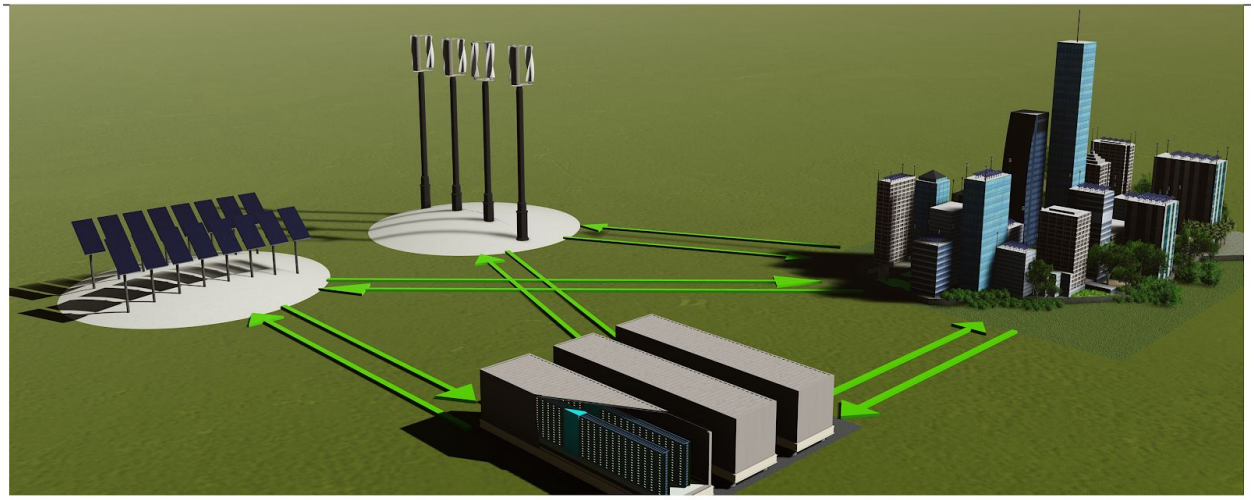
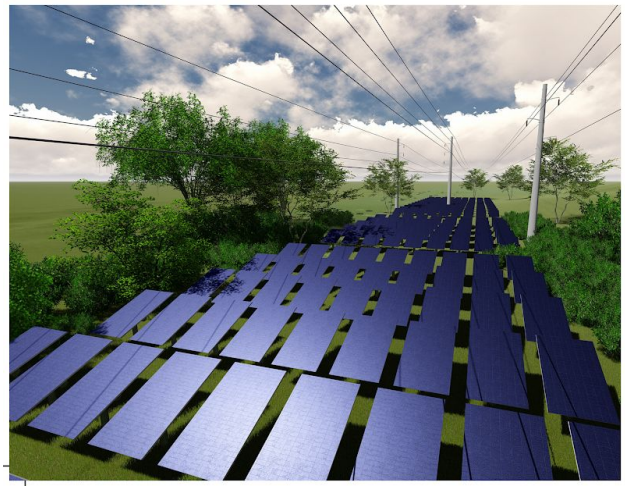
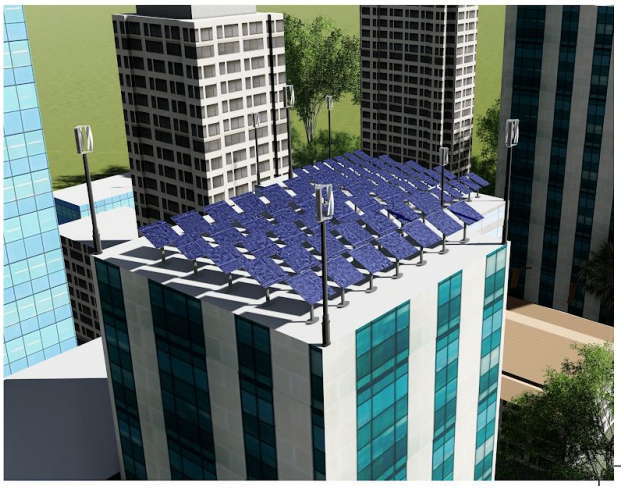
100% Renewable Energy Cranston by 2030

The First Step Towards the Renewable Energy Economic Transition for Rhode Island







January 1, 2020

Prepared By: Ocean State Community Energy
For: The Rhode Island Progressive Democrats
www.oceanstatece.info

Ocean State Community Energy

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Part 1:

Introduction

The opportunity, prosperity, and improved quality of life that will result with successful implementation of this project would put our communities and the State of Rhode Island in a place where our air, our water, our soil, our people, and our economy are infinitely healthier via technology, systems, and processes that already exist today.

