I. Introduction

M-RETS is a non-profit, mission-driven organization whose environmental attribute tracking platform facilitates the drive toward economy-wide decarbonization. M-RETS passion does not stop simply at providing scalable and replicable digital solutions to help solve environmental problems at local, regional, and national levels, it also involves providing thought leadership and support to growing environmental attribute markets. On the data side, M-RETS accomplishes this mission with innovative, dynamic digital infrastructure and a team of passionate energy and technical experts.

The M-RETS Renewable Energy Certificate ("REC") and Renewable Thermal Certificate ("RTC") registries provide key data that serve new and existing voluntary and compliance markets across North America. The M-RETS board approved the tracking of all generation in 2018. Therefore, while M-RETS uses the term REC, M-RETS is already set up to track clean electricity certificates ("CEC"), thus, in this filing the terms REC and CEC are used interchangeably.

M-RETS facilitates REC markets by issuing a unique, traceable digital certificate (i.e., one REC) for every megawatt hour ("MWh") of verified renewable energy recorded on the platform. Once issued, M-RETS users can choose to transfer (buy/sell), retire, import, or export RECs.

M-RETS users can retire certificates either to comply with state or provincial mandates or to fulfill their voluntary commitments, ensuring that certificates are not double counted. M-RETS registers projects in all U.S. states and Canadian provinces and will support imports and exports with any registry in North America. Thus, if the federal government wanted to use one registry, M-RETS could provide that one stop solution.

M-RETS verifies all data in its system. M-RETS does not determine eligibility for specific state or voluntary programs. M-RETS develops and implements software code to support regulators of voluntary and compliance programs to ensure all retirements meet their specific needs. M-RETS is policy neutral; however, it often acts as a resource to policy makers, state utility commissions, and other energy regulators given its expertise in assisting these bodies in overseeing voluntary and compliance renewable energy programs.

M-RETS developed a unique feature called "Programs" that allow regulators to set up eligibility criteria specific to their unique needs. Regulators can then invite the organizations they regulate to their Programs. Upon accepting the invitation and attaching the retirement account to the Program, M-RETS software validates all certificates retired to an account associated with a program to ensure the certificates meet all set compliance requirements. This automated process—unique to M-RETS—prevents unnecessary rework for regulators due to an accidental retirement outside the scope of an RPS. The Program feature also saves valuable time for compliance entities by rejecting any retirements that do not fit the unique requirements set up by the regulators of the program. The IESO and Ontario stakeholders could take advantage of this feature, as it is also available for voluntary buyers to ensure their retirements meet their preset requirements.

Good governance is a core M-RETS principle. Good governance starts with M-RETS unique space in the registry platform market as an independent 501(c)(4) non-stock corporation overseen by a Board of Directors. The M-RETS Board of Directors includes state and provincial regulators, investor-owned, cooperative, and municipal utility representatives, and other diverse experts. Should the IESO or the Ontario government nominate the use of M-RETS as an official tracking tool, the province may nominate a regulator to serve on the Board of Directors.

Good governance principles also extend to M-RETS financial practices. As a fiscally strong organization, M-RETS adheres to the highest level of transparency, accountability, and integrity. In years 2014-2020, M-RETS received a clean, or unmodified opinion on its audited financials, the highest level of assurance possible by a certified public accounting firm. M-RETS would be happy to provide our unredacted audited financial statements or IRS tax form upon request by the IESO.

The M-RETS board, leadership, and development team continually stress that at its core, M-RETS is a data provider. This core function and the M-RETS mission to serve as a centralized gateway to environmental markets are at the heart of everything M-RETS does. As a non-profit, M-RETS can provide unbiased feedback to regulators about the most efficient way to achieve their policy goals. By working with M-RETS in the initial stages of program design, regulators are often able to save significant dollars by better understanding the platform's technical capabilities and how to integrate .

Embedded in the DNA of M-RETS is a commitment to providing stakeholders innovative and dynamic digital infrastructure. M-RETS recently facilitated the first ever hourly REC issuance and retirement in collaboration with Google. This work was the focus of a Google Cloud Blog titled *T-EACS Offer a New Approach to Certifying Clean Energy*.[1] On September 18, 2021, the Center for Resource Solutions awarded M-RETS a 2021 Green Power Leadership Award for Market Development in recognition of the work M-RETS completed with Google.[2]

M-RETS can bring this passion for data and environmental attribute markets to the IESO. The IESO gets more than just a modern, flexible, and scalable platform, it also joins a proven registry that adheres to the highest financial and operational standards, a focus on data access including offering a free open application programing interface ("API") to users, and most importantly database and user security, such as being the first U.S. REC registry to offer multi-factor authentication, a commitment to working with all registries, and the ability to track in every U.S. state and territory and Canadian province.

M-RETS is a value-based system, and it is important to evaluate M-RETS as such. M-RETS provides users:

[1]Texier, Maud, T-EACS offer a new approach to certifying clean energy, https://cloud.google.com/blog/topics/sustainability/t-eacs-offer-new-approach-to-certifying-clean-energy [Accessed 3 March 2022].
[2] CRS 2021 Green Power Leadership Awards, https://resource-solutions.org/programs/gpla/winners/2021-winners/ [Accessed 3 March 2022].

- a clean, modern interface backed by state-of-the art technology, and
- free API access, and
- industry leading security that is rigorously reviewed by outside entities.

II. M-RETS Maintains Deep Roots in Canada and Currently Tracks a Significant Number of RECs in Ontario

M-RETS maintains deep ties to Canada, especially the Province of Manitoba. Manitoba was instrumental in the creation of M-RETS and has maintained a consistent presence on the M-RETS Board from incorporation as a non-profit in July 2008 through today. The current M-RETS Manitoba board representative is Leanne Shewchuk, Director, Stakeholder Relations and Reporting, Climate and Green Plan Implementation Office, Government of Manitoba.

M-RETS has issued just short of half a billion RECs in Canada since 2008. Manitoba accounts for approximately 450 million of those RECs. Since becoming a North America wide tracking system in 2018, M-RETS saw considerable growth across other provinces in Canada. M-RETS issued approximately 35 million RECs across British Columbia, Prince Edward Island, Ontario, Quebec, and Saskatchewan. Ontario accounts for approximately 15 million of those 35 million certificates.

