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## CATALYZING A CLEANER POWER GRID, ONE FINANCIAL TRANSACTION AT A TIME

Our mission is to bring unprecedented speed, security, and flexibility to billions of power transactions each year in order to enable the digital, connected, distributed, and renewable electric grid.

Our advanced energy settlements platform – EnergyNet® – makes this all possible.

# White Paper

Q1 2018

**Note to Readers:** This White Paper is meant to stimulate thought about the future of the electric power industry and the potential role Causam eXchange can play in causing the future we want to become reality. Many factors will shape the future and there is no guarantee that the industry will evolve as anyone currently envisions. This White Paper seeks to solicit the views of other players in the electric power industry and should not be relied upon for any purpose other than a starting point for that conversation.

# Executive Summary

*Causam eXchange, through our blockchain-based EnergyNet® platform, seeks to revolutionize how power is bought and sold, thereby enabling electric power systems that are more secure, digital, connected, distributed, resilient, and renewable.*

*Similar to the way that VisaNet transformed credit card settlements, our sophisticated financial technology platform can create unprecedented speed, security, and flexibility for billions of power transactions in a global market that exceeds \$1.7 trillion per year.*

**1**

## What problems are we helping to solve?

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- ✓ Lack of choice in electricity source
- ✓ Lack of energy data access
- ✓ High transaction costs in the power sector
- ✓ Slow financial settlements for payments for power and other distributed resources
- ✓ Lack of grid resilience and flexibility due to inability to be compensated for services
- ✓ Lack of cybersecurity on the power grid
- ✓ Inefficiencies in scaling, aggregating, and managing distributed energy resources
- ✓ Climate change

**2**

## What growth areas in the energy sector are we enabling and leveraging?

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- ✓ Smart Grid – Projected to be a \$400 billion market by 2020 ([link](#))
- ✓ Internet of Things (IoT) – Expected to be \$186 billion market by 2023 ([link](#))
- ✓ Solar Power – Costs have fallen more than 70% since 2009 ([link](#))
- ✓ Energy Storage – Estimated to be \$250 billion market by 2040 ([link](#))
- ✓ Microgrids – Projected to be a \$40 billion-a-year business worldwide by 2020 ([link](#))
- ✓ Demand Response – Roughly 23 million sites expected by 2020 ([link](#))
- ✓ Electric Vehicles – Mainstreaming with 120 EV models on the road by 2020 ([link](#))

**3**

## Initial focus will be on supply-side customers at the distribution-level:

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- ✓ Building owners – We help real estate investors and owners, especially those with multiple buildings or tenants, to become virtual power plants, increase net operating income and building values, automate financial settlement with tenants, and advance renewable energy and efficiency goals.
- ✓ Retail electric providers – We help energy providers to improve customer satisfaction, differentiate their offerings with renewables and storage, reduce costs and increase profit margins, and grow and retain customer bases.

## What makes Causam eXchange unique?

**“Causam eXchange sits at the middle of two massive global trends: 1) dramatic changes to make the \$6 trillion-dollar energy industry more digital, distributed, connected, and renewable, and 2) the disintermediation of conventional financial settlements via cryptocurrencies and blockchain technology.”**

### Blockchain Integration with the Existing Power Grid

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Our software platform creates a bridge to utilize blockchain networks for settlements and payments, while also interfacing with the legacy electric grid. We know we can't scale by displacing the existing power grid. Instead, we took the approach of enabling the transition to the next generation distributed grid from what we have today. This integration will further accelerate the adoption of renewable energy and distributed energy resources.

### Patents

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We are leveraging our deep intellectual property, having created one of the world's largest known patent portfolios around financial settlements in the energy sector. See here for a [summary of the patent portfolio](#) from Causam eXchange and our parent, Causam Enterprises.

### Deep Team Experience

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We are building on our team's extensive backgrounds as technology executives and entrepreneurs, having founded and sold seven prior innovative companies worth millions of dollars.

### 4+ Years in the Making

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We are not newbies who just recently jumped on the “blockchain bandwagon.” We have been building the technology behind Causam eXchange since 2013.

### No Utility Approval Needed

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We can work independently of conventional power players.

### Smart Grid, Smart Contracts

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We utilize IP-based communication protocols for managing grid elements, and harness blockchain to create smart contracts with complex rules engines to allow transactions to be executed automatically based on the predefined preferences of buyers and sellers. In turn, this facilitates smart, real-time, and low-cost transactions between any willing counterparties on the grid.

### Open to All

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We have not built an independent blockchain or exchange to trade tokens for some speculative future value. Instead, we provide the platform through which energy buyers and sellers of all types can transact according to their needs and preferences.

### Energy Democracy

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We are democratizing the use of energy data and creating new economic opportunity for market participants from selling power and services via the grid. Transparency in energy data is a key goal for us. Knowledge is power.

### All Currencies Work

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We can manage financial transactions in cryptocurrencies (e.g., ether, bitcoin), conventional currencies (e.g., US dollars), credit cards, ACH, and wires.

### Compatible with All Hardware

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We do not depend on, nor manufacture or sell, any specific devices that are required for financial settlements via our Energy-Net platform. In prior companies that we built, we did that, so we know the challenges and market restrictions this creates to access a larger and more diverse user base.



## Background

**“Transactive Energy (TE) platforms will underpin tomorrow’s consumer energy market, and blockchain is the hottest technology in the energy industry, and TE is its hottest use case, [representing potentially billions of dollars of value to be created. Today,] there are 110+ trials of utility industry-related blockchain and Transactive Energy.”**

- [Navigant Research](#)

The power grid is currently undergoing its greatest transformation since the invention of mainstream electricity by Thomas Edison and Nikola Tesla over 130 years ago.

Today, the electric energy industry is largely based on a monopoly model of large interconnected utilities, where power is created in centralized power plants and distributed over thousands of miles of power lines on a one-way path to consumers. This architecture is being decoupled due to economic, regulatory, environmental, reliability and national security megatrends.

This change is possible through the use of wired and wireless two-way, real-time Internet Protocol communications capabilities, and the proliferation of distributed energy resources that can be located anywhere on the elec-

tric grid (e.g., solar power, wind farms, distributed generators, energy storage, electric vehicles, demand response, microgrids, and smart thermostats).

The existing wholesale electric power market systems and apparatus do not have the capability to optimally monetize these new distributed, two-way energy resources. Furthermore, utilities do not possess the core competencies required to measure, verify, clear, reconcile, and process payments for services provided via this new distributed electric power grid.

As a result, the business model of the electric energy industry, like the telecom industry that changed in the 1990’s, is shifting towards greater interconnectivity and smart communications, more productive competition between market participants leading

to greater efficiency, a greater reliance on renewable and distributed energy resources, and an increased focus on meeting growing customer demand for clean energy, resilience, and cybersecurity.

The result is likely to be billions of dollars of value creation for those companies that are disrupting today’s dominant utility model, while simultaneously forcing dominant energy players to rethink and reorganize key parts of their businesses.

This new business model is known as “Transactive Energy,” where customers and producers of energy will have greater transparency over their energy-related data, as well as more control and choice in how they make, use, or sell power. Causam eXchange seeks to be the leader in Transactive Energy.

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# Overview:

## The Transactive Energy Opportunity

SECTION

01



# 1.1 Challenges with Today's Electric Grid

## LACK OF CHOICE IN ELECTRICITY SOURCE

Many people do not like to be told what to do, nor what to buy, which policies to support, or which companies to promote.

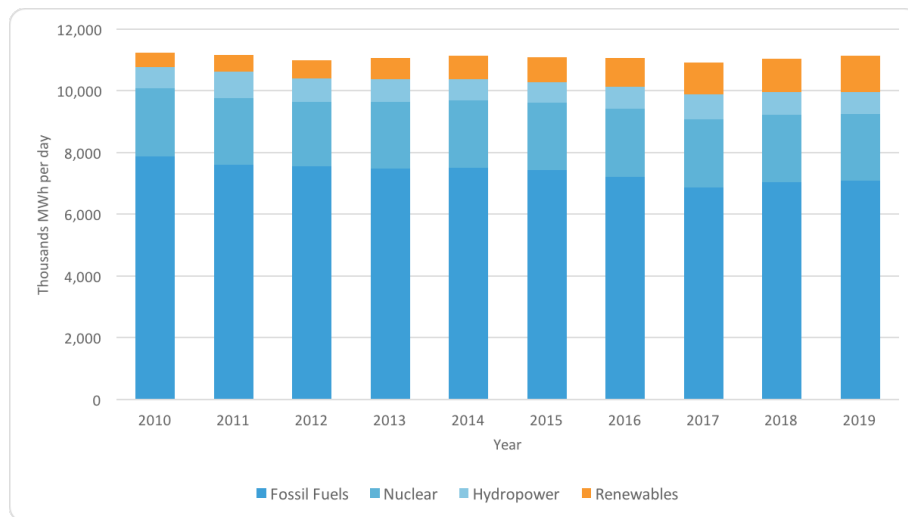
The same is true when it comes to buying power from the grid. Often, consumers are left with no choice or too few choices regarding who generates the power or how the power is produced.

Consider the figure below, which shows the percentage of electricity in the U.S. coming from coal, natural gas, nuclear, petroleum, hydropower, and renewable energy.



**Figure 1.1:**

U.S. Electricity Generation, by Source of Power: 2010-2019

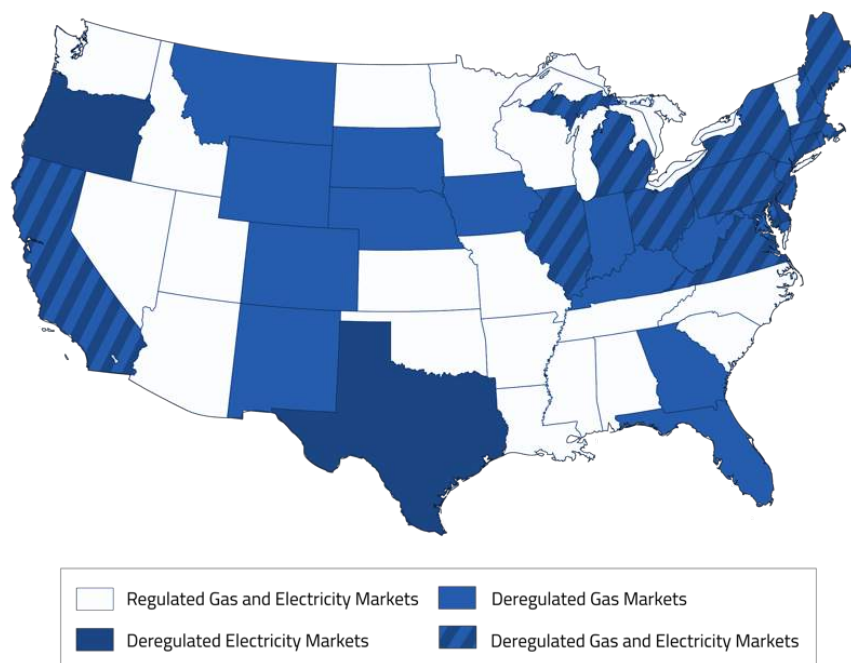


Source: [U.S. Energy Information Administration](#)

Despite the fact that most Americans prefer to buy clean power, per [2017 surveys by the Pew Research Center](#), most power comes from conventional energy, such as fossil fuels and nuclear power.

In addition, most homeowners and business customers cannot choose where their power comes from. The figure below shows which states have some degree of deregulation in their electricity or gas markets, which does allow some customer choice.

**Figure 1.2:**  
U.S. Electricity and Gas Markets: Deregulated (Free choice) vs. Regulated (Monopolistic)



Source: [Electric Choice](#)

As you can see, we have a long way to go before each American can have freedom to choose in the energy sector. Causam eXchange is on a mission to empower every home and business to change this when it comes to electricity choices.

## LACK OF DATA ACCESS

Today, large centralized utilities control the access to and content of end customers’ energy data. They do not promote transparency of this information and typically maintain total control over how it is used, despite the fact that the data belongs to the consumer.

Moreover, the Edison Foundation notes that the U.S. has roughly 70 million “smart” meters. This sounds great on the surface, but it has also created a problem. This movement towards grid modernization has exponentially increased the quantity of energy data, while not increasing customers’ access to that data, especially in real-time when it could be used to inform energy choices.

Why does access to energy data matter? For a deep dive, you can check out the long answer by the American Council for an Energy-Efficient Economy (ACEEE). In short, it is important because when presented in an easy-to-understand format, it enables power users to take actions to reduce their electricity usage and minimize costs by change behavior, shifting to a new energy provider, or installing new on-site generation or analytics. For greater understanding of utility policy around data sharing, check out [OpenEI platform](#), developed and maintained by the National Renewable Energy Laboratory with funding and support from the U.S. Department of Energy.

So how does this fit into Causam eXchange’s mission: We will provide, for the first time, secure access to an end customer’s own data, and a linkage among electricity use, real-time data from the electric power grid, and the electric power markets, by leveraging the EnergyNet platform and blockchain infrastructure. With knowledge, comes power – the ability to take control over your electricity costs, availability, and impacts on the environment.



## LACK OF RESILIENCE IN THE ELECTRIC GRID

To illustrate the problem of our fragile power grids, here is a joke that only energy nerds can truly appreciate. (Stop us if you have heard it before...)