Last year, leaders of a Rhode Island State Coalition of Non-Profit's led by the Rhode Island Progressive Democrats approached Ocean State Community Energy with an innovative concept for the future of Rhode Island. They asked for a plan that they could take to the grassroots within the state and then bring electoral pressure to bear on issues that stand to better the lives of everyone across Rhode Island. Ocean State Community Energy was asked to begin with the City of Cranston because it is the second most populated city in the state, to produce a scalable project, while using zero green space and include heating/cooling and transportation in our calculations for a transition to renewable energy by the year 2030.

This bottom up approach to bringing such large scale energy, sustainability, and economic change has never been attempted before and so, despite the very real challenges, Ocean State Community Energy decided to produce a work of scale and scope that many have and will continue to say cannot be done. Coupled with a project for Rhode Island comes the quality of the people and the organization making the ask; and the abundance of renewable resources across Rhode Island, the knowledge and expertise found in Rhode Island's Universities, the ingenuity of her entrepreneurs and businesses, and the work ethic that has always defined the people who make up the Ocean State. When it comes to a scalable project for the New Clean Energy Economy, it seems fitting to come from the birthplace and people of the American Industrial Revolution.

Ocean State Community Energy does not present this study and roadmap as the only or even, necessarily, the best pathway to reaching 100% renewable energy by 2030. This work is meant to show that it is feasible and that other states are making transitions similar to this. Ocean State Community Energy and The Rhode Island Progessive Democrats of America acknowledge that there are numerous issues to be resolved

beyond technology and economics that will need to be addressed in order for this transition to be successful; especially in regards to conventional societal behaviors. Such questions as how to guide an entire population towards transition to electric transportation and heating/cooling in ten years. What we hope to succeed in starting this project is a serious conversation amongst Rhode Islanders around energy, a clean, healthy environment, the new economy, and a sustainable way forward for our children. We hope to bring the discussion to the point where it is focused on how the Ocean State succeeds in this endeavor.

While climate change is certainly a central reason for the necessity and the aggressive timeline of this initiative, we chose to focus on the improved quality of life and health of Rhode Islanders and the incredible, once in a century economic opportunity that this transition offers the state and everyone who lives here. If you would like to learn more about the effects that fossil fuels have on our environment and the climate, overall, please visit our website at oceanstatece.info and click on the “Why 100% Renewable” tab.

Finally, within every conversation, report, and initiative, economic and environmental justice must be a central tenet. All too often it is those who played very little role in the current state of our climate who bear the brunt both in the way climate change is affecting them and, in the health, and financial costs associated with it. As we look to ways to improve our air, water, health, and economy through renewable energy and cleantech we must take advantage of the opportunity to include those who have paid the highest price in the past and ensure that everyone is lifted up in the years and generations ahead.

A. THE CRANSTON STUDY & ROADMAP

This is the Phase I feasibility study and roadmap created by Ocean State Community Energy. While we were able to access certain data and provide basic site analysis in and around Cranston for solar and onshore wind, time and budget constraints prevented us from performing the deep analysis that will take place in Cranston and across the state in Phase II from January 2nd until August 1st 2020. The data and site analysis did allow us the ability to definitively show the feasibility of 100%+ renewable energy use in Cranston by 2030 from a technological and resource perspective. Through cited studies we also demonstrate that this can be done with significant energy cost savings to residential and commercial customers, however, in the case of Cranston, the need for an upgrade to a decentralized smart grid and variables with

regard to statewide energy production and sharing, meant that a more robust cost/benefit analysis and discussion of potential mechanisms for covering costs will have to be further explored in the Phase II feasibility study and roadmap.

In the following section we will begin by discussing the different renewable technologies, efficiencies, and grid/storage upgrades that we propose for Cranston to achieve 100% renewable energy by 2030. Next, we will discuss the overall movement and momentum towards 100% renewable energy, the general ideas around feasibility, other U.S. cities and towns leading the way, the latest in the transition of the energy and transportation sectors, and the overall positive economic impact of making this transition now. Finally, we will lay out the importance of upgrading our end of life grid system with a new smart grid technology, our recommendation and general approach for moving forward, a vision for Cranston's energy and economic future, and a preview of what to expect in Phase II.

The work performed in Phase I and the initial steps towards making this innovative concept a reality would not have been possible without the vision and generosity of hundreds of Rhode Islanders that stepped up and donated the funds needed with only the promise of a feasibility study and no certain outcome. While they are too many to be recognized here, we will be shining a spotlight on each of them at our Phase II kickoff event winter 2020. Thank you to every one of those visionaries!