If Ontario or the IESO decides to officially nominate M-RETS as the official tracking system for the Province, Ontario may nominate a director to serve on the M-RETS board. This provides unparalleled operational and financial transparency should Ontario desire to take advantage of nominating someone to serve on the board.

III. M-RETS Direct Response to the January 25, 2022, Letter from Ontario Energy Minister Todd Smith to Ms. Lesley Gallinger and the Clean Energy Credits ("CECs") Feedback Form Dated February 24, 2022[3]

M-RETS remains confident that the existing M-RETS platform could meet the needs of Ontario in a cost effective and efficient manner. M-RETS already serves a significant fleet of renewable generators in Ontario; thus, M-RETS could easily meet a January 2023 launch. In fact, joining the M-RETS platform without requiring significant customization would not cost anything to Ontario.[4] However, should Ontario desire significant software customization this may result in additional fees if the work is substantial. M-RETS—a policy neutral non-profit technology platform—points this out not to question the validity of the restriction but simply to provide the appropriate context for the Ministry to make the most informed decision.

A. Scoped to Ontario

M-RETS understands the desire to have the initial design of the registry scoped to enable the trading of credits within Ontario. Only allowing the trading of credits within Ontario may create

[3] Clean Energy Credits Feedback Form dated February 24, 2022, https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Clean-Energy-Credits; IESO to Report on the Design of a Provincial Clean Energy Credit Registry, https://www.ieso.ca/-/media/Files/IESO/Document-Library/corporate/ministerial-directives/Letter-from-the-Minister-of-Energy-20220126.ashx [Accessed 16 March 2022].

[4] The Ministry and IESO will not pay any fees to join the existing M-RETS platform as regulator accounts are free. However, M-RETS would still charge annual Organization fees and transaction fees as outlined in the M-RETS Fee Schedule to non-regulator system users available at https://www.mrets.org/m-rets-fees/.

uncertainty in the liquidity of the market and could depress the market value of the certificates. M-RETS—a policy neutral non-profit technology platform—points this out not to question the validity of the restriction but to provide the appropriate context for the Ministry to make the most informed decision. While M-RETS suggests the Ministry seriously consider the cost and access restrictions this decision may impose, M-RETS could easily implement a process whereby only those with specific authority granted by the appropriate regulator could hold Ontario certificates.

M-RETS provides regulators free and unfettered read only access to the system. Thus, recognized regulators (e.g., Ministry of Energy or their nominee such as the IESO) can monitor access to what is happening in the market. M-RETS maintains a suite of reports specifically tailored to assist regulators. M-RETS works directly with regulators to continuously improve the reporting and data access desired by regulators.

B. Clean Energy Certificates ("CECs")

M-RETS is already set up to track CECs in addition to RECs. In fact, M-RETS already has generators in the system that create similar certificates to CECs, called Alternative Energy Certificates ("AEC"). M-RETS defines AECs as all the environmental attributes from one MWH of electricity generation from a generator no state, provincial, or federal government recognize as powered by renewable energy or fossil fuels.

M-RETS could easily implement a CEC should Ontario prefer that over an AEC. Moreover, should Ontario want assistance with the development of definitions, M-RETS provides this level of assistance at no cost as part of the organizations dedication to building and sustaining clean energy markets.

C. Maximizing Market Opportunity and Customer Choice

As an independent system, M-RETS is the only REC platform that can track in any North American state or province. This provides incredible value for all market participants as it provides wide geographic access to both generators and consumers. Moreover, this eliminates the need for generators and consumers to pay fees to multiple registries. M-RETS wide geographic scope also increases market liquidity and provides for a more efficient market.

M-RETS dedicated support to develop and sustain both compliance and voluntary markets provide customer choice unlike any other environmental attribute registry. Due to the constant interaction between the M-RETS Board of Directors, executive leadership, and development team and users, M-RETS maintains a close connection with the existing and developing markets. That is how M-RETS can develop industry leading products like the Program feature, by listening to users and creating software to address pain points.

D. Future Proof

In Sections IV and V M-RETS provides important context around the organizational software development process, commitment to an agile framework, and Day-1 philosophy. As a non-profit technology provider, M-RETS reinvests all the proceeds from operations back into the system. M-RETS record in both programmatic innovation through the pioneering of hourly REC markets as well as leading security implementations in the industry like multi-factor authentication all provide robust evidence of M-RETS commitment to a future proof system.