OK, so imagine that Thomas Edison has magically reappeared on Earth and you are giving him a tour of technology today. You focus on two items. First, you show him the amazing computer power of the smartphone in your pocket. He oo's and ahh's in awe. Second, you stop along the Interstate, and you show him how today's power grid. Then he says, "Oh yeah," with a straight face, not withholding his displeasure, "That looks familiar."

Why does this matter? Below are three reasons.



First, when power grids go down, the economic loss can exceed billions of dollars. Consider the hundreds of billions of dollars lost during natural disasters in the U.S. Here is a full list from the [U.S. National Oceanic and Atmospheric Administration](#).

Second, lack of resilience can result in significant impacts on human health. Consider the aftermath of hurricanes, where critical facilities such as hospitals and water treatment plants are left as dark islands.

Third, according to [GlobalChange.gov](#), a collaboration among 13 U.S. federal government agencies, "extreme weather and climate events have increased in recent decades, and new and stronger evidence confirms that some of these increases are related to human activities." Accordingly, these problems could become worse going forward.

In recognition of the serious nature of resilience, the Rockefeller Foundation launched the [100 Resilient Cities](#) initiative in 2013 to help metros prevent the negative outcomes from insecure infrastructure. Similarly, major industry associations such as the Urban Land Institute, the U.S. Green Building Council, and the Sustainability Accounting Standards Board (SASB), as well as agencies across the U.S. federal government, via the [U.S. Climate Resilience Toolkit](#), are all working on best practices to create a more resilient and secure nation.

By making energy use and generation data more transparent, and by enabling more distributed energy resources – such as solar power, energy storage, electric vehicles, demand response, and microgrids – to be profitably installed on the grid, Causam eXchange aims to contribute to a more resilient grid, too.

## LACK OF CYBERSECURITY

If you are in the power sector, you should be losing a little sleep over cybersecurity risks.

As proof, consider the results of the Utility Dive's 4th annual "[State of the Electric Utility Survey](#)," in which over 600 utility professionals listed cyber and physical security as the #1 concern for their companies, with more than 70 percent describing it as "important" or "very important" today.

The National Electrical Reliability Council (NERC) considers reliability, which is the bullseye for cybersecurity threats, to be so critical that grid system operators that fail to comply with these NERC standards can be stuck with penalties of \$1 million per day per violation.

Moreover, with 90 percent of the U.S. power infrastructure is held by private companies, which makes quick, large-scale improvements all the more difficult.

Causam eXchange can support risk reduction from cybersecurity through its focus on a blockchain infrastructure, with greater transparency in electricity transactions, and more “eyes” on an abundance of accessible energy data.

## CLIMATE CHANGE

We intentionally left the topic of climate change for our last “problem to solve” in this part of the paper. We did this for two reasons:

#1: We are saving the best (worst) for last.

Make no mistake, the climate change dilemma is real and colossal.

Let us consider a few [facts from the U.S. National Aeronautics and Space Administration \(NASA\) and U.S. Environmental Protection Agency \(EPA\)](#):

- 16 – Number of hottest years in recorded history have occurred since 2000.
- 1.5 – Average worldwide temperature increase in Fahrenheit compared to a century ago.
- 9 – Number of the most explosive fires in America’s history, which have all occurred since 2000.
- 30% – Percentage increase in acidity (i.e., carbonic acid) in the world’s oceans, which destroys coral reefs.
- 97% – Percentage of climate scientists agree that global warming trends over the past century are “very likely caused by human activity.”
- 400,000 – Number of years ago that the world experienced greenhouse emissions as high as they are to day.



The result is not just environmental impacts, but also economic loss. The [U.S. Government Accountability Office](#) estimates that climate change has also contributed to \$350 billion in expenses so far. In addition, research summarized in a [Harvard Business Review article](#) suggests a potential price tag of \$2.2 trillion through 2025.

#2: We care about environmental protection and climate change mitigation.

We believe in being responsible corporate citizens, in utilizing the power of business to create a better world. In the words of Henry Ford, “A business that makes nothing but money is a bad business.”

On top of that, we understand that the massive transition to a low-carbon energy system is one of the biggest wealth creation opportunities in decades. As an example, the [World Economic Forum](#) suggests that climate change mitigation represents a \$23 trillion investment opportunity. We want to help customers, investors, employees, and other partners to take part in this historic opportunity.

## 1.2 Opportunities in the Digital, Connected, Distributed, and Renewable Grid

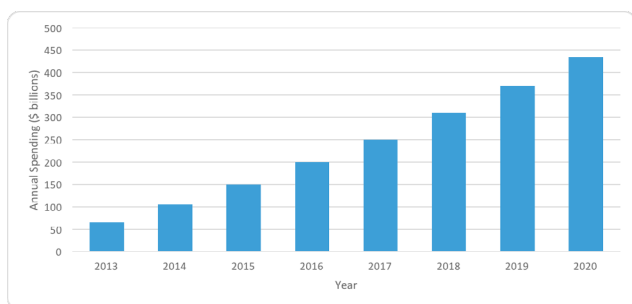
**“The global electricity market is undergoing a revolution: In the last 5-10 years, solar power costs have fallen ~80 percent and energy storage costs have fallen ~70 percent. Electric vehicles are becoming mainstream with 100+ EV models on the road in two years. And technology has advanced to allow for management of large quantities of real-time data and communication. The 800-pound gorillas in the power sector are not prepared to accept or address these megatrends. That’s where Causam eXchange comes in.”**

### SMART GRIDS

[Industry analysts project](#) that the global smart grid market could surpass \$400 billion by 2020 as grids modernize to address the threats and opportunities of the 21st century. Areas for smart grid investments include transmission optimization, distribution automation, analytics, advanced metering infrastructure (AMI), and network operation software. [Energy experts forecast](#) that \$110 billion will be invested over the next ten years to further enable the U.S. smart grid, which will likely be empowered by [90 million smart meters by 2020](#).

**Figure 1.3:**

Smart Grids – Annual Global Spend: 2007-2022



Source: [GreenTech Media](#)

**Figure 1.4:**

Smart Grids – Deployments by State (2015)



Source: [Institute for Electric Innovation](#)

Causam eXchange is uniquely situated to support the smart grid sector because of three reasons.

First, our EnergyNet platform can accept and process the millions of data points coming from smart meters or Internet of Things (IoT) devices, thereby enabling energy market participants to make better decision about how, when, where, and why choices are made regarding electricity generation and consumption. Ultimately, these decisions show up as financial settlements in the energy sector, in which Causam eXchange is one of the world’s leading known patent holders.

Second, our team has played leadership roles creating and selling multiple companies in the smart grid sector.

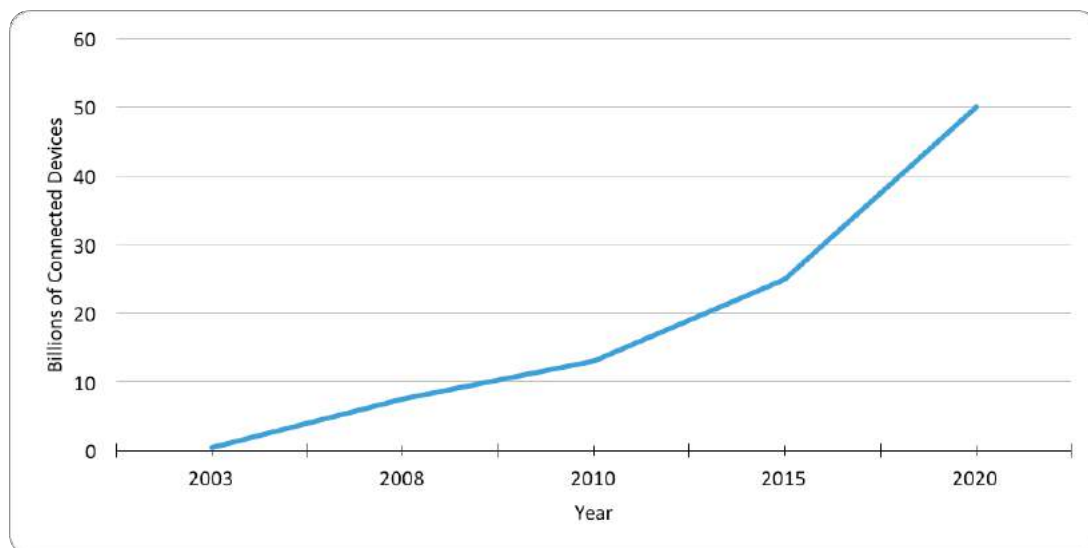
And, third, we are located in the Research Triangle Park (RTP) area of North Carolina, which has one of the world’s largest concentrations of smart grid companies in the world.

## INTERNET OF THINGS (IoT)

The Internet of Things (IoT) – driven by cheap sensors, smart software, and better analytics – is causing a transformation in multiple sectors, from energy and water, to telecom and transportation.

The sheer magnitude of this enabler of smarter homes and smarter cities is hard to comprehend. [Market research suggests](#) that the global market for IoT is expected to reach \$186 billion by 2023, up from just \$16 billion in 2016.

**Figure 1.5:**  
Internet of Things (IoT) – Number of Connected Devices: 2003-2020



Source: [Cisco](#)

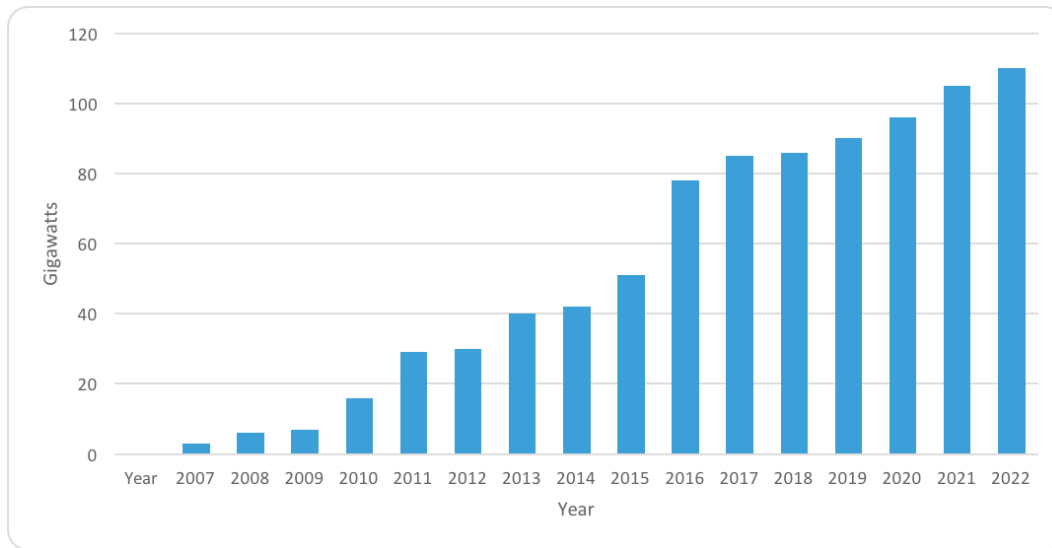
Causam eXchange can benefit from this growing IoT market. While hardware agnostic, its EnergyNet software rely these connected devices to provide the data it needs to enable financial settlements in the electricity sector that are faster, cheaper, more transparent, and more efficient.

## SOLAR POWER

The solar industry has grown tremendously since about 2009, when it took its first step to be a serious player in the electricity sector. Drivers include falling costs ([down about 70 percent since 2009](#)), strong policy support at the federal and state level, consumer preference for renewable energy, and improved bankability of solar system technology.

Causam eXchange can help solar developers and owners better monetize their solar power generation, support building owners in more efficiently allocating and accounting for solar use among multiple tenants and buildings, and aid retail electric providers in offering solar power options to satisfy their customers' demand.

**Figure 1.6:**  
Global Solar Power (PV) – Annual Installations: 2007-2022

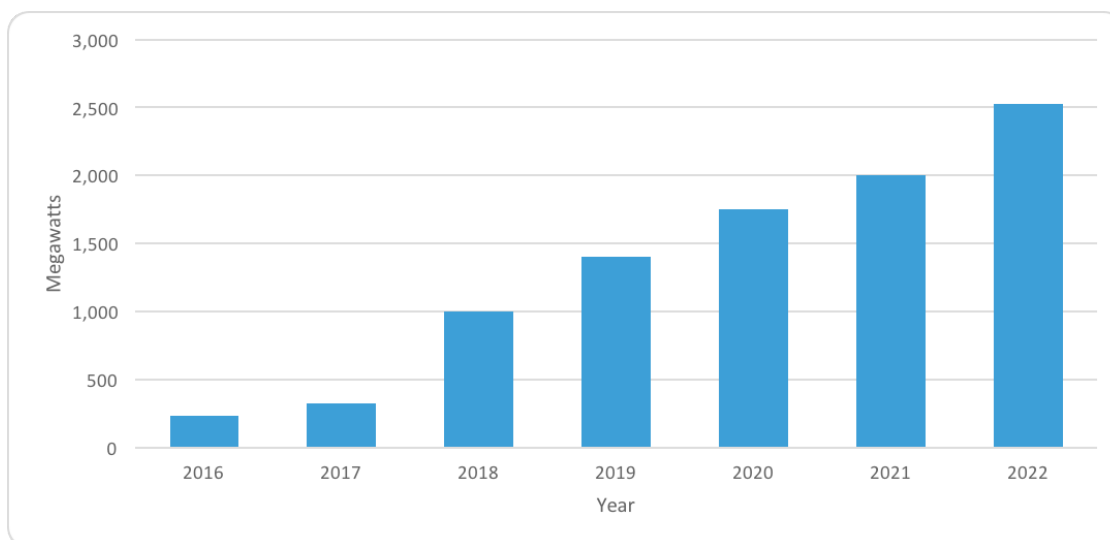


Source: [GreenTech Media](#)

## ENERGY STORAGE

Many energy experts suggest that the relatively young energy storage market is today where the solar power sector was in 2009. As example, [Bloomberg projects](#) the global energy storage market to exceed \$250 billion by 2040, and [IHS sees](#) worldwide market growth of almost 7x between 2017 and 2040, from 6 GW to 40 GW.