Part 2:

Renewable Energy In Cranston

A. Solar

One of the key components of this project is community and commercial solar plants. Ocean State Community Energy has identified and surveyed numerous brownfield and large commercial sites that can be utilized for this renewable energy technology piece of Cranston's move toward 100% renewable energy. These systems have been preliminarily designed and will utilize a total of 244 acres, none of which will occupy current green space. The main sites that were modeled for solar installation would all require a public/private partnership agreement and they include the high transmission line byway through Cranston, Garden City Center, and Keating Quarry, along with a number of other commercial and municipal sites. All sites will be further modeled in Phase II of the study and only represent potential locations. Homeowners making the

decision to move towards residential solar and energy storage options could offset the need for all of the larger commercial sites and would improve the options for a decentralized community owned micro grid system.

In Phase II, as we expand the scope of our planning statewide, other communities may offer significant solar site opportunities that would also reduce the solar generation need in the City of Cranston.

Potential Garden City Center Site (Solar/Vertical Wind Mix)

Design 1 Garden City Center, 100 Midway Rd, Cranston, RI 02920

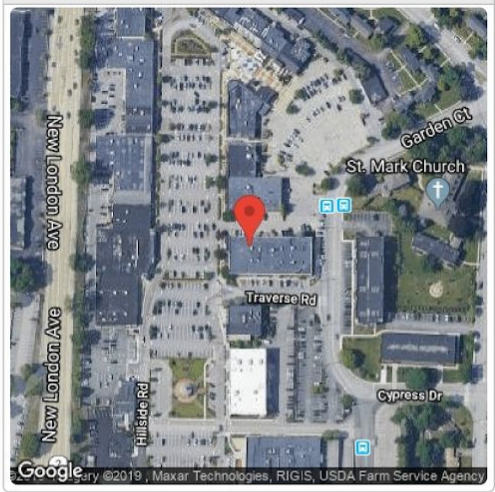
Report

Project Name	Garden City Center
Project Address	100 Midway Rd, Cranston, RI 02920
Prepared By	Jason Loyet jasonloyet@solarsitedesign.com

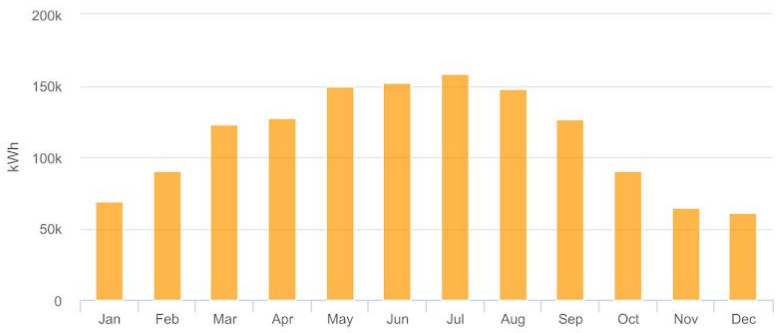
System Metrics

Design	Design 1
Module DC Nameplate	1.00 MW
Inverter AC Nameplate	818.0 kW Load Ratio: 1.22
Annual Production	1.361 GWh
Performance Ratio	86.8%
kWh/kWp	1,359.1
Weather Dataset	TMY, 10km grid (41.75,-71.45), NREL (prospector)
Simulator Version	29b7389bc5-884efda8d5-433b079687-e9aa9ee880

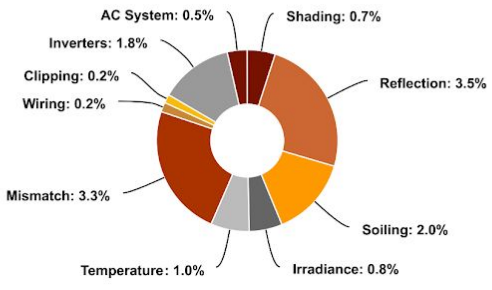
Project Location



Monthly Production



Sources of System Loss



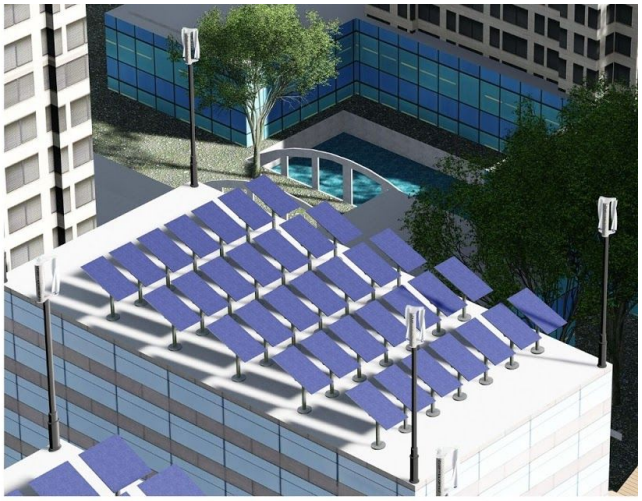
Potential Keating Quarry Site (Solar/Vertical Wind Mix)