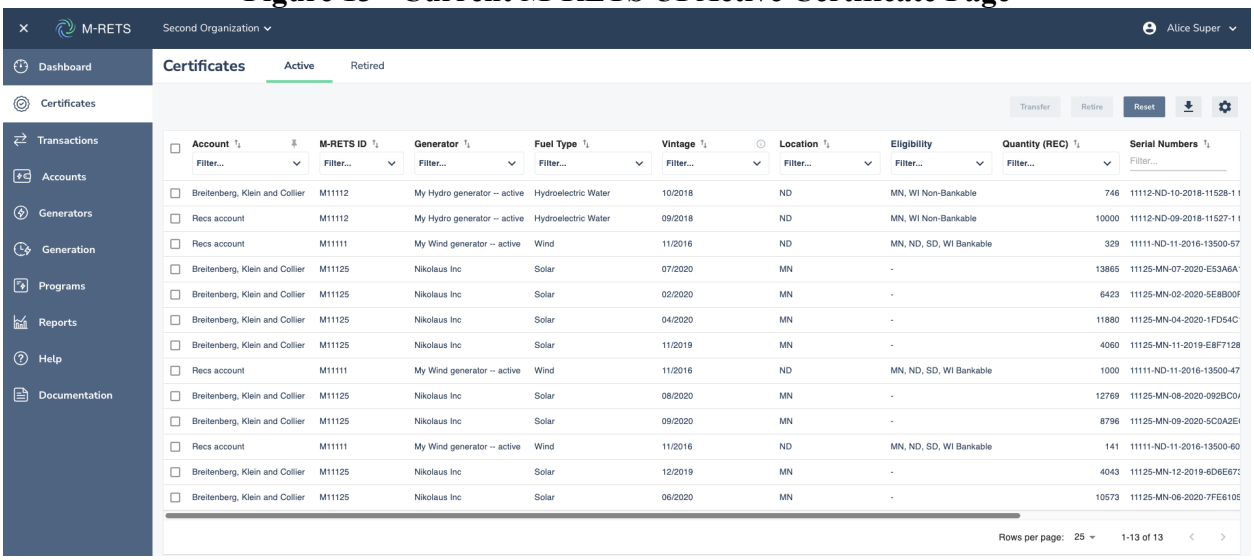
IV. M-RETS Development Philosophy

M-RETS operates with a Day 1 mindset. This mindset, pioneered by Amazon, requires a relentless customer first mindset, a focus on long term value, and bold innovation.[5] For example, M-RETS treats software as outdated the moment after release. Adhering to a day one mentality requires flexibility, an agile business model, and a focus on innovation.

The M-RETS development team constantly works to optimize the UI, the back-end database architecture, and the API, and constantly review and update security protocols. A Day 1 mentality allows M-RETS to focus on meeting currently recognized standards—such as testing controls through things like a planned SOC 2 audit in 2022 as well as support constant innovation to meet constantly evolving security threats and customer expectations.

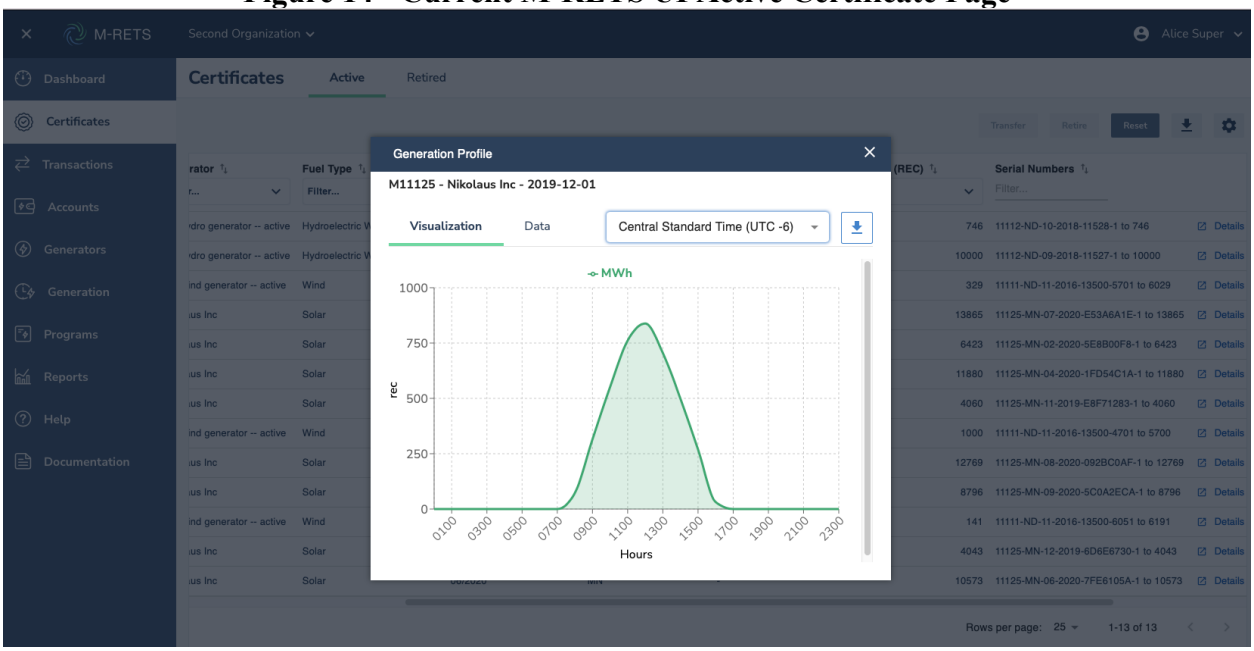
This philosophy is what led M-RETS to build and release a new frontend in October 2022. M-RETS built the new front end in REACT, which is one of the most widely used front-end frameworks for web applications and maintains a strong developer community.

Figure 13 - Current M-RETS UI Active Certificate Page



[5] Slater, Daniel, Elements of Amazon's Day 1 Culture, https://aws.amazon.com/executive-insights/content/how-amazon-defines-and-operationalizes-a-day-1-culture/ [Accessed 3 March 2022].

Figure 14 - Current M-RETS UI Active Certificate Page



M-RETS relationship with our stakeholders continues to strengthen since the 2017 launch of the M-RETS platform. The new paradigm allowed M-RETS to become much closer to our users and understand exactly what their needs are and prepare software solutions. For example, M-RETS launched the Program Feature for regulators to fix issues that arise in the RPS retirement process. Now Minnesota and Wisconsin utilize the program feature for their RPS programs, so they never have to deal with opening a program back up because a regulated entity incorrectly retired certificates that did not qualify (e.g., past the vintage allowances or did not have the correct state eligibility flag).

V. Technical Specification

A. M-RETS Platform Technical Architecture

M-RETS is a modern software application consisting of a backend application built using Ruby on Rails (Ruby v. 2.6.6, Rail v. 5.2.4) and a decoupled frontend application built using React (v. 17.0.1). M-RETS hosts both applications on Heroku, a cloud application hosting platform owned and operated by Salesforce. Heroku utilizes AWS infrastructure including database hosting and processing tools. Both applications are single tenants, meaning the database and related management software are the sole residents of resources on the instance, offering more predictable performance.

Heroku is a scalable platform used by both large enterprise level firms such as Citrix as well as startups.[6] Heroku manages over 60+ billion requests per day.[7] Heroku provides M-RETS instant scalability during times of heavy usage but allows M-RETS to save on resources during slower

[6] *See* https://www.heroku.com/what#heroku-grows-with-you [Accessed 3 March 2022].
[7] *See id.*

times.[8] The scalability and cost-effective nature of the Heroku platform provides real benefits to system users.