**Figure 1.7:**  
U.S. Energy Storage Growth: 2016-2022



Source: [GreenTech Media](#)

Causam eXchange can support energy storage companies and battery owners in earning better and more diverse revenues, increase reliability and market value of renewables, support building owners in becoming virtual power plants, and help retail electric providers managing costs, improving margins, and offering more innovative products to increase customer satisfaction.

## MICROGRIDS

The increasing occurrence of recent natural disasters has been a driver of microgrid growth, as business, residential, and government players focus on the need for resilience. Other drivers include energy cost reduction, transmission deferral, and less risky supply chains.

**Figure 1.8:**

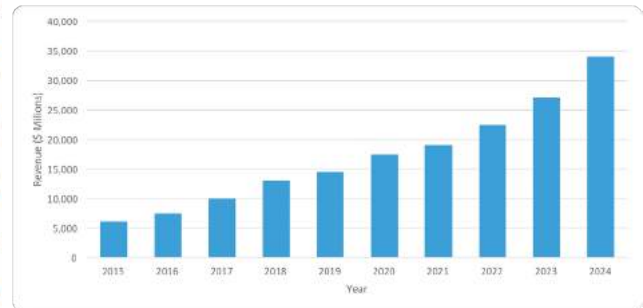
Internet of Things (IoT) – Number of Connected Devices: 2003-2020



Source: [GreenTech Media](#)

**Figure 1.9:**

Global Microgrid Growth: 2015-2024



Source: [Institute for Electric Innovation](#)

[Market experts project](#) that microgrids could become a \$40 billion-a-year business worldwide by 2020, taking about 6 GW of business away from utility leaders. Further more, [EY estimates](#) that by 2020, microgrids could save between \$64 billion and \$171 billion in electricity costs for businesses in 20 countries.

Causam eXchange can support this rapid microgrid expansion by facilitating easier financial settlements across multiple generation sources or multiple behind-the-meter customers, as well as serve as a communications and accounting interface between the utility and the onsite customers.

## DEMAND RESPONSE

Utilities’ implementation of demand response programs is nothing new, but it is on the rise, by percentage adoption and by variation in type of demand response offering.

But first, what is demand response?

SEPA (Smart Electric Power Association) defines it this way: “Changes in the electric load – such as reductions, increases, or shifts – by end-use customers from their normal consumption patterns in response to specific market or system conditions. Such conditions could include time-varying changes in the cost of producing energy, shortages of distribution, transmission, or generation capacity, or unusually high or low voltage or frequency.”

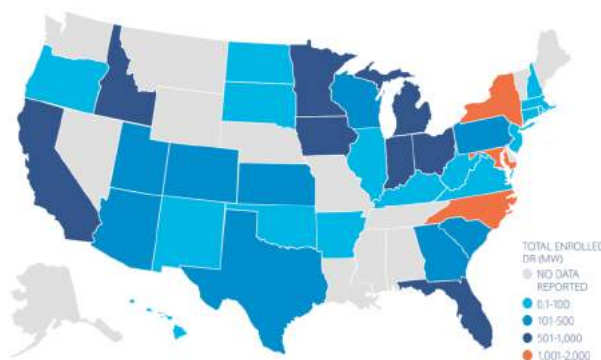
Examples include more conventional methods such as cycling air conditioners or water heaters (i.e., remote controlled to

lower power use during peak periods), with 41 percent and 16 percent of surveyed utilities offering each, respectively. Newer types of demand response are less common, but their rise is likely – e.g., 24 percent offer thermostat programs and 9 percent offer behavioral modification programs to their residential customers.

Utility use of demand response is driven in part to manage their costs; defer generation, transmission, or distribution upgrades; address climate change goals; and lower customers’ bills.

Figure 1.10:

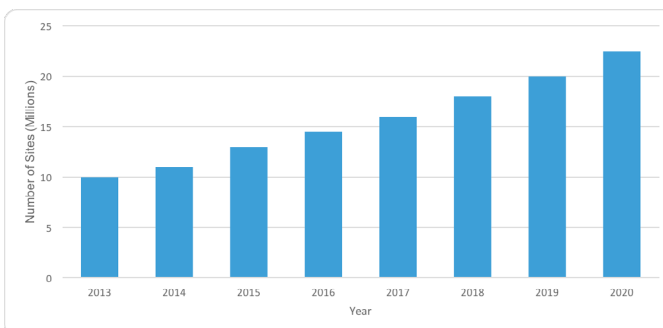
Demand Response – U.S. Adoption by State (Megawatts)



Source: [Smart Electric Power Alliance](#)

Figure 1.11:

Demand Response – Global Growth: 2013-2020



Source: [Naviant Research](#)

Causam eXchange can ride the wave of the growing demand response market by enabling greater efficiency in the deployment, measurement, verification, and financial settlements among DR players and users of these services.

## ELECTRIC VEHICLES

The electric vehicle (EV) market has transformed from “sports toy for wealthy environmentalists” to cars for the masses, with 120 EV models expected to be for sale by 2020, [according to Bloomberg](#).

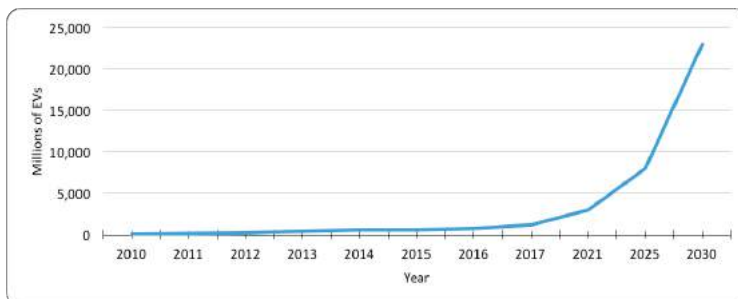
Factors influencing this growth include lower fuel costs, lower maintenance costs, popularity among consumers, faster acceleration, adoption by fleet managers, and, most importantly, falling battery costs, which [McKinsey & Company estimates](#) fell over 70 percent since 2010.

Causam eXchange has a role to play in the EV sector when these “batteries on wheels” become distributed energy assets and start serving as backup power, batteries to store onsite solar power, or resources to support ancillary services and capacity needs on the larger power grid.

When this future becomes a reality, and [numerous trials are underway](#) to test [vehicle-to-grid opportunities](#), Causam will be there to measure, verify, and settle financial transactions among the various parties.

Figure 1.12:

Electric Vehicle Growth – Annual Sales: 2010-2030



Source: [Bloomberg](#) and [EV Volumes](#)

## SUPPORT FROM FEDERAL ENERGY REGULATORS

The electric power grid and the utilities and market participants who operate on the electric power grid, are governed by the Federal Energy Regulatory Commission (FERC) and the National Electric Reliability Corporation (NERC). As one role, FERC ensures there is open access and published electricity rate tariffs for the transmission of electrical power, regardless of ownership of the transmission lines.

In the 1990s, FERC issued the first of a series of regulatory orders that began the process, just like in the Bell Operating System (e.g., legacy AT&T) of decoupling the utilities to their components of generation, transmission, distribution, and retail operations. The impact of FERC's orders and forward-thinking states began the process of deregulation of the electric power grid to bring market forces to a traditional monopoly. Below is a summary of the relevant FERC orders that support the growth of the solar, sectors that on which Causam eXchange is focused.

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**FERC Order 745** requires Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) to pay market prices for demand response programs, effectively categorizing for financial purposes the curtailment of power on par with the generation of peak power. Current approaches to management of demand response are deficient because they lack real-time control and reporting. Further, settlements have the unintended consequence of causing secondary peak events with no efficiency because all power that is removed during period of peaks is recovered when the systems are simultaneously released. Current demand response technologies on the market are generally an inconvenience to customers and, as a result, are given the lowest benefit of operating reserves by NERC's functional model.

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**FERC Order 750** enables storage technologies and fast acting frequency response by requiring RTOs and ISOs to pay higher compensation to owners of electric power storage assets such as electric vehicles, batteries, compressed air, and other ancillary devices that offer fast responses to demand contributing to grid stability by their operation. Currently, new battery technologies are emerging as well as storage technologies that could ultimately license Causam eXchange technology. In the short-term, electric vehicles that have the capability of both storing and delivering their battery storage are candidates for licensing.

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**FERC Orders 888, 889, and 1000** require open access and promotion of wholesale competition, and force states to coordinate with each other on transmission planning. This means that each owner of transmission and network interconnection requirements must coordinate and put in place a definable, non-discriminatory process for those who wish to connect with the grid. These orders have a very high analog to the Telecommunications Acts ordered by the Federal Communications Commission during the 1980s and 1990s with the intent of facilitating interconnection of other market participants to the grid.

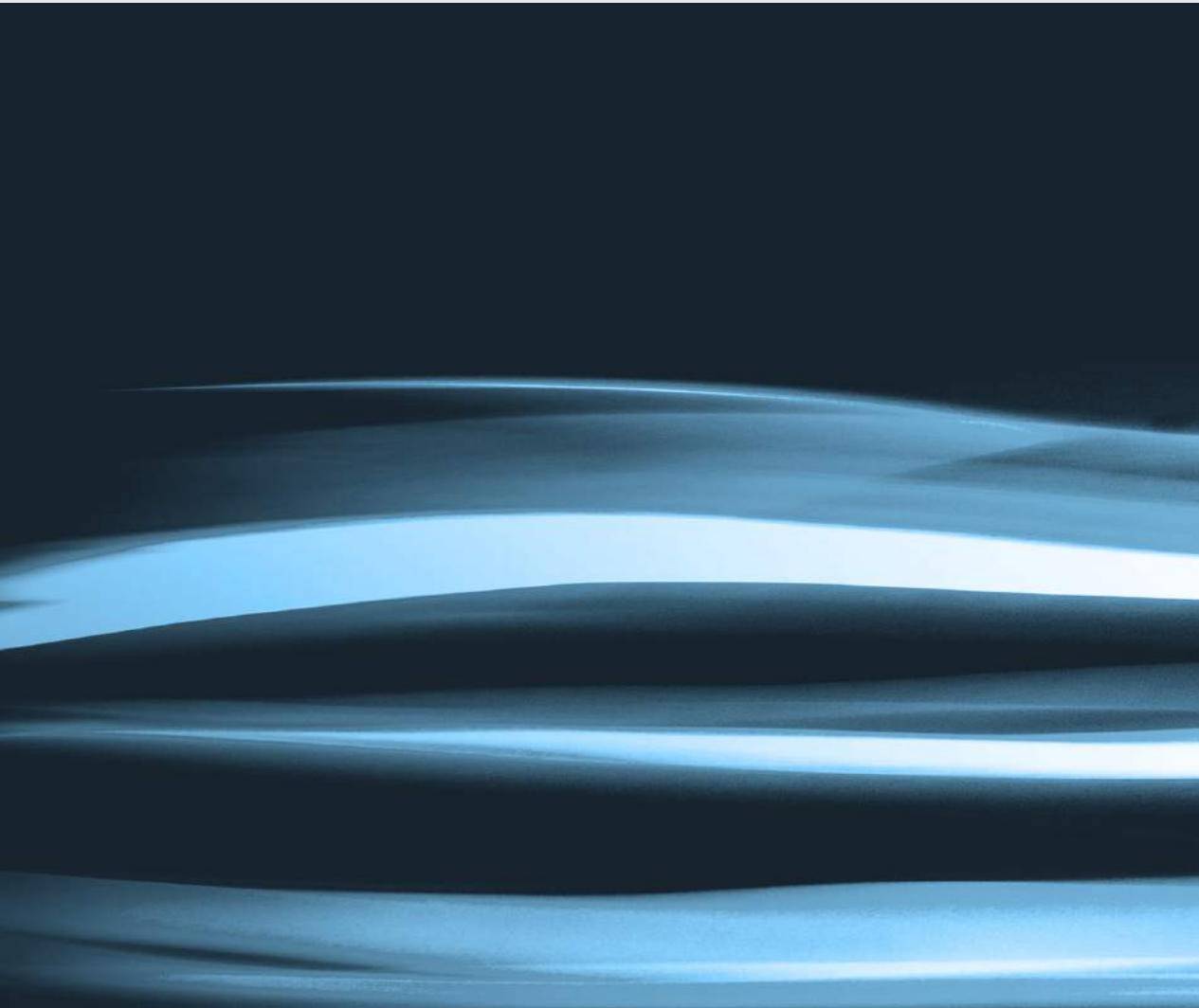
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**FERC Order 755** enables distributed energy and increased use of microgrids by requiring RTOs and ISOs to permit the attachment of smaller generating resources such as backup generators, solar and micro-turbines at the distribution level of their grids. This order also requires RTOs and ISOs to pay higher compensation to owners of micro-turbines and other micro-generation assets when they offer grid stability through their ability to have or offer fast acting reserves. Current approaches to management of Distributed Generation Resources are deficient because they lack the ability to communicate, control, aggregate and settle their assets in sufficient trading blocks to present to a market for monetization. Under the Distributed Generation Resources technology applications, Causam eXchange has applied for patents for various systems, methods and apparatus for improvement in the communication, measurement, verification and settlement of transactions between RTOs / ISOs and owners of microgrids and micro-generation assets.

