guaranteed that resources will be available)

Timelines for Implementation

Upgrading the Technology for the Systems

- Most tracking systems agreed that the timeline to update their software system (coding) would likely be relatively quick: 3 months to 1 year. One system (WREGIS) estimated 1–2 years, depending on the scope of the request

Stakeholder Engagement and Approval

- Most tracking systems agreed that the timeline to engage stakeholders and receive approval by the tracking system oversight body is much longer than the technology implementation phase. Most timelines ranged from 9 to 21 months. One system (WREGIS) estimated 2–3 years
 - ERCOT and NC-RETS are exceptions—they were unable to give a timeline

Conclusions and Recommendations

Current Status and Timelines

- Tracking systems were originally set up to track monthly (or quarterly) data
- 3 tracking systems have the capability to track hourly data, and their functionality is evolving
- It is generally more difficult for single-state tracking systems to implement hourly functionality
- Although hourly tracking cannot be implemented nationwide immediately, the majority of the existing U.S. REC tracking systems estimate a short phase-in period of 1–2 years once the decision to implement hourly tracking has been made

Conclusions and Recommendations

Current Status and Timelines

- New England (NEPOOL-GIS) will likely be ready to roll out hourly tracking next year (pending approval by their Markets Committee)
- New York (NYGATS) does not have any current plans to implement hourly functionality. As an interim solution, monthly RECs could be retired within NYGATS, and hourly data could be provided and validated off-system by a third party
- PJM-GATS has implemented hourly functionality to cover the PJM (Mid-Atlantic) area. Hourly functionality is limited and will be expanded in the future

Conclusions and Recommendations

Current Status and Timelines

- WREGIS is starting a working group later this year to gather information about needs and requirements of stakeholders in western (WECC) states. Implementation is estimated at 3–5 years, depending on the overall scope
 - Their timeline could be closer to 3 years if (1) there is full state agency buy-in, (2) clear instructions are received from federal or state agencies, and (3) funding for stakeholder participation is made available
 - As an interim solution, monthly RECs could be retired within WREGIS, and hourly data could be provided and validated off-system by a third party

Conclusions and Recommendations

Current Status and Timelines

- M-RETS can cover the rest of the country (outside NY, PJM, New England, and WECC) until other regional or single state tracking systems add functionality
 - Monthly certificates with hourly data can be retired to make hourly matching claims
 - Hourly trading functionality is limited and will be expanded in the future
 - M-RETS is open to coordinating with other tracking systems to import certificates into M-RETS as a “Granular Certificate Platform” in accordance with EnergyTag procedures

Conclusions and Recommendations

Steps Needed to Unlock Barriers to Implementation

- To avoid overprocurement (and added costs) in states with a RPS, using the approved tracking system for that state will be important
 - **Coordination with state regulators** will be important to determine whether they will accept hourly certificates for RPS compliance
- If stakeholders are interested in pursuing hourly tracking in a certain state, they should directly engage with the state's approved tracking system to **submit a change request** and facilitate implementing functionality

Conclusions and Recommendations

Steps Needed to Unlock Barriers to Implementation

- **Engagement with PUCs** or state legislatures would be helpful for interested stakeholders to consider
 - RPS states with state-approved tracking systems that have no current plans for hourly tracking: NY, TX, NC, MI, KS, MO
- **Equitable funding solutions are needed for single-state tracking systems**—for example, with either impacted users or federal government agencies providing funding. State PUC approval will likely be needed.

Conclusions and Recommendations

Follow Best Practices

- Follow best practices and do not allow for self-reporting of data for facilities > 1 MW. ISOs/RTOs, QREs, and/or independently owned/operated data loggers should be used to report data
- Tracking systems should continue to be consistent and compatible with the needs and requirements of existing programs, including:
 - State programs (e.g., RPS, CES)
 - Voluntary market programs, such as Green-e[®] Energy certification

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Appendix: Helpful Resources for Understanding RECs

- Video: “What is a Renewable Energy Certificate”
<https://vimeo.com/113250210>
- Publication: “The Legal Basis for Renewable Energy Certificates”
<https://resource-solutions.org/document/the-legal-basis-for-renewable-energy-certificates/>
- Publication: “Guide to Purchasing Green Power”
<https://www.epa.gov/greenpower/guide-purchasing-green-power>
- Learn more:
<https://resource-solutions.org/learn/recs/>

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