B. Modern "API-First" Software Architecture

The M-RETS platform was completely reimagined and rebuilt from the ground-up in 2017 using best in class technologies as well as modern software architecture. A fully functional API is increasingly considered a mandatory feature for any platform that provides services around data. M-RETS has a fully functional API that is available to all users at no additional cost. This API we provide to users is the same API that powers our own frontend; thus, it covers all functionality in the system including generator registration, generation data submittal, issuances, transactions, and retirements.

M-RETS' backend application utilizes such technologies as Redis to provide in-memory data storage for snappy response times. The M-RETS platform also hosts several job queues for efficient processing of transactions.

C. Modern User Interface ("UI") and User Experience ("UX")

M-RETS recently rebuilt the UI with the best-in-class frontend framework, React, enabling the M-RETS team to provide an optimal user experience. M-RETS constantly works to optimize UI performance as well as providing users a streamlined experience for all tasks, simple or complex. M-RETS supports all major browsers including Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Edge.

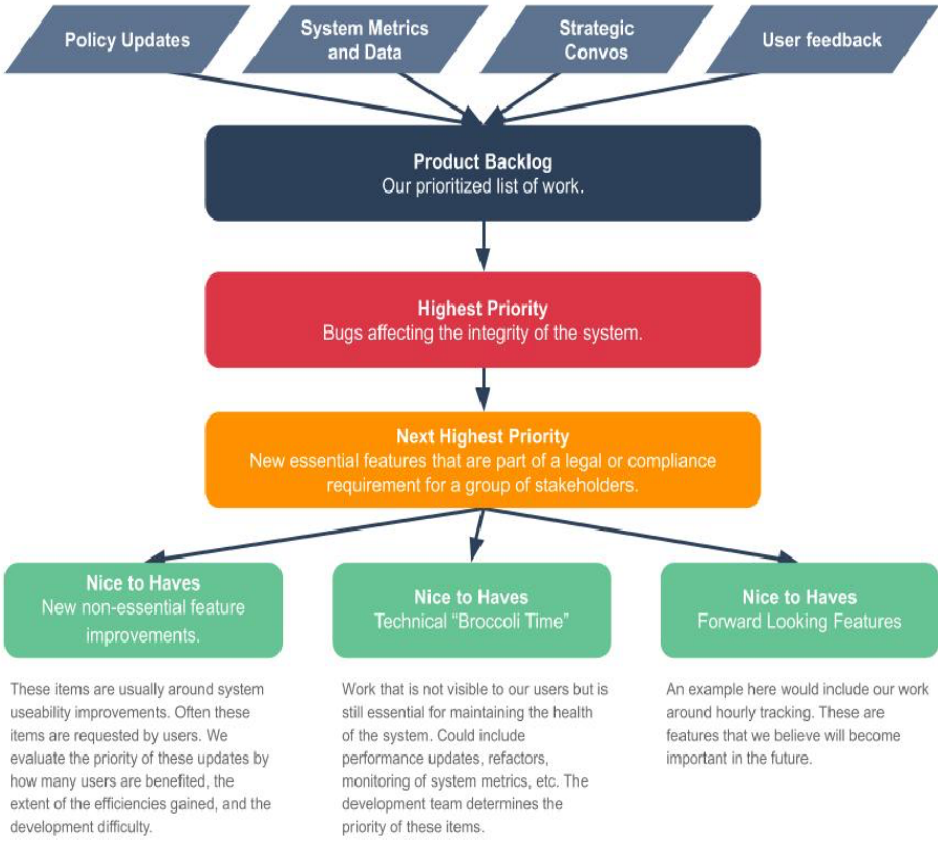
Maintaining a modern UI and ensuring a positive UX are no longer optional. In the platform economy, "[t]he concept is simple: instead of offering consumers a discrete set of products, companies are instead increasingly developing networks or systems that enable participants to exchange information, services and products in many different directions. Think Airbnb, Uber or Amazon."[9] Customers expect seamless interactions and compare experiences globally—not just between direct competitors. This drove M-RETS to build a platform that was intuitive, even though REC markets are niche.

D. Internal Management of Maintenance, Feature Development, QA

M-RETS resolute team of talented developers work to maintain 99% or higher up time for the platform.

[8] *See id.*
[9] *See Platform Model will be Key for Illinois Future Power Grid*, http://midwestenergynews.com/2017/10/05/platform-model-will-be-key-for-illinois-future-power-grid/ [Accessed 3 March 2022].

FIGURE 1. The M-RETS Development Cycle



The success of M-RETS is due to the deep expertise of its staff supporting the operations, maintenance, and development of the platform.[10] A recent example is that M-RETS staff rewrote the M-RETS Operating Procedures that went into effect January 1, 2020.[11] The goal was to ensure the Operating Procedures were accessible to all levels of users.

As part of rewriting the Operating Procedures and work on database optimization, M-RETS now embeds the rules and regulations from the Operating Procedures into the codebase. In the future, developers or anyone auditing the codebase can refer to wherein the Operating Procedures software logic originates.

M-RETS staff are dedicated to growing environmental commodity markets and serving as thought leaders at a national and international level. M-RETS staff presented for the fourth year in a row to the EUCI Overview of REC Registries & Administrative Aspects of Operation, at the Renewable Energy Buyers Alliance (REBA), Clean Energy States Alliance, Renewable Energy Markets Conference (REM), and at the National Association of Regulatory Utility Commissioners conferences. M-RETS staff have also worked to promote these markets in national outlets and

[10] *See* https://www.mrets.org/m-rets-staff/ [Accessed 3 March 2022].
[11] *See* https://www.mrets.org/wp-content/uploads/2019/11/M-RETS-Operating-Procedures-2020.pdf [Accessed 3 March 2022].

have even published an article in Utility Dive.[12] The purpose of this is not merely to promote M-RETS as an organization, it is a chance for M-RETS to meet with other thought leaders and demonstrate the key role technology forward registries provide commodities markets.

The value of M-RETS goes far beyond a competitive fee structure, transparency, technology, and financial accountability. M-RETS provides both subscribers and regulators unparalleled input into platform operation, governance procedures, and new features directed at enhancing the user experience or to meet the demands of new regulatory and/or industry developments. The innovative platform brings a modern look and feel to the industry, provides subscribers with efficient access to their information, and underlying technical flexibility to support subscribers well into the future.