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**FERC Order 825** was recently issued in 2016. The Commission is revising its regulations to address certain practices that fail to compensate resources at prices that reflect the value of the service resources provide to the system, thereby distorting price signals, and in certain instances, creating a disincentive for resources to respond to dispatch signals. The Order requires that each RTO and ISO align settlement and dispatch intervals by: (1) settling energy transactions in its real-time markets at the same time interval it dispatches energy; (2) settling operating reserves transactions in its real-time markets at the same time interval it prices operating reserves; and (3) settling intertie transactions in the same time interval it schedules intertie transactions. This Order also requires that each RTO and ISO trigger shortage pricing for any interval in which a shortage of energy or operating reserves is indicated during the pricing of resources for that interval. Adopting these reforms will align prices with resource dispatch instructions and operating needs, providing appropriate incentives for resource performance.





# ENERGYNET® TECHNOLOGY

SECTION  
02

## 2.1 Value Proposition to Platform Users



Causam eXchange created the EnergyNet platform to revolutionize how energy financial settlements occur between those who produce electricity, those who sell that power to others, and those who buy electricity at the retail level. As detailed in the prior section, the energy sector lacks an innovative solution to simplify and streamline energy transactions between willing counterparties, democratize the use of energy data, boost renewable energy adoption, and deliver smart energy management at the grid and distributed level.

**“What does it matter to have storage, rooftop solar, electric vehicles, commercial microgrids, and net zero buildings, if you can’t get paid adequately for the value you are creating when you deploy them? Our blockchain-based EnergyNet® platform can change that.”**

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**JOSEPH FORBES, JR.**

**Chief Executive Officer**

Causam eXchange’s EnergyNet platform is a secure cloud-based, software-as-a-service platform that solves the most important challenge of Transactive Energy: compensation for providing distributed energy services via the distributed electric grid.

EnergyNet’s advanced energy settlement platform seamlessly integrates with legacy wholesale and retail electric power markets using any energy measurement device. This market integration is unique to EnergyNet and solves an essential problem that many blockchain-based energy transaction platforms fail to address.

In the near-term, existing energy markets are unlikely to be discarded and replaced by new energy exchanges that function separately and apart from them. Rather, a bridge technology is needed to interface with existing markets, while also enabling new Transactive Energy business models. EnergyNet was created to achieve these dual goals.

At its core, EnergyNet facilitates smart, real-time, and low-cost transactions between any willing counterparties on the grid. It democratizes the use of energy data in combination with a blockchain-based market that enables simple and transparent contracting, transacting, and trading of power and other services.

EnergyNet leverages blockchain technologies to execute real-time, two-way, actionable digital contracts that increase transparency by accelerating the flow of information and automate real-time decisions among end-users who own or manage distributed energy assets. This market will attract new participants beyond traditional energy providers, from small-scale energy prosumers to large-scale energy retailers, and generate substantial cost savings and increased profits due to the ease and speed of transacting for power and other services.

An essential part of Causam eXchange's mission is to accelerate the proliferation of renewable energy and distributed energy resources, including solar, wind, battery storage, backup generation, fuel cells, and electric vehicles. EnergyNet's advanced energy settlement capabilities unlock a wide array of new economic opportunities and revenue structures for distributed energy resources.

This transformation in clearing and settlements is similar to the changes that took place in the late 1990s with business verticals such as stock market transactions and the conversion of checks to Visa. In similar fashion, the revolution in the use of retail information best embodied by the internet retailer, Amazon, is analogous to what we are witnessing today in energy data and new transactional platforms.

Causam eXchange aspires to be a leader in this transformational period in the energy sector, and has designed EnergyNet to deliver value to the full ecosystem of market participants (e.g., utilities, system operators, independent power producers, retail electric providers, renewable energy generators, microgrid operators, and end-use consumers) by:



- ✓ Automating real-time smart contracting and financial settlement of energy transactions
- ✓ Measuring and verifying power generated, transferred, or consumed under market rules
- ✓ Enabling distributed energy and demand response resources to be aggregated and compensated through participation in power markets
- ✓ Allowing any liquid currency, cryptocurrency, or token to be used to provide compensation between counterparties in an energy transaction
- ✓ Using smart, real-time Internet Protocol based communications to manage and control grid elements to achieve greater resilience and flexibility
- ✓ Registering, authenticating, tracking, and managing grid elements in support of the smart grid and in accordance with regulations and standards
- ✓ Empowering end-users to share their energy data via the EnergyNet platform
- ✓ Generating optimized energy efficiency and utilization strategies and pricing schemes

## 2.2 EnergyNet® Platform

**“On one hand, Causam eXchange is complicated, with blockchain, Ethereum, complex algorithms, and smart contracts. On the other hand, our model is simple: We are a software and technology platform that connects buyers and sellers of power at the distribution level, facilitating near real-time financial transactions, similar to how VisaNet connects businesses, customers, and banks in non-power transactions all the time.”**

EnergyNet was designed to create new economic opportunity for market participants from selling power and services via the grid. It achieves this through its core features:



### FINANCIAL SETTLEMENTS ENGINE

A Financial Settlements Engine for customers, aggregators and other service providers to easily manage energy transactions that are part of utility programs, power purchase agreements, or commercial energy management programs



### DIGITAL CONTRACTS

Digital Contracts that provide a simple, streamlined process of contracting for the power or other services provided by distributed energy resource assets, including renewables



### COMPLEX RULES ENGINE

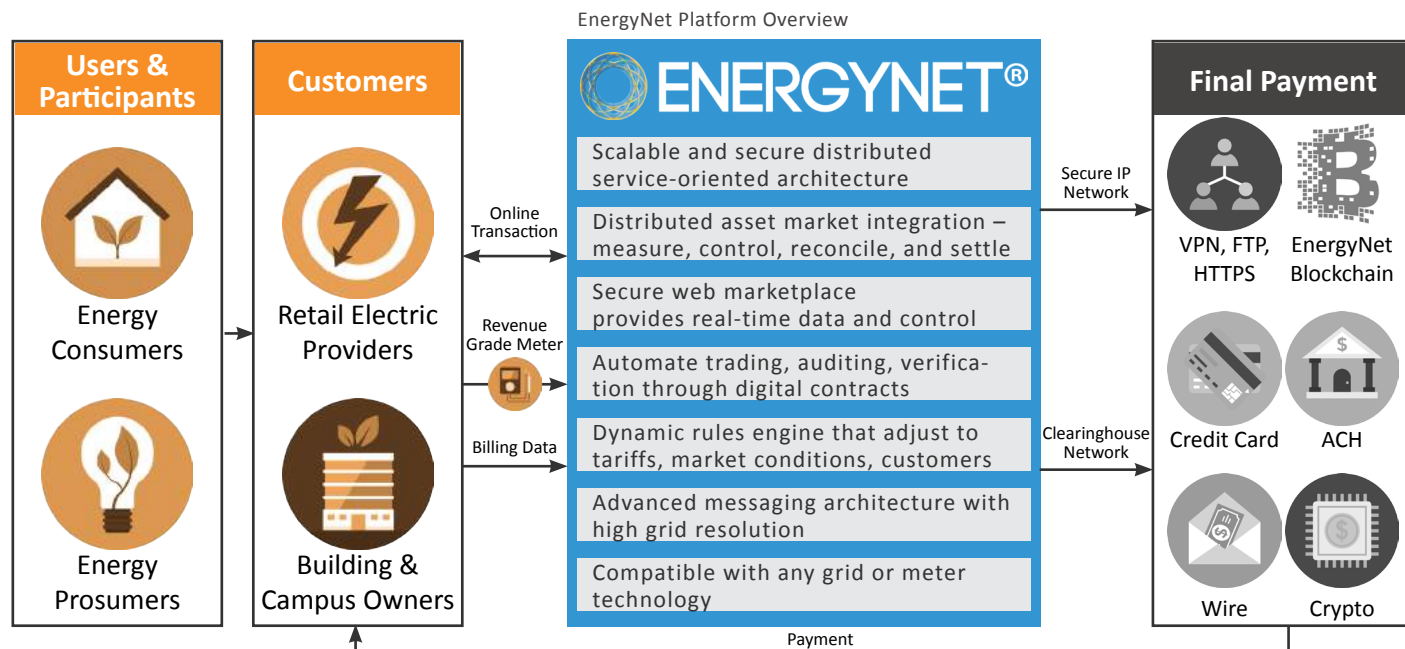
A Complex Rules Engine that empowers market participants to quickly design customized plans for the acquisition, aggregation, and enrolling of distributed energy or commodity power for end-use customers



### MODELING & ANALYTIC TOOLS

Modeling and Analytic Tools that facilitate real-time power modeling of the distribution system and real-time power flow impact analyses for interconnection and distribution planning

Figure 2.1:



Causam eXchange can help solar developers and owners better monetize their solar power generation, support building owners in more efficiently allocating and accounting for solar use among multiple tenants and buildings, and aid retail electric providers in offering solar power options to satisfy their customers' demand.

### EnergyNet is a sophisticated financial technology that seamlessly interfaces with the legacy electric grid and enables the next generation distributed electric power grid

The EnergyNet platform simplifies how all market participants interface with the existing electric grid and the electric power markets. This allows for easy adoption by customers and energy providers that are not seeking to defect from the existing power system.

It also enables emerging Transactive Energy business models, such as peer-to-peer (P2P) energy contracting and trading. Importantly, it does not depend on the creation of a new or separate energy exchange or the utilization of tokens as a medium of exchange. It works with the electric grid of today, and the emerging distributed and digital electric grid of the future.

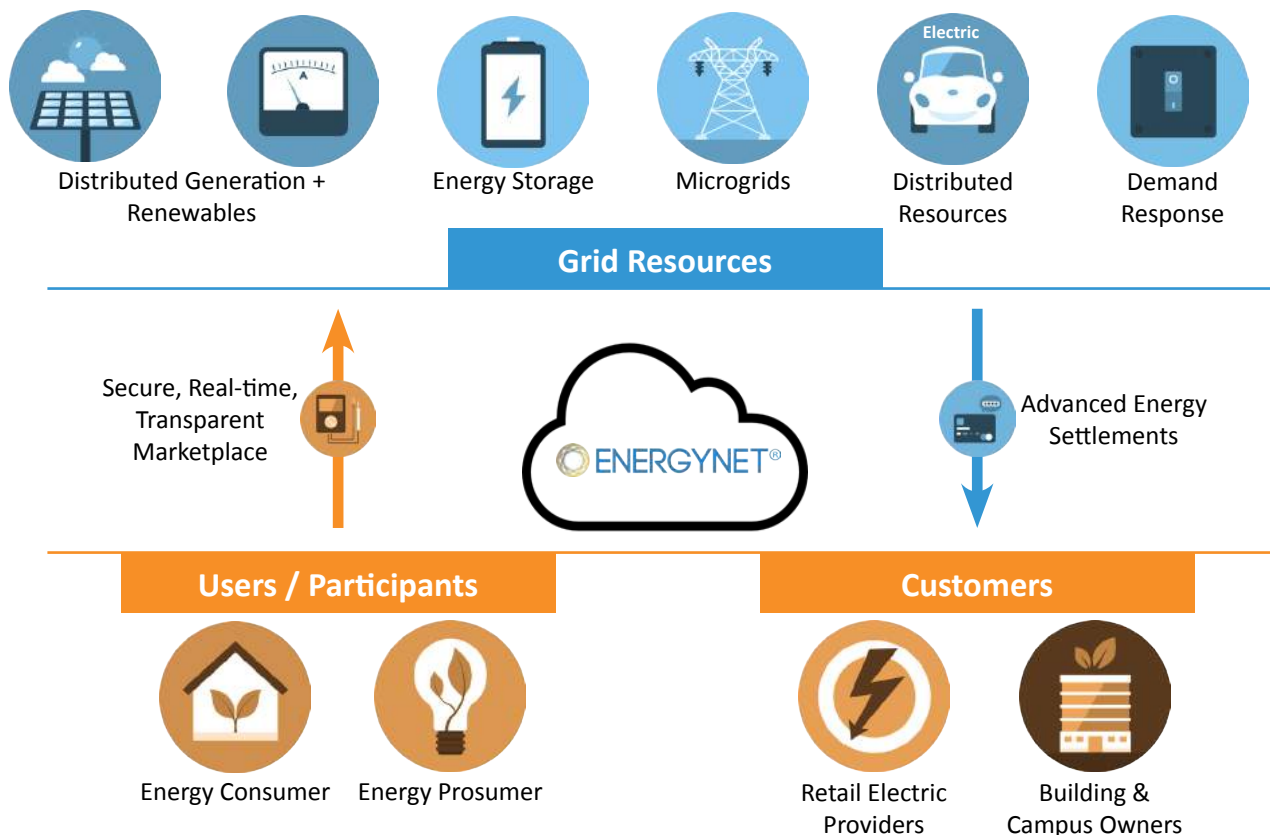
Additionally, EnergyNet makes it possible to use not only conventional currencies, but also any liquid cryptocurrencies or tokens as a form of compensation in an energy transaction.

### EnergyNet creates a new market at the distribution level that is sorely needed yet does not currently exist

In today's wholesale and retail electric power markets, the measurement, verification, clearing and settlement is performed in an archaic fashion riddled with inefficiencies, inaccuracies, and delays.

At the distributed-level, market participants must transact via an intermediary, such as a broker, in order to be compensated for the use of their resources, be it onsite solar, energy storage, demand response, or related assets. These interme-

Figure 2.2:  
EnergyNet Platform Elements and Users



diaries capture a great deal of value in the transaction, and undermine the economic potential of owning and managing distributed energy resources. In other words, there are no tracking, clearing, and settlement systems for an asset owner to be directly compensated for the full value derived from the use of their distributed energy resources by an end-user.

This is proving to be a substantial impediment to the proliferation of distributed energy resources, as there is no transparent market mechanism through which to buy, sell, or trade distribution-level assets and services in today’s transmission-only electric power market.

EnergyNet provides a much-needed solution to this problem with its ability to measure, verify, and settle the accounts of distributed energy resources, renewables, energy storage, demand response, and electric vehicles in a simple, automated manner at the distributed-level.

**EnergyNet accelerates the clearing and settlement of energy payments to be near real-time**

Whereas energy settlements often take on the order of weeks to months, EnergyNet can achieve this with a higher degree of accuracy in the measurement and verification in a matter of hours to days. With the evolution of other supporting technologies such as meters, inverters, and building energy management systems, EnergyNet will settle transactions in real-time, as occurs today in the stock, bond, credit card, and money transfer markets.

## **EnergyNet is hardware agnostic, and can integrate any meter or grid technology**

Many emerging Transactive Energy business models and platforms depend on the use of specific meter technologies in order to properly function. EnergyNet was built with the opposite approach in mind – to integrate with any existing meter or grid technology, including electric meters, sub-meters, inverters, building control systems, or any device that can provide acceptable power measurement data and be used for financial settlement of power.

This allows EnergyNet to more easily interface with existing markets, energy providers, and consumers. Herein lies one of EnergyNet's key technological advantages.

## **EnergyNet democratizes access to and use of energy data and increases energy choice**

Most end-use customer do not realize they are the owners of their energy data – not utilities or energy providers. Usage data from smart meters and other measurement devices can be accessed directly by the customer, or on behalf of the customer, through services like EnergyNet.

This data is then analyzed to produce customized options to meet the end-use customers goals and interests. This unprecedented level of energy choice will enable end-use customers to install or procure renewable power or other distributed energy resources on their own or change their energy plan that procures electricity on their behalf. Though EnergyNet utilizes energy data, it is not for the purpose of taking possession of capacity or energy in the marketplace.

## **EnergyNet is not a market participant, but rather an enabler of market participants to achieve greater transactional flexibility and efficiency**

EnergyNet connects willing buyers to willing sellers without the need for regulatory intervention. The EnergyNet platform is an independent “network” for the clearing, reconciliation, processing of settlements, and the exchange of information between any market participant.

However, it is not a registered exchange for the purchase or sale of wholesale power or other commodity transactions. Causam eXchange will not enter a market that requires that EnergyNet be registered as a market participant.

## **EnergyNet equips energy retailers and their customers to be proactive economic participants, not just passive observers, in the evolution of the electric grid**

How does the owner of a renewable energy project, backup generator, storage device, programmable thermostat enabled for demand response, or combination thereof, know “what to do” in order to participate in the evolution of the electric power grid?

The short answer is that it is exceedingly difficult to understand the benefits of making such investments, or to know how to be compensated by other parties seeking renewable power or other services.

EnergyNet makes it simple to evaluate compensation options and automate contracting and payment for power or services provided by distributed energy resources.

## 2.3. Revenue Model



*EnergyNet generates revenue through a simple transaction fee on any payment that is processed and settled through its platform.*

Like Visa and other similar transaction processing businesses, EnergyNet's revenue model is simple and elegant. It charges a fee based on a percentage of the value of each transaction cleared through the platform. This revenue model is based on very small payments for a high volume of transaction.

We anticipate transaction revenue from the following:

### DEMAND SIDE

**Demand Side Aggregators:** Enabling retail electric providers, municipal, coops, and utility providers to source power for their customers from behind-the-meter, distributed power generation.

### BEHIND-THE-METER

**Behind-the-Meter Applications:** Examples include multi-tenant commercial buildings where energy is produced locally or sourced externally and cost allocated to the tenants.

### SUPPLY SIDE

**Distributed Energy Resources:** Enabling solar, energy storage, generators, EVs, and other DERs to be fully compensated for the power and services being provided.

### DEMAND RESPONSE

**Demand Response:** Enabling both buy- and sell-side market participants to curtail peak loads for compensation.

An essential requirement of these sectors is real-time, or near-real-time, data acquisition and analysis which is provided by the EnergyNet platform. The EnergyNet platform enables greater market efficiency and transparency which provides market participants cost savings and increased profits. Moreover, its architecture is designed for data intensive and high speed secure messaging to improve the speed and efficiency of measurement and verification.



## 2.4. EnergyNet Blockchain Platform

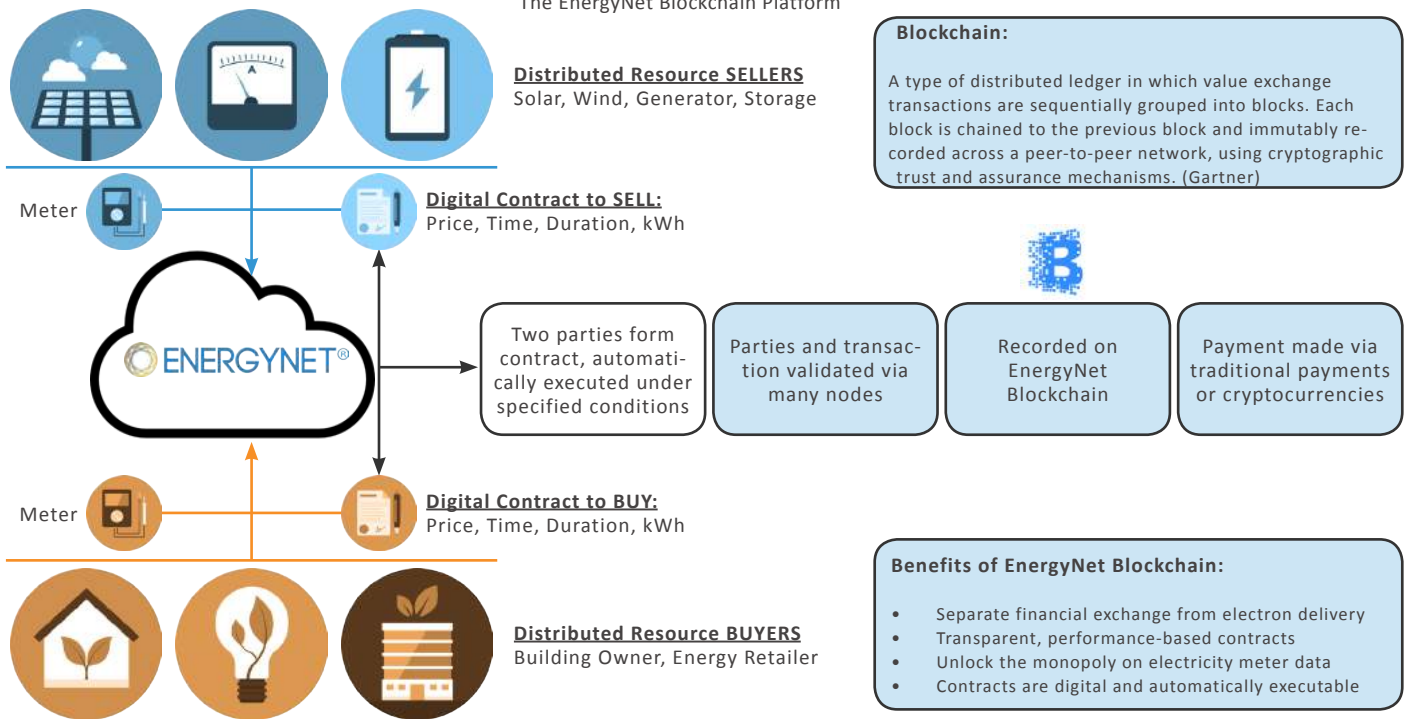
“The blockchain promises a transactional platform that is highly secure, low cost, fast, with lower incidents of error, and the possibility of reducing capital requirements. It essentially allows companies to automate more while processing greater volumes of data cheaper with fewer people at lower cost and risk...It has the potential to radically disrupt and open up the energy markets in ways people have not yet even considered...This is hard to ignore.” - [Deloitte](#)

**Blockchain technology itself is not sufficient to deliver a functional energy transaction platform, but EnergyNet makes it possible**

Without EnergyNet, the transition to a blockchain-based energy transactional model would be challenged due to the limitations of blockchain alone to satisfy all of the requirements for data ingress, measurement, verification, clearing and reconciliation, as well as our ability to interface with both the emerging peer-to-peer (P2P) market and traditional energy markets as they exist today. EnergyNet makes blockchain implementations for Transactive Energy a reality for the legacy electric grid and the next generation digital grid of tomorrow.

Figure 2.4:

The EnergyNet Blockchain Platform



## The EnergyNet platform imbeds blockchain into its three core technological pillars



### MEASUREMENT & VERIFICATION

Block payloads are used via the EnergyNet Blockchain to transfer meter read data, which can be seen by the supplier of the power and the buyer they are contracted with to sell that power. This enables market participants to know exactly what information is being used to execute their transactions.



### SMART DIGITAL CONTRACTS

The EnergyNet Blockchain is used to form and hold references to smart digital contracts executed among market participants. The smart digital contracts in EnergyNet are similar to today's paper based power purchase agreements (PPAs), but their terms are in a standardized form which allows them to be more easily understood and transferable to other parties, which enables participants to easily buy and sell contracts. Blockchain allows both transacting parties access to real-time energy data, which when processed through EnergyNet's complex rules engine, enables real-time execution of smart digital contracts.



### ADVANCED ENERGY SETTLEMENTS

Blockchain can be used as a payment point (to or from) in public/hybrid networks, or as an indication to commit payment using another method (e.g., credit card, ACH) in private networks. As a point of payment, public blockchain networks have currency capabilities which can be used for payment (e.g., Ether Tokens). EnergyNet's digital contracts provide the transaction amount, party, and timing for payments, which can be made in any liquid conventional or cryptocurrency.

These core technological pillars can be combined in a number of different ways to help move the grid from a centralized, analog power delivery system to an ecosystem of distributed energy producers, prosumers, and consumers on the digital electric grid.

## 2.5 Technical Description

**“Blockchain technology has the potential to radically change energy as we know it...It enables prosumers, i.e., households that not only consume but also produce energy, to buy and sell energy directly, with a high degree of autonomy...In addition to reducing transaction costs across the system and delivering cost benefits for customers, it ensures that existing [energy] generation capacity is utilised optimally...Financial blockchain applications have already reached an astounding level of maturity.” - [PwC](#)**

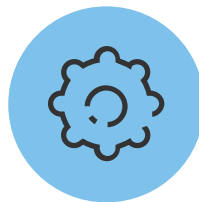
### Who realizes value on the EnergyNet Blockchain?

Three types of individuals and entities will exchange value on the EnergyNet Blockchain by proposing, executing, and settling energy contracts:



#### POWER PURCHASER

An entity or individual that needs to purchase power for their own consumption or on behalf of others to maintain operations, comfort, or meet renewable energy goals.



#### POWER GENERATOR

An entity or individual that is producing power available for purchase and use by other Power Purchasers. Power Generators can produce power via a variety of technologies.



#### POWER BROKER

An entity or individual responsible for facilitating new power contract creation, forecasting demand and supply futures, and performing market research to develop new offers and services.

### Public Identities on the Blockchain

All entities or individuals interacting with the EnergyNet Blockchain must maintain a public identity and associated private credentials retained in a Blockchain wallet.

Value in the EnergyNet Blockchain is accrued to the public identities, and expressed in terms of market exchangeable Tokens. Accrued value is publicly visible to all parties via analysis of immutable Settlement Events (defined below) contained within the blockchain.

## Events and Elements on the EnergyNet Blockchain

The EnergyNet Blockchain is comprised of “Events” being processed by “Elements.” Events capture the tasks that are being conducted via the blockchain. Elements are the key entities that perform an executing function to realize a transaction. Events and Elements can be configured to achieve any transactional outcome desired by a market participant.

### **Event #1: Measurement Event**

A set of revenue-grade power measurements and metadata over an interval of time containing an immutable record of observed power supply or demand. Measurement Events are produced by an EnergyNet Hub in combination with a revenue-grade measurement device. Importantly, this can be any measurement device in the market today. The measurement data is encrypted on the EnergyNet Blockchain and visible only by a public identity, typically by the owner of the EnergyNet Hub device or other ratified parties on a Contract Event.

### **Event #4: Settlement Event**

A statement of Token value assignment from a public participant who made the commitment via contract to one or more other public participants who have delivered Measurement services or Ratification Events and are verified to have performed within the terms of the contract. Settlement Events assign Token value (based upon the form of currency or cryptocurrency utilized) from the contract and associate Ratification Events to public participants identified in the contract. Settlement Events are also the vehicle to terminate contracts by Settling the Token value to zero remaining on the contract.

### **Event #2: Contract Event**

A commitment of value transfer from a public participant to other public participants in exchange for performance under certain terms and conditions satisfied by Measurement Events. Contract Events express the terms and conditions using a protocol that Settlement Authorities (defined later) must understand and process. The conversion of traditional energy contracts into blockchain is a critical part of the process, especially to enable integration with existing markets. Contract Events may be for long-term or short-term service delivery, and may result in demand control or supply control changes during performance of the contract.