E. Agile Best Practices Software Development

As the complexity of the data required by users grew, M-RETS found it was critical to maintain control of the development cycle as well as system maintenance. The M-RETS dedicated development team follows Agile best practices with two-week sprints and short release cycles. The development team also follows models of constant improvement, working to optimize the UI, the back-end database architecture, and the application programming interface (API).

The M-RETS customer support team works closely with the development to help prioritize new features and fixes that will most effectively serve our users. The System Administrator, software developers, and M-RETS leadership all sit in on the daily standup calls and weekly software development queue prioritization meetings. This transparency allows M-RETS to determine the most efficient way to achieve the goals of its stakeholders, especially regulators and customers demanding more data. M-RETS structure is well suited to achieve their goals in a cost-effective manner.

F. Full Life-Cycle Environmental Commodity Tracking

M-RETS provides for full traceability across the full life cycle of a certificate from issuance through retirement. The system provides all basic functions necessary to support a robust market including certificate origination, certification, tracking, transfer, import, export and retirement of RECs.

G. Security

i. Application Hosting Security

Maintaining an appropriate standard of data security is critical to the trust between M-RETS and the M-RETS user community. M-RETS data is an asset to the organization and the entities that M-RETS supports, including government regulators. M-RETS takes this role extremely seriously and spends a great deal of time and development resources documenting, implementing, and maintaining industry best practice security measures that protect M-RETS data. M-RETS also

[12] *Decarbonization requires more access to and consensus around energy data*, Utility Dive, 3/30/2021, available at https://www.utilitydive.com/news/decarbonization-requires-more-access-to-and-consensus-around-energy-data/597445/

maintains a CyberFirst insurance policy underwritten by Traveler's Property Casualty Co. of America to ensure platform viability and continuity in the event of a breach or other cyber event.

M-RETS is hosted on Heroku, a trusted cloud hosting platform owned by Salesforce. Heroku's Trust and Compliance certifications include:

- TRUSTe Certification: Salesforce's Website Privacy Statement and privacy practices related to the Heroku Services are assessed by TRUSTe annually, for compliance with TRUSTe's Certification and Verification Assessment Criteria.

- ISO 27001/27017/27018 certification: Salesforce operates an information security management system (ISMS) for the Heroku Services in accordance with the ISO 27001 international standard and aligned to ISO 27017 and ISO 27018. Salesforce has achieved ISO. 27001/27017/27018 certification for its ISMS from an independent third party. The Salesforce ISO 27001/27017/27018 Certificate and Statement of Applicability are available upon request.

- System and Organization Controls (SOC) reports: Salesforce's information security control environment applicable to Heroku Services undergoes an independent evaluation in the form of a SOC 1 (SSAE 18 / ISAE 3402), SOC 2 and SOC 3 audits.

ii. Database Security User System Authentication

M-RETS encrypts the platform at rest using AES-256 block-level storage encryption, which is industry standard and used widely by cloud storage companies like Google Cloud and Amazon Web Services.[13] Encrypting data at rest means that data is always encrypted while stored in the databases and is not moving through networks. This includes both online and offline backups. "Encryption operations occur on the servers that host EC2 instances, ensuring the security of both data-at-rest and data-in-transit between an instance and its attached EBS storage."[14] Encryption at rest is an important security protocol:

> Encryption is one piece of a broader security strategy. Encryption adds a layer of defense in depth for protecting data — encryption ensures that if the data accidentally falls into an attacker's hands, they cannot access the data without also having access to the encryption keys. Even if an attacker obtains the storage devices containing your data, they won't be able to understand or decrypt it.
>
> Encryption at rest reduces the surface of attack by effectively "cutting out" the lower layers of the hardware and software stack. Even if these lower layers are compromised (for example, through physical access to devices), the data on those devices is not compromised if adequate encryption is deployed. Encryption also acts as a "chokepoint" — centrally managed encryption keys create a single place where access to data is enforced and can be audited.[15]

[13] See Heroku Data Encryption, https://devcenter.heroku.com/articles/heroku-postgres-production-tier-technical-characterization [Accessed 3 March 2022].
[14] *Id.*
[15] *See* Encryption at Rest in the Google Cloud, https://cloud.google.com/security/encryption/default-encryption

Both M-RETS commercial website (https://www.mrets.org) and the application (https://app.mrets.org/login) use SSL certificates. Cloudflare, the service M-RETS uses, states on their website that "[a]n SSL Certificate displays important information for verifying the owner of a website and encrypts web traffic with SSSl/TLS, including the public key, the issuer of the certificate, and the associated subdomains."

Regarding internal M-RETS controls, M-RETS strictly enforces documented permissions governing the access to the production database.

iii. User System Authentication

M-RETS takes all reasonable steps to ensure the security of data owned and housed within the platform. M-RETS follows modern password encryption best practices and enforces 12-character passwords. In 2020 M-RETS was the first North American REC registry to implement multi-factor authentication ("MFA") for users. MFA does this by requiring an attacker to not only compromise a password, but also must have physical access to a mobile device and the ability to log in to that device. The more layers/factors in place, the lower the risk of an intruder gaining access to critical systems. M-RETS defaults users to enrolling in MFA.

H. Disaster & Business Continuity Plans

M-RETS maintains and annually updates a Disaster & Business Continuity Plan ("Plan"). M-RETS would happily share this plan with the IESO should they wish to review the plan in full. The Plan covers both physical and virtual security and incident response reporting and recovery. The written plans emphasize data security and integrity while ensuring minimal application downtime in the case of a catastrophic failure of the M-RETS platform, the infrastructure that supports it, and/or an incident that would affect the M-RETS staff or physical office site.