### **Event #3: Ratification Event**

A commitment of participation within a contract by a public participant. Ratification Events express the acknowledgement and acceptance of the contract by the participants. Ratification Events may assign additional Token value to the contract. The Settlement Authority only settles the contract once all the public participants identified on the contract have created Ratification Events for that contract.

### **Element #1:**

#### **EnergyNet Hub**

A physical device with Internet Protocol connectivity, memory, software, and wallet capabilities that interfaces with a revenue-grade power measurement device, such as a consumption meter, supply meter, transformer meter, or inverter meter. Typically EnergyNet Hubs physically live near the location of power supply and demand, distributed in the world.

### **Element #2:**

#### **EnergyNet Settlement Authority**

A software and computational wallet process that monitors the EnergyNet Blockchain for contracts for which the EnergyNet Settlement Authority is designated by public identifier. Settlement Authorities are responsible for connecting Measurement Events to Contract Events, running all the data against a set of rules that determines performance and delivery, and producing Settlement Events that reassign value from the contract to the public identities involved.

### **Element #3:**

#### **EnergyNet Deal Desk**

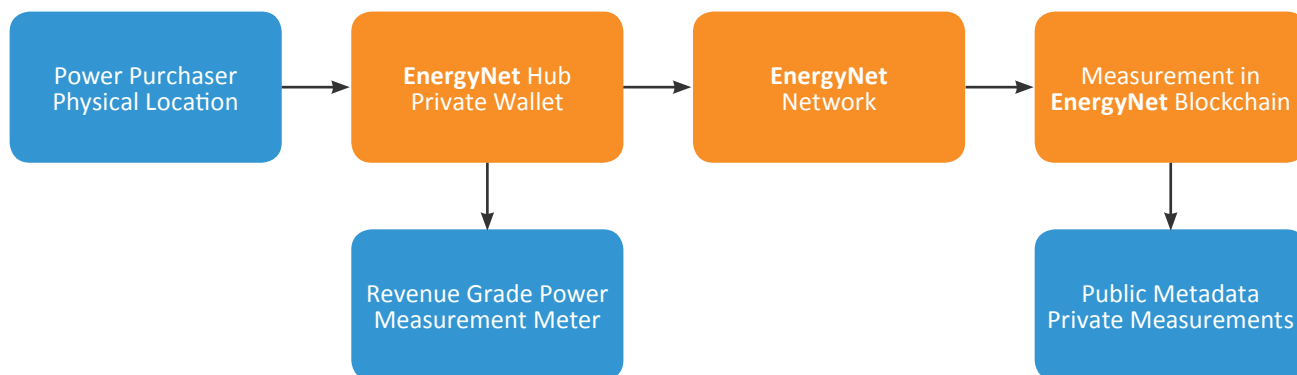
A software wallet application or wallet portal that enables participants to manage, search, and create new Contract Events. The Deal Desk also enables extraction, summarization, and visualization of Measurement and Settlement Events associated with those Contract Events.

## 2.6 Use Cases

### #1 – Sharing Energy Data: A Power Purchaser publishes Measurement Events

A Power Purchaser has installed an EnergyNet Hub paired with a revenue-grade meter or equivalent capable device (e.g., smart meter, inverter). As the meter measures power, the EnergyNet Hub encrypts and transmits those measurements to the closest EnergyNet Network node for the purpose of publishing public metadata and private measurements to the blockchain. The Power Purchaser can decrypt their own private measurements from the blockchain at any time.

Figure 2.5:  
Sharing Energy Data



### #2 – Smart Digital Contracting: A Power Broker creates a request for measurement information using a contract. A Power Purchaser automatically provides measurement to fulfill contract

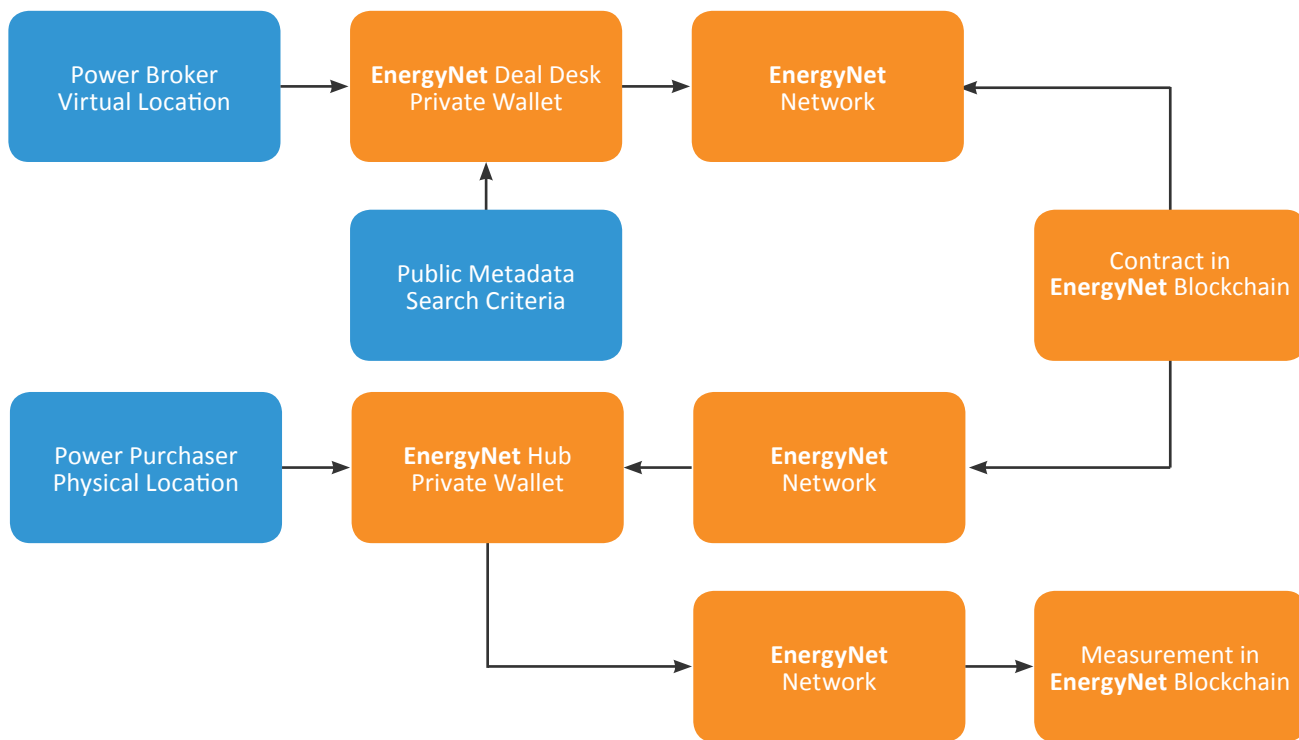
A Power Broker is designing a new service offering or planning a new distributed generation facility and is ready to exchange a Token value for measurement data to create an accurate power offering.

The Power Broker creates the offer via a contract, associates a marketable Token value to the new contract, and publishes the contract onto the blockchain. The contract metadata solicits measurement data from specific Power Purchasers based on public identity or a larger group of purchasers based on a public metadata query.

The Power Purchaser's EnergyNet Hub detects a contract with criteria matching the measurements the Power Purchaser has published to the blockchain. The Power Purchaser's EnergyNet Hub will automatically publish measurements when the contract contains enough value to meet a configured threshold.

The Power Broker now has access to an encrypted copy of the measurement information recorded into the blockchain in a Measurement Event. An EnergyNet Settlement Authority then detects the presence of a Measurement Event that matches a contract and clears the transaction with the next block creation in the blockchain.

Figure 2.6:  
Smart Digital Contracting



### #3 – Advanced Energy Settlement: An EnergyNet Settlement Authority clears transactions based on Measurements and Contracts

Each EnergyNet Settlement Authority monitors the chain for new Measurement Events that reference Contract Events that publicly designate it as the Settlement Authority. An EnergyNet Settlement Authority is responsible for reassigning Token value from the contract to the public parties so that it can confirm provided measured services. Each EnergyNet Settlement authority reassigns this value via liquid Tokens or other off-network payment mechanisms. EnergyNet Settlement Authorities typically retain a portion of the Token value as a transaction fee.

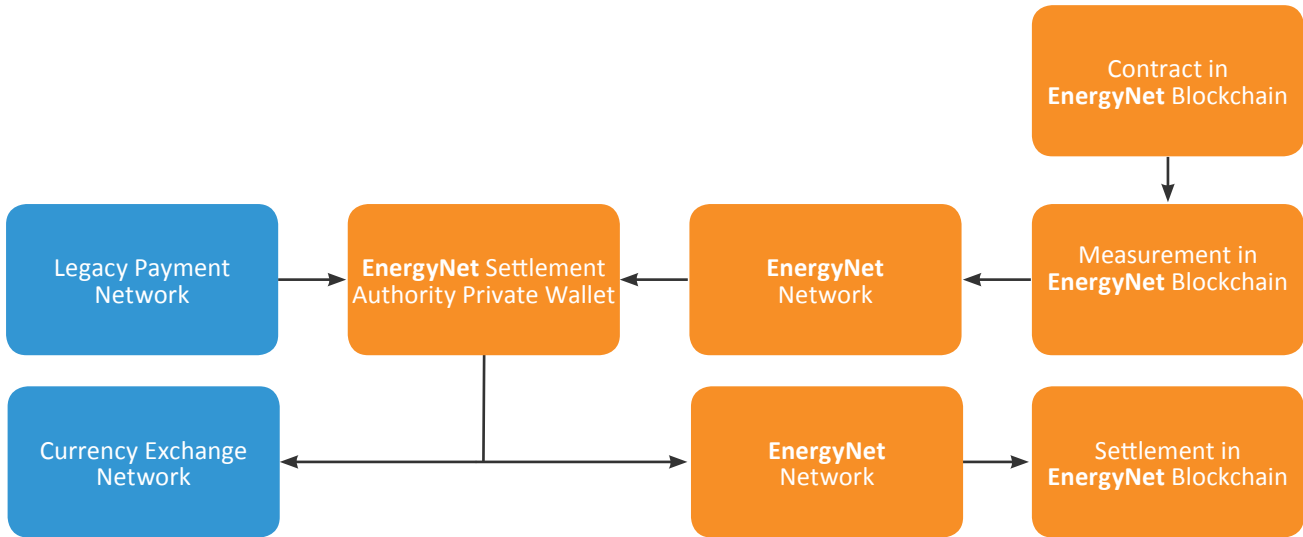
Each EnergyNet Settlement Authority is required to have a computational rules engine capable of processing Measurement Events by validating, verifying, and estimating any incomplete measurement and processing contracts by executing the rules in priority order as per contract terms.

The EnergyNet Settlement Authority is ultimately responsible for executing all measurements against the contract terms and producing a final Settlement Event that assigns value from the Contract to every participating providing Measurement services.

Each Settlement Authority implementation may be unique and selected by the contract owner at will. Settlement Authority implementations may coordinate with legacy payment network processors like Automated Clearing House (ACH) or bridge into alternative cryptocurrency networks.

EnergyNet Settlement Authorities are initially provided by Causam eXchange. However, it is expected that alternative Settlement Authorities will begin to provide settlement and clearing services on the EnergyNet Network. The settlement authority used to manage the contract is a choice of the contract owner.

Figure 2.7:  
Advanced Energy Settlement



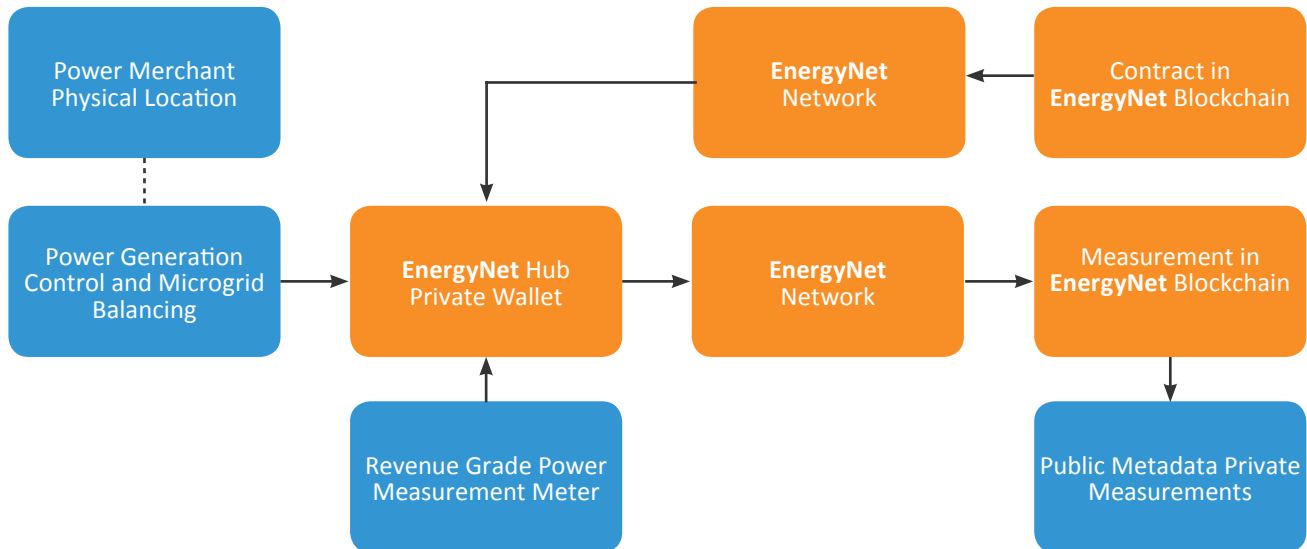
**#4 – Enabling Demand Response: A Power Generator controls supply operation to meet Contract conditions**

A Power Generator is engaged in a Power Contract to perform power delivery that meets certain terms and service conditions. The Power Generator’s EnergyNet Hub controls the power production asset in a manner to deliver power that meets the contract’s performance criteria, such as discharging battery storage.

To prove delivery, the Power Generator’s EnergyNet Hub automatically publishes measurement information to the EnergyNet Network, encrypted so that the privileged parties on the Power Contract and the EnergyNet Settlement Authority can see private measurements.

Contract Events are created and ratified with enough value in them to pay the entire contract, which ensures payment at the appropriate times.

Figure 2.8:  
Enabling Demand Response





# ADDRESSABLE MARKET & TARGET CUSTOMERS

SECTION

03





## 3.1 Addressable Market



The addressable market for Causam eXchange is wide, deep, and global. Electricity is being produced and sold every minute of every day through a multitude of various types of energy transactions.

Initially, Causam eXchange plans to serve the needs of those entities and end-use consumers in the U.S. which either produce, aggregate, or resell electricity, and related products and services, from the expanding renewables, distributed energy resources (DER), and demand response (DR) market segments – all of which occur at the distribution and retail level.

**“As the Country Western song goes, ‘I was Country when Country wasn’t cool.’ We’ve been building, patenting, and testing real-time transactional architecture in the energy sector for many years. We took the path of having a product protected by intellectual property and staying in stealth mode, rather than having pretty website and fancy marketing without any of the above.”**

**JOSEPH FORBES, JR.**  
Chief Executive Officer

Eventually, the goal is for EnergyNet to serve as the transactive platform for the wholesale energy market, which presents an enormous market opportunity. According to the [U.S. Energy Information Administration \(EIA\)](#), blended wholesale power sales in the U.S. in 2017 exceeded \$440 billion dollars in gross sales, of which over \$100 billion is facilitated by retail electric providers, municipal utilities, or electric cooperatives.

In the U.S., commercial energy consumption represents approximately 40 percent of the total consumption, but 60 percent of the total dollars spent according to the U.S. EIA. Energy retailers and commercial energy consumers represent two key customer segments for Causam eXchange.

## 3.2 Initial Target Markets

The most suitable target markets for the deployment of Causam eXchange's EnergyNet meet several of these key criteria:

### COMPETITIVE MARKETS

The deregulation of the electric power grid has brought market forces into a sector historically dominated by traditional monopolies. This has created regions of the U.S. where there is a greater degree of energy choice for consumers, and consequently a great array of energy providers. These energy providers, largely retailers that resell electricity produced by utilities, are in need of solution to differentiate their product offerings, enable direct procurement of renewables and distributed energy resources, and enhance customer service and satisfaction.

### ELECTRICITY COST

Higher prevailing costs of electricity allow lower-cost distributed energy resources and renewables to more easily out-compete conventional power sources. In fact, [research shows](#) that over 20 states in the U.S. already have achieved grid parity with solar at the residential level. According to the [U.S. EIA](#), high electricity cost regions of the U.S. are concentrated primarily in New England and the West Coast. In these regions and others, there is an added incentive to shift power sources from conventional to cost-competitive renewable.

### SOLAR MARKET

A combination of factors, including state regulation and incentives, solar irradiation, and electricity rates, help create the conditions in which a productive solar market can exist. According to [Solar Power Rocks](#), which compiled a composite Solar Report Card by factoring in policy, incentives, and financial returns, the top solar states are (in rank order): (1) Massachusetts, (2) New Jersey, (3) Rhode Island, (4) Oregon, (5) New York, (6) Maryland, (7) Connecticut, (8) Vermont, and (9) the District of Columbia. Other notable states such as California (>20 GW), North Carolina (~3.8 GW), and Arizona (~3.4 GW) have the most cumulative amount of solar capacity installed according to [SEIA](#) as of Q3 2017, but may have mounting policy or financial hurdles looking to the future.

### ENERGY STORAGE MARKET

Behind-the-meter energy storage is in a relatively nascent state compared to solar, and is much more geographically concentrated largely due to its dependence on certain policy mechanisms. Net energy metering, rate reforms, demand charges, grid services, resiliency incentive programs, and interconnection processes all factor into where behind-the-meter storage is most viable according to [GTM Research](#). The presence of these policy mechanisms in California, Arizona, and parts of the Northeast and the PJM territory have made these the primary markets for behind-the-meter energy storage currently. However, by 2021, [onsite batteries are expected](#) to make financial sense in 19 states.

### DEMAND RESPONSE MARKET

Demand response (DR) entails a range of approaches to load reduction or shifting in response to specific market or electric system conditions. Traditional DR approaches are prevalent, including, one-way load control switches for appliances such as air conditioners and water heaters. However, a wave of technological innovation has led to new DR strategies such as programmable thermostats, behavioral programs, and even electric vehicles to start to gain traction. To varying degrees, DR can participate in wholesale markets. According to [SEPA](#), North Carolina, New York, and Maryland have enrolled the most DR, at over 1.0 GW each, while California, Florida, Idaho, Minnesota, Iowa, Michigan, Indiana, and Ohio have enrolled between 0.5 and 1.0 GW.

### 3.3 Customer #1: Multi-Tenant Buildings

Multi-tenant building owners are confronted with two key challenges in addressing energy management. On the one hand, they increasingly require more advanced building energy management systems and capabilities to cater to tenant demand and capture new revenue streams from utility and other incentive programs.

variety of different angles. None of them, however, also tackle the second challenge, which is that building owners have very limited means of capturing the value from investments in onsite distributed energy resources, including solar, energy storage, and backup generators.

There are a range of advanced building energy management platforms that have arisen to address this challenge from a

EnergyNet offers a solution to both of these pressing challenges that increases the bottom line (e.g., net operating income) and enhances building value by:

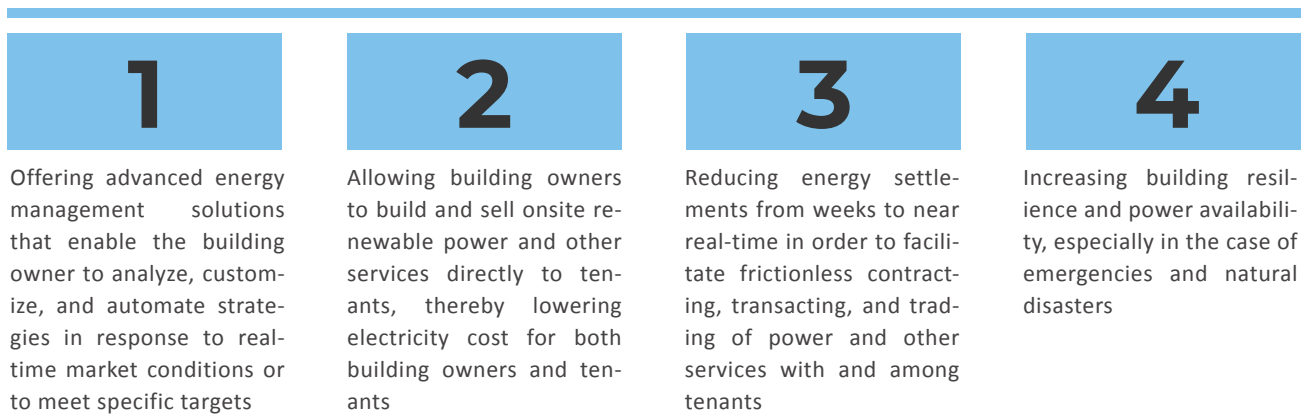
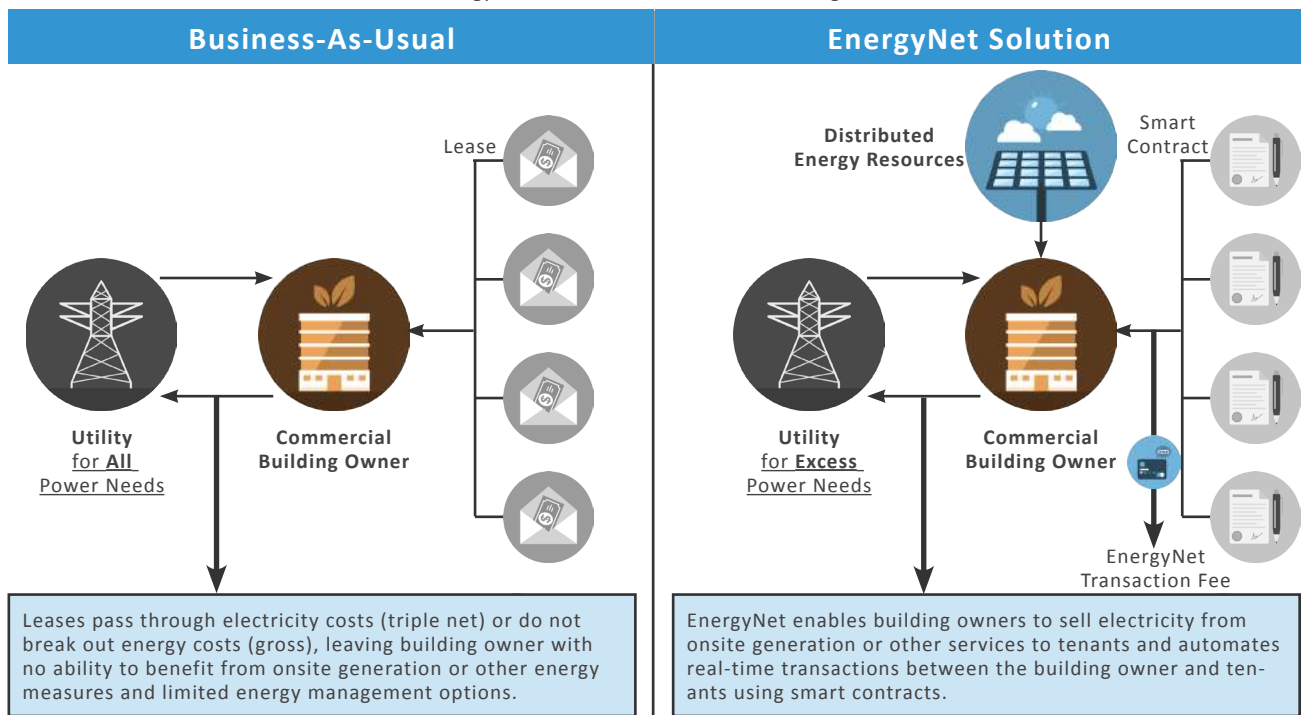


Figure 3.1:

The EnergyNet Solution for Multi-tenant Building Owners



### 3.4 Customer #2: Retail Electric Providers

Retail Electric Providers (REPs), including municipal utilities and electric cooperatives, are confronted with several key challenges in their business model. Their value proposition to their retail customers is hampered by their role as intermediaries reselling power purchased from larger utilities that own and operate generation capacity. This limits their ability to offer more differentiated or customized products and services to their customers, including meeting the growing demand for clean energy.

Moreover, they tend to have high transaction costs, low customer retention over the long-term, and relatively low margins.

EnergyNet offers a solution to help usher REPs and other energy retailers into being active participants and beneficiaries of the distributed electric grid by:

- 1

Improving customer satisfaction and retention through enhanced ability to serve customers with customized offerings including direct procurement of distributed energy resources and renewables
- 2

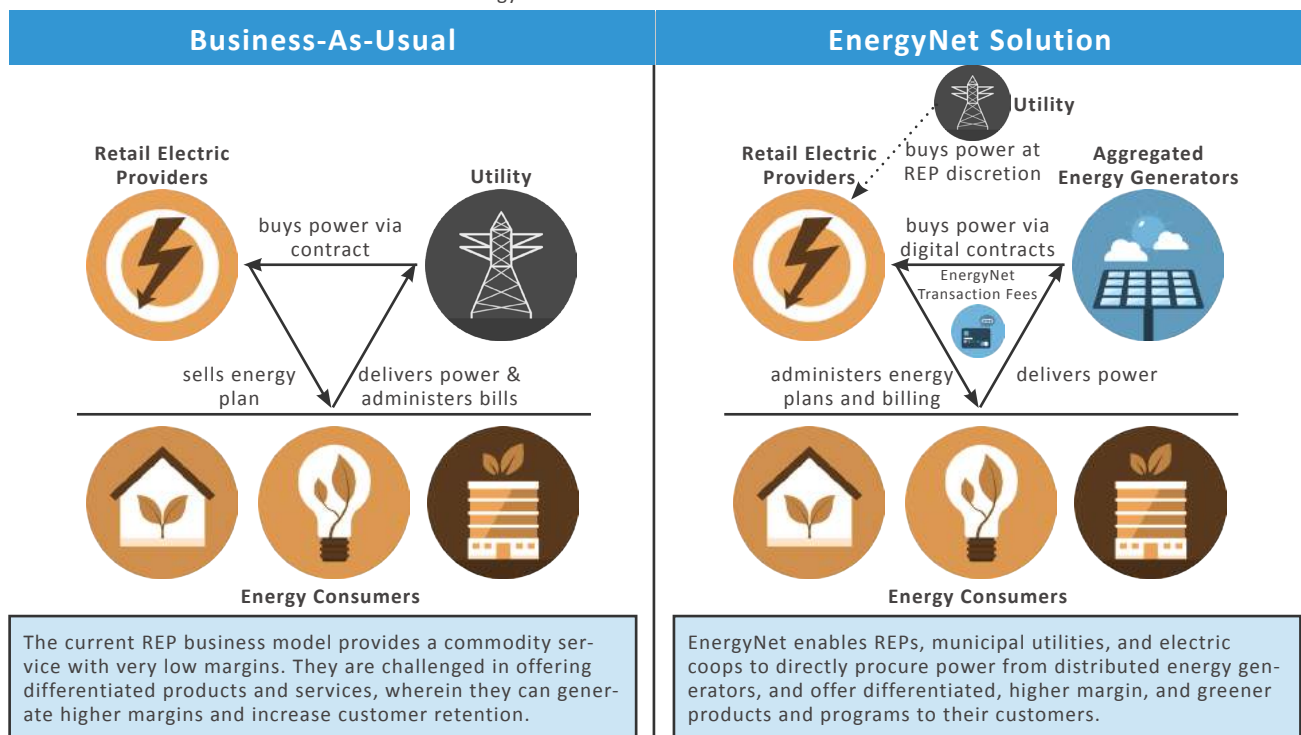
Enhancing customer acquisition capabilities through fine-grain economic resource and community mapping and analysis
- 3

Reducing costly inefficiencies in the energy retailer business model, leading to lower electricity costs for all customers and users and higher profit margins for the energy retailer
- 4

Reducing the duration of energy settlements from months to minutes, which decreases working capital needs and lowers financial risks

Figure 3.2:

The EnergyNet Solution for Retail Electric Providers





# TEAM

SECTION

04



## 4.1 Management Team

Causam eXchange's team has significant experience in the industry and technologies that the company is in the process of commercializing and deploying. The team is comprised of executives who have a history of public and private exits in their careers.