Transparency and accountability are critical to ensuring trust in the M-RETS platform. M-RETS documented policy states that, "[i]t is the policy of M-RETS to ensure that all information security incidents should be dealt with promptly, including immediately notifying the M-RETS Board of Directors, relevant local, state, and/or federal officials, and disclosing the incident to the M-RETS subscriber community." M-RETS policy requires that M-RETS subscriber community must be notified of an actual breach within 2-business days from the first report of the incident, unless local, state, or federal law enforcement directs M-RETS to not disclose the breach. 2 business days is incredibly fast, especially when compared to the average public company which took 53-days to disclose a breach.[16]

M-RETS believes in a whole organization approach to emphasizing the importance of proper security. M-RETS is happy to share with the IESO the enacted security policies as well as the work M-RETS does with the retained third-party security consultant to constantly evolve those policies as threats emerge. This culture even involves the M-RETS Board, which for example heard from

(while M-RETS uses Heroku which is uses AWS, the benefits of encryption are the same) [Accessed 3 March 2022].

[16] Ryan, Vincent, Cyber Breach Disclosure Still Take More Than a Month, https://www.cfo.com/cyber-security-technology/2021/04/cyber-breach-disclosures-still-take-more-than-a-month/ [Accessed 3 March 2022].

a Special Agent of the FBI on the Cyber Security Task Force about the importance of cybersecurity at a board meeting.

I. Back-up and Recovery of Data

M-RETS has the capability to rebuild the production application from code and data back-ups. M-RETS backs up the platform daily and the application's Heroku Postgres database hosting service uses physical backups for continuous protection by persisting incremental snapshots or base backups of the file system and write ahead log (WAL) files to external, reliable storage. The system also records detailed audit logs that track every change. This allows the M-RETS team to replicate the state of the database at any moment in time.

M-RETS Heroku Postgres database comes with a High Availability (HA) feature. This database cluster and management system is designed to increase database availability in the face of hardware or software failure that would otherwise lead to longer downtime. When a primary database with this feature fails, it is automatically replaced with another replica database called a standby.

J. Rebuilding the Application in the Case of Catastrophic Failure

The M-RETS application code lives in a distributed secure version control system called Github. As the industry standard for code version control, Github integrates well with most hosting platforms. The availability of the code repository with a full version history ensures M-RETS could easily rebuild the M-RETS application.

The M-RETS team has confidence in the hosting infrastructure and fail-safe systems. Just the same, M-RETS holds an annual drill where the development team must rebuild the production application from data back-ups on a different application hosting platform. In the last exercise during the summer of 2021, M-RETS rebuilt the application in a day on Microsoft Azure, ensuring minimal downtime should Heroku or AWS have a catastrophic failure. This keeps the development team fresh in the event they must do this. M-RETS also maintains written policies and a password vault that would allow staff to support the seamless transition of responsibilities due to the loss of one or more staff members.

M-RETS began tracking RECs in 2007. In 2017 M-RETS successfully launched its own proprietary registry platform. Part of the process involved porting all M-RETS data from the previous provider to the new M-RETS platform. M-RETS also took over all aspects of technical and customer service responsibilities. When M-RETS launched the platform in 2017, M-RETS issued 88,307,296 RECs and 32,872,546 RECs were retired. In 2020 M-RETS issued 118,595,847 RECs and retired 62,336,220.

In that timeframe between 2017-2020 M-RETS launched a renewable thermal tracking system ("RTC") that is the system of record for Oregon (the only state that mandates gas utilities over a renewable natural gas program to customers), issued over 60 million RECs with hourly data associated, launched a new front-end in REACT, provided our users with a free and open API, and

launched the first of its kind hourly REC retirement.

VI. With M-RETS, IESO Obtains Access to the Leading Environmental Attribute Registry in North America.

A. Hourly REC Accounting

Google became the first renewable energy purchaser to make an hourly retirement claim in a production system while using the M-RETS platform in January 2021. While this achievement is something to celebrate, it is just the beginning of a process to enhance global renewable energy markets. The impetus behind this publication is a call to action for creating an advanced renewable energy commodity market built for and driven by increased data access. M-RETS exposes the process utilized to reach this milestone, asks critical questions to stakeholders and lays out a path forward.

M-RETS recognized that an important first step in providing a path forward to understanding the benefits of 24/7 renewables was to innovate by acquiring and experimenting with greater amounts of data. While obtaining hourly renewable generation data was the first step, M-RETS also explored other data integrations. This is what feeds the idea of data-driven renewable energy markets, including layering more energy market data on top of the existing REC framework. This allowed the M-RETS development team to build out the platform data model to support hourly and peak/off-peak data, as a first step. The Midcontinent Independent System Operator ("MISO") started providing M-RETS this data for all generators beginning in January 2019. Starting in Q2 2022 M-RETS will also have access to hourly data from generators within the Southwest Power Pool (SPP).

M-RETS worked through the early questions surrounding hourly generation data to arrive at this phased approach. A larger and more complex set of questions emerged around how to structure the market and provide efficient access to a diverse user group. The complexity of the data, although real, did not create significant roadblocks. For example, in contrast to the manageable complexity of hourly data, providing a user interface ("UI") and user experience ("UX") that allows all users—from the most to least experienced—an opportunity to access and use hourly data is one of the more complicated technical problems to solve.

M-RETS first achievement in 2019 was to include a full month of hourly generation information for generators where MISO directly provides generation information to M-RETS. Once M-RETS maintained a level of comfort with the data and market needs, M-RETS developed a process to provide for hourly REC retirements. At the time of the first hourly retirement, M-RETS did not issue RECs in individual hours, due strictly to market limitations and not technical concerns. Instead, the M-RETS process provides access to hourly data that is associated with specific batches.

M-RETS spent the rest of 2021 engaging with stakeholders across the industry—and the world—to determine the next steps in a more granular REC market. Consultations included a presentation on September 15, 2022, hosted by the United States Environmental Protection Agency ("U.S. EPA") and a global forum with Energy Tag and the European based Association of Issuing Bodies

("AIB")[17]. Following extensive stakeholder input and collaboration, M-RETS began the process of planning to release the ability to issue, transact (buy/sell), and retire certificates by hour down to the watt level.

B. 2022 Hourly Transaction Updates

Accurate hourly accounting for a true 24/7 REC market requires changes to the existing REC transaction framework. The requirement that REC transactions (e.g., issuance, retirement, import/export) occur only in whole numbers does not support the demands of a granular approach to meeting 24/7 goals. Thus, M-RETS will offer a fractional issuance option for generators that provide hourly data. Generators in the M-RETS system will have the option to have certificates issued in non-whole numbers. Only certificates issued in non-whole numbers can undergo a granular hourly transaction.

M-RETS plans to only issue hourly certificates to generators that opt into the market, preserving choice for those that do not wish to participate in hourly REC markets. M-RETS will add an "Issue Fractional RECs" flag to all generators that opt-in to this feature. Therefore, by default the flag remains unchecked until the generator owner actively checks the appropriate acknowledgement on the generator. If checked, the system will issue the full quantity uploaded including any non-whole certificates. To qualify for hourly transactions, a certificate batch must contain a full hourly generation profile for a defined period, currently in M-RETS a full month.

M-RETS will require hourly generation uploads to indicate the reporting time zone. This time zone may not be the same time zone as the generator resides. For example, MISO reports all hourly generation to M-RETS in the Eastern time zone, even though the generator's physical location may be in the Central time zone. Generators may reside in the Central or Mountain time zone. Therefore, M-RETS saves all data in Coordinated Universal Time (UTC) in the database.

Depending on the context in the system, M-RETS will default either to the time zone the generator reported the data or UTC. In most cases, however, users have the option to select whatever time zone they prefer to view, download, or transact the data. For example, a generator that reported in the Eastern Time zone could still be subject to a retirement that makes the claim in the Central Time zone.

One issue M-RETS worked through with stakeholder input was how to prevent loss of significance with the move to a more granular market. The consensus among the industry was that within hourly REC markets, systems should support precision without loss of significance out to six decimal places, which is down to a watt level.

M-RETS will support two distinct types of transactions for REC batches that have hourly data. The first type of transaction is a "simple split" transaction. To calculate the hourly data matrix for

[17] *See* EPA Webinar Series: 24/7 Hourly Matching, 15 Sept. 2021, https://www.zoomgov.com/rec/share/LrE2MumRk2LV4pJ72PQsstuqA54-9y7yDeBlIb-kBzaUHXz4BWEx5pmpKLGMLvx1.JlSSptgcKMYIYtKC and A Path to Solving the Complexity of Fractional RECs: Issuance, Transaction, and Retirement, 8 Sept. 2021, https://www.youtube.com/watch?v=a8HStfNJMjM&feature=youtu.be [Accessed 3 March 2022].

any given quantity of certificates that has gone through a Simple Split, every hour's value is multiplied by the quantity of certificates in a batch divided by the total number of certificates issued for a period. For example, this means if 100 certificates were issued for a given month, then half are sold. The Hourly Matrix for this quantity remaining can be calculated by multiplying each value in its Generation Profile by 50/100.

The second type of transaction occurs when the owner of a batch of hourly certificates initiates an hourly transaction. The initial conversion of Standard Certificates to Hourly Certificates can occur during a normal transfer either internal (to another account in the same organization) or external (to another organization), or a retirement. Once a batch of certificates is subject to an hourly transaction, all further transactions to that batch must be completed through the hourly process. The process is not reversible and serves to protect the integrity of claims so that all subsequent transactions are clear that certain certificates were removed.

C. M-RETS Hourly Tools

M-RETS created a new hourly reporting feature that automatically pulls all REC batches in an organizations account that qualify for hourly transaction into one screen. This allows the user to search and organize the hourly data to their needs. The user can also download the data they select for the reports. This is just the first step in providing more comprehensive reporting and visualization functions within M-RETS.

D. Potential Use Cases

Potential use cases for hourly REC markets include:

1. Save for the few customers not interconnected to any grid network, customers will rely on the grid in some capacity. There is an untested assumption that there is at least less grid reliance and, therefore, less associated reliance on potentially carbon emitting resources for those following a 24/7 renewable matching process over an annualized process. This is something M-RETS hopes to test over the course of this process.

2. Hourly load matching sends more efficient market signals. As Gregory Miller points out in his publication, "Beyond 100% Renewable: Policy and Practical Pathways to 24/7 Renewable Energy Procurement," "[v]oluntary renewables procurement that does not coincide with the buyer's demand increases both the short- and long-term costs of grid-scale renewable energy generation. Periods of over- and under-supply cause market-destabilizing swings in energy prices, periods of negative pricing (during which grid operators must pay adjacent energy markets to take the energy), and the need to invest in costly storage and transmission upgrades to move the energy."[18] There is an increasing recognition that independent system operators ("ISO") and regional transmission organizations ("RTO") are not really markets in the classical interpretation, but alternative regulatory structures forced to accommodate a dizzying array of state policy.[19] A fair

[18] G. Miller, "Beyond 100 % renewable: Policy and practical pathways to 24/7 renewable energy procurement," *The Electricity Journal,* vol. 33, no. 2, 2020.
[19] Federal Energy Regulatory Commission, "Electric Power Markets," 23 October 2020. [Online]. Available: https://www.ferc.gov/industries-data/market-assessments/electric-power-markets. [Accessed 3 March 2022].

criticism is that RTO/ISO reform such as revising balancing rules based on serving large, centralized fossil generators, inefficient geographic boundaries, etc. are a better solution to driving greater renewable penetrations than a focus on building greater access to data such as hourly generation and energy market data. Realistically, achieving societal decarbonization goals requires multiple strategies. Both RTO/ISO reform and greater access to hourly generation and energy market data serve important roles and are not mutually exclusive.

3. The ability to understand where renewable power is generated and where it is demanded (i.e., consumed), could allow for better generation development planning. Grid operators are set up to serve economic transmission and dispatch. However, the data provided from hourly markets could help drive renewable development focused more on reducing carbon and not just economic efficiency. A use case under development involves using system information to provide a data-driven approach to maximize investment in renewable generation assets with the greatest carbon reduction potential. Potentially providing access to generation and consumption data that does not compromise user confidentiality or trade secrets could enable the development of tools to evaluate projects on a granular level. In fact, some voluntary customers are already engaged in this type of renewable development analysis. In "More Than a Megawatt: Embedding Social & Environmental Impact in the Renewable Energy Procurement Process," Salesforce states an analysis they completed found that a West Virginia solar project avoided almost three times the emissions of a similar California-based solar project.[20] M-RETS expects to see more renewable generation investments based on this sort of analysis in the future.