They have specialties in intellectual property, advanced telecommunications, high performance transactional software, energy markets, service oriented architecture, utilities, distributed generation, regulatory experience, and public markets. The team has over 100 years of combined management experience in these domains and over 15 private and public exits representing hundreds of millions of dollars returned to shareholders.

**Joseph Forbes, Jr.**



**Chief Executive Officer**

Joe Forbes is a technology executive and entrepreneur with 30+ years of experience in evaluating, creating, and operating opportunities that have historically resulted in high investor returns. He has created five successful technology companies in wireless communications, engineering, hardware and software development, and clean energy, with public and private exits, leveraged buyouts, and successful capital formation with Fortune 100 companies. Joe holds a BS in Electrical Engineering from NC State University, and has completed substantial work towards an MBA before moving on to take advantage of entrepreneurial ventures.



**Tom Gordon**



**Chief Operations Officer**

Tom Gordon has 30+ years of experience developing and managing innovative technology companies focused on payments, real estate, and energy. He has been a founder of several companies and has raised over \$30 million in from angel investors and venture capital firms. Tom was one of the founders of SynXis, which was the first Internet-based hotel reservation system that was purchased by Sabre Holdings (owner of Travelocity). He has held a number of leadership positions, and most recently was the Vice President of Software Engineering for OpenText Corporation (NASDAQ: OTEX). He began his career as a management consultant with PwC. Tom obtained his MBA from Vanderbilt University, and has a BS in Management Science from Virginia Tech.



**Taylor Brockman****Chief Technology Officer**

Taylor Brockman is a software development expert with 15+ years of experience creating and leading ventures backed by venture capital investors. His focus has been software product innovation and delivery experience in the mobile commerce, medical benefits management, and electrical smart grid industries. Taylor co-founded Motricity (NASDAQ: MOTR) in September 1999 and was instrumental in growing the company to more than \$100 million in annual revenues and 500 employees globally. As Motricity's Research Technology Architect, he invented, designed, and implemented one of the industry's leading mobile content delivery platforms – a platform that has delivered more than \$3 billion of content to mobile phones.

**Ian DeCone****SVP Business Development**

Ian DeCone brings 25+ years in of experience in product development, business development, technology strategy, and systems engineering for leaders in the wireless industry such as GTE Telecommunication Services and Verizon. Sample experience includes corporate technology strategy for cloud, wireless, and enterprise solutions; supply chain logistics; network operations; investment in startups focused on machine-to-machine learning; and Lean Six Sigma programs. He has catalyzed new business units generating over \$100 million of revenue per year and created systems to uncover billions of dollars of corporate inefficiencies. He has a BS in Accounting from Merrimack College and a Master Black Belt certification from Verizon.



## 4.2 Advisory Board

**Ed White**



**Smart Grid, Entrepreneurship**



Ed White is a seasoned executive and entrepreneur with 40+ years of experience. In 1980, he founded Utility Translation Systems, Inc. (UTS), a successful remote meter-reading software company focused on the electric power sector. He sold UTS to Itron, Inc. in 1996 and served as Itron's Chairman until retiring in 2003. Mr. White currently serves as Chairman of Field2Base, Inc., a technology company that uses tablet PCs, wireless communications, and Field2Base software to support the mobile workforce for a variety of industries. He is also the Founder of White Ventures LLC, a private equity and commercial real estate development company. Ed serves as a Board Member for Causam Enterprises; Board member for the North Carolina Chamber of Commerce; former President of the NC State Engineering Foundation; and former Chairman for the Research Triangle Cleantech Cluster.

**Tom Noyes**



**Payments, Banking, Mobile**



Tom Noyes is CEO of Commerce Signals. He has 20+ years experience in banking, payments, venture finance, ecommerce, mobile, and product innovation. He has worked with leading banks, mobile operators, payment networks, and regulators globally to bring innovation to consumers. Mr. Noyes provides unique perspectives based upon his global experience as a senior executive with Starpoint LLP, Citibank, Oracle, Gartner Group, and various startups. He has built high performance global teams focused on bringing new products to market, both directly to consumers and to Fortune 100 companies. He is also frequent guest on CNN, Fox, and ABC.

**Kevin Meagher**



**Microgrids, DER, Adv. Energy**



Kevin brings 30+ years of systems architecture and power expertise. As President of Power Analytics, the company is focused on the future of distributed generation, microgrids, and data centers. Under his guidance, the company introduced industry-leading capabilities for energy management and pattern recognition in the Paladin technology. Kevin is the creator of the Power Analytics™ Energy Alignment Process and has to his credit more than 15 patents. He has authored numerous papers on power, energy, and high availability architectures and has led development organizations and provided strategic planning for companies including Eaton, Invensys, Computer Associates, and IBM. He was previously named a GreenTech Media's list of the top 100 people you must know in Smart Grid. Kevin has undergraduate degrees in biochemistry and business and an MBA from the University of Colorado



## 4.2 Partners



[Power Analytics](#) is a power engineering and software development firm utilizing a patented software platform for advanced power projects, distributed energy resources, and microgrids, including technical and financial power modeling analysis. Power Analytics also provides professional engineering services for commercial and industrial customers ranging from government and privately-owned utilities to petrochemical, oil and gas, and commercial data centers who own microgrids or distributed energy resources, backup generators, combined heat and power (CHP), renewables, energy storage, fuel cells, and wind farms. Power Analytics is a subsidiary of Causam Enterprises.

Power Analytics is partnering with Causam eXchange to provide power modeling and other professional services to commercialize EnergyNet for specific customers.

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[Neo IP](#) is an Intellectual Property (IP) law firm established to maximize the return on investment for IP assets while also protecting them. Neo IP works to empower innovators to impact society for good and to connect them to the resources they need to make positive commercial impact. There are four pillars of IP assurance – monetization, risk management, strategic portfolio development, and acquisitions.

Neo IP is advising Causam eXchange on its IP strategy, and has helped to build one of the world's leading IP portfolios in advanced energy settlements.

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[Cherokee Investment Partners](#) is an investment company that blends capital with creativity, experience, and resolve to provide superior financial, environmental, and social returns for investors, partners, and communities. Cherokee invests both private equity and venture capital to create value for all involved. Since 1990, Cherokee has invested in more than 550 environmentally contaminated, or brownfield, real estate assets across the United States, Canada and Europe. Cherokee is the world's only known ISO 14001 certified private equity manager, with a total of five investment funds since 1996, with aggregate commitments exceeding \$2 billion. Additionally, Cherokee has managed or invested in over 100 venture companies in environmental remediation, renewable energy, waste-to-energy, energy management, and other fields.

Cherokee was an early-stage investor in Causam Enterprises, the parent company of Causam eXchange.



[Ward and Smith, P.A.](#) is a leading law firm with five offices in the Southeast and recognition from many organizations, including Best Lawyers, Super Lawyers, and American Board of Trial Advocates. Their business and patent lawyers have been thought-leaders in advising businesses about blending the best of new and old legal, technical and business practices.

Ward and Smith, P.A. is advising Causam eXchange on product commercialization and corporate finance.



[RuyakCherian, LLP](#) is a technology and competition law firm based in Washington, D.C., and is nationally ranked in patent law by U.S. News Best Lawyers®.

Ruyak-Cherian's practice have significant experience in Competition Law covering: Anti-trust monopolies, anti competitive agreements and restraints; Patent enforcement and infringement defense; Trade Secret and Business Theft; Fraudulent, Unfair and Deceptive practices; Copyright and Trademark infringement; False Advertising; and Government Regulatory civil and criminal investigations and actions. The firm has represented both plaintiffs and defendants in Class Actions, Insurance Recovery, Shareholder, and Contract Disputes. The firm advises Causam on all areas regarding its Intellectual Property and Patents.



[City Gateway](#) is the first mainstream “energy-positive” commercial building of significant scale in the Southeast. City Gateway is a premier mixed-use development in the heart of Downtown Raleigh’s innovation district. With smart building technology, information from various building systems can be leveraged to optimize energy and operational performance, and ensure that the building’s systems produce more power onsite than the building actually requires. Real performance means a better, more productive, and more comfortable work environment.

City Gateway has partnered with Causam eXchange to implement the EnergyNet platform, a key to realizing the project’s energy positive goals.













The [Research Triangle Cleantech Cluster \(RTCC\)](#) is an initiative of business, government, academic, and nonprofit leaders focused on accelerating the growth of the Research Triangle Region’s cleantech economy. They promote collaboration and partnership which drives innovation and sector growth and creates competitive advantage for both companies and the region by concentrating resources on a single vision and plan to advance company growth and attract cleantech investment.

RTCC is collaborating with Causam eXchange as a member of their startup ecosystem.



# TARGET TIMELINE

SECTION  
05

2013 Q2		<p><b>Causam Enterprises Founded</b> Company is created to tackle the challenge of advanced energy financial settlements on the distribution grid, with an initial emphasis on building a leading IP portfolio of patents.</p>
2013 Q2		<p><b>Development of EnergyNet Platform Begins</b> Building on Causam Enterprise’s growing IP portfolio, the EnergyNet software platform begins development to address key challenges in measurement, verification, reconciliation, and settlement of distributed energy transactions.</p>
2015		<p><b>EnergyNet Platform Milestones</b> Key milestones include development of communication layers, ingress of meter data from disparate sources, integration of grid elements, and automation of deployment.</p>
2016		<p><b>EnergyNet Platform Milestones</b> Key milestones include adding advanced messaging capabilities, development of client and portals, integration of analytics capabilities, enhancing cybersecurity, integration of merchant services.</p>
2016 Q2		<p><b>Causam eXchange is Founded</b> A wholly owned subsidiary of Causam Enterprises, Causam eXchange was created to commercialize the EnergyNet cloud-based, software-as-a-service platform for customers on the distributed electric power grid.</p>
2017		<p><b>EnergyNet Platform Milestones</b> Key milestones include advanced rules and contracts, content management, onboarding facility management, and blockchain integration. Minimum viable product created.</p>
2018 Q1		<p><b>Causam eXchange’s First Multi-Tenant Building Customers</b> City Gateway, a cutting edge, energy-positive building, partners with Causam eXchange to implement the EnergyNet platform on their campus, in order to deliver advanced clean energy management and settlement for their tenants.</p>
2018 Q3		<p><b>Causam eXchange’s First Retail Electric Provider Customers</b> The EnergyNet platform is deployed with retail electric providers to enhance product offerings to meet customer demand for clean energy, increase acquisition and retention of new customers, and lower electricity costs for all.</p>
2019		<p><b>Causam eXchange Expands Capabilities in Distributed Markets</b> Causam eXchange expands implementation of EnergyNet to broader distributed markets, demand response, distributed energy resource management systems (DERMS) integration, and EV settlement.</p>
2020		<p><b>Causam eXchange Expands Customer Base to Wholesale Markets</b> Causam eXchange expands implementation of EnergyNet beyond the distributed markets to address the \$440B wholesale U.S. transaction market.</p>

Note that all future points in time are presented as goals, and are subject to change based on a number of factors, both external and internal to Causam eXchange.



[www.causamexchange.com](http://www.causamexchange.com)

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## CATALYZING A CLEANER POWER GRID, ONE FINANCIAL TRANSACTION AT A TIME

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Our mission is to bring unprecedented speed, security, and flexibility to billions of power transactions each year in order to enable the digital, connected, distributed, and renewable electric grid.

Our advanced energy settlements platform – EnergyNet® – makes this all possible.

# White Paper

A background image showing a close-up of solar panels in the foreground, with a blurred city skyline of skyscrapers in the background under a blue sky.

Q1 2018