4. A data-driven storage market could provide price signals for battery storage. As some battery storage incentive programs seek to provide a market mechanism rather than a set capacity payment, using both hourly generation and location-based grid carbon data could create a data-driven storage market that includes important price signals. For example, pairing specific hours of renewable generation from generators based on time and/or location to specific charging and discharging activity from a storage asset. This could ensure charging and discharging achieve certain goals, such as estimated avoided emissions, reducing reliance on undesirable generation sources and ensuring grid connected storage charges using renewable resources. One process could in theory change the time of a certificate or retire a specific hour from a renewable asset and reissue the same volume which would identify the subject generation as renewable, that it was subject to a storage claim all while maintaining the original generation attributes.

5. Energy efficiency markets and measuring the grid benefits of load shifting may also benefit from access to hourly generation and energy market data. There is a real possibility of valuing actual or estimated avoided emissions from credibly measured energy efficiency and/or load shifting targeted at high carbon intensity grid periods. This is not

[20] Salesforce, "Sustainability: Salesforce," October 2020. [Online]. Available: https://c1.sfdcstatic.com/content/dam/web/en_us/www/assets/pdf/sustainability/sustainability-more-than-megawatt.pdf. [Accessed 3 March 2022].

without criticism and would require transparency across many different players.[21] A time- and/or location-based energy efficiency market that takes advantage of granular grid data could gain traction as a decarbonization tool with value placed on carbon avoidance or other desired outcomes.

A common misconception is that there is a lack of data which continues to slow a data driven approach to decarbonization. However, the truth is that much of this data exists it is just inaccessible. Complicating access to the data is the lack of data standards that would allow for the efficient movement of this data across multiple systems and the lack of process standards that make comparing data difficult once acquired.

For example, under the MISO FERC approved treats locational marginal emissions ("LME") a trade secret. However, PJM publicly lists nodal LME on its website. Such inconsistent treatment of important data frustrates the ability to utilize grid data to make important data driven decisions. Moreover, should MISO start to provide this data, it is important that independent or regulatory standards evolve to ensure that data points like nodal LME utilize the same data inputs and processes to allow for efficient cross jurisdictional comparisons.

E. Future Development

M-RETS believes that the success of granular REC market—including 24/7 CFE goals—will require a suite of new products developed by third parties. M-RETS non-profit structure allows the organization to focus on data integrity and offering solutions while opening the M-RETS API to third parties that can create innovative tools to leverage the underlying M-RETS platform. For example, the Australian firm Power Ledger is working to use the M-RETS API to create a transactive spot market and other hourly products. M-RETS is also collaborating with companies such as Singularity Energy, which plan to utilize the M-RETS API to develop data tools to support a 24/7 CFE market. M-RETS maintains open dialogue with other companies such as Electricity Map, ClearTrace, WattTime, and other companies looking to build tools to leverage the evolving 24/7 market.

VII. M-RETS Governance

M-RETS is governed by a Board of Directors ("Board") that is structured to provide for a balanced representation of the various member states and provinces, regional electric utility businesses, non-profit organizations, and renewable energy producers. The Board consists of:

1. **Government Directors** – Any U.S. state or Canadian province that participates in the M-RETS system may nominate someone to serve on the M-RETS Board.

2. **Industry Directors** – No more than three individuals who are owners, shareholders, members, Directors, or employees appointed from utilities operating in the M-RETS region and participating in the system with an active M-RETS Load Serving Entity or Generating Unit account with up to one individual from the following:

[21] L. Freehill-Maye, "California has a renewables curtailment problem. Can your Google and Facebook activity help?," *Utility Dive,* 8 October 2020.

a. Municipal Utility or Municipal Power Agency Director

b. Cooperative Electric Utility Director

c. Investor-Owned Utility Director

3.**Subject Matter Experts ("SME")** – SMEs are individuals who serve on the board to provide technical and subject matter expertise. No more than half of the total membership of the board at the conclusion of each annual.

4.**Renewable Generator/Marketer** – No more than one individual who is an owner, shareholder, member, Director, or employee of producers of renewable energy resources and maintains a marketer or generating unit account.

Exceptional attention to financial transparency and accountability is another important reason to seriously evaluate M-RETS. In years 2014-2021, M-RETS received a clean, or unmodified opinion on its audited financials, the highest level of assurance possible by a certified public accounting firm. M-RETS would be happy to provide our unredacted audited financial statements or IRS tax form upon request. Very few—if any—companies can give such a detailed look at the organization's finances and operational controls.

Any revenue that exceeds M-RETS operating budget remains within the organization, unlike a for-profit tracking system where the entity may distribute profit to shareholders. Therefore, if M-RETS—after considering all factors—is not the lowest cost option, any revenue above cost will remain for the benefit of Ontario customers. This is an important reason states continue to utilize and trust the M-RETS platform.

VIII. Conclusion

The value of M-RETS goes far beyond a competitive fee structure, transparency, technology, and financial accountability. M-RETS provides both subscribers and regulators unparalleled input into platform operation, governance procedures, and new features directed at enhancing the user experience or to meet the demands of new regulatory and/or industry developments. The innovative platform brings a modern look and feel to the industry, provides subscribers with efficient access to their information, and underlying technical flexibility to support the needs of regulators and market participants well into the future.

With M-RETS, IESO and Ontario get:

1. A partner that is a proven innovator focused on developing industry leading software.
2. A software team dedicated to the full time needs of the tracking system.
3. Industry leading attention to data and user security.
4. Technical and programmatic advisory services to all stakeholders.

M-RETS pledges to provide valuable assistance and relieve regulatory burden on regulatory agencies as well as producers, marketers, and consumers of clean energy within the IESO through the M-RETS Platform. By appointing M-RETS as the official platform to track CECs, the IESO obtains a transparent, experienced, and ready solution. Moreover, Ontario

regulators may choose to nominate a Director to the M-RETS Board which provides unprecedented governance and administrative access. M-RETS looks forward to collaborating with stakeholders across the Province of Ontario to further assist with the development of a robust CEC market.

Dated: March 17, 2022

Respectfully submitted,

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