B. On-Shore Wind

Vertical wind turbines have air foils that spin on a vertical axis, like a DNA helix; this innovative design allows them to have zero noise pollution, zero bird strikes, and zero green space issues. Because of Cranston's shore line and urban density, on-shore vertical wind turbines will provide a majority of energy generation for the area.

We recommend B-Wind as it is the world's first urban vertical dual axis wind production system. Their turbine design produces 15-20% more power, efficiently, while generating usable power beginning at winds of 5-7 MPH. These turbines require minimal area for setup, requiring a small parcel of land. This piece of Cranston's renewable energy

system will fit on a total of 5 square acres (non-consecutively). B-Wind turbines are elegantly designed to blend urban living with renewable energy.



C. Off- Shore Wind

Rhode Island currently has two off-shore wind turbines under review with the goal of coming online in 2020 and 2023. One of them is a 300 MW system and the other is a 400 MW system. While 700 MW is produced, 60% of the energy is lost as heat during transportation of the energy. This has to be factored into the amount of energy that is earmarked for Craston. As these turbines will produce energy for the entire state of Rhode Island, 5% of the total usage from these turbines is factored in for the city Cranston.

D. Energy Efficiency

Rhode Island has the 3rd highest energy efficiency rating in the United States. By keeping with this high standard this report shows that we can reduce energy consumption by 14% resulting in both a cost savings and energy utilization that can show the state of Rhode Island as a national leader in energy efficiency.

With the robust energy efficiency standards in place the average building can realize up to a 10%-20% electricity use reduction, some older buildings can realize a 50% reduction by taking advantage of energy audits and implementing a small change, such as switching to LED lights or installing programmable lighting/heat controls. This would reduce the city's electricity usage by 14%, leading to a significant reduction in consumption and cost.

E. Smart Microgrid Technology

A microgrid is a modern, small-scaled version of the centralized electricity system. They achieve specific local goals, such as reliability, carbon emission reduction, diversification of energy sources, and cost reduction, established by the community being served.

A Smart Microgrid does all of this and more, in real time down to the millisecond by constantly monitoring the system in its entirety in order to keep it in a homogeneous state. This means that a Smart Microgrid can shunt power to areas that are in high demand from areas that are generating power but not consuming as much as they are generating. A Smart Microgrid can sense subtle changes like a load imbalance and then immediately correct it, or they can detect a catastrophic failure, such as a power outage and switch to the shared storage solution without an interruption in the end user's power usage.

F. Energy Storage

In this report we are looking at a hybrid energy solution to cover both The Sprinter and The Marathon energy needs of a community. The Sprinter load delivers short but high powered bursts of energy during times of extreme need or catastrophe. The Marathon load refers to the consistent, low power needs of end users, which is seen in everyday use of the system.

These storage arrays will be a hybrid system of batteries that can handle both Sprinter and Marathon loads. By utilizing a Smart Shared Storage Solution we will be able to decentralize 80% of the storage capacity to be used, in real time, across the entire microgrid.

This also reduces the need of the Energy Reserve Margin, which is how most energy companies “keep the lights on.” They forecast what is needed and then add a 15-20% margin onto that amount, which is then held in immediate reserve should a spike in the system occur. The consumers still pay for the energy, whether it is used or not. A smart storage battery solution can eliminate the need for the Energy Reserve Margin by storing power distributed through the smart grid to address any need that arises within the microgrid itself. This means that 99% of the Energy Reserve Margin, and the costs associated with it are eliminated, resulting in a net cost reduction overall.

Part 3:

100%+ RENEWABLE ENERGY AND THE LEADERSHIP MOMENT FOR CRANSTON & RHODE ISLAND

A. The Movement

The proposal for 100% renewable energy by 2030 in Cranston and across the state of Rhode Island is one of the many movements throughout the country transitioning away from fossil fuels. 2019 brought explosive growth in the movement towards 100% clean and/or renewable energy in the United States. As of December 2018 only Hawaii and California had mandates to fully decarbonize their electricity supply. Six months later there were six additional state-level jurisdictions, including Washington D.C., and other states, such as Colorado that have set carbon reduction targets, or non-binding goals as in Nevada. In 2019 Washington State mandated 100% carbon-free power by 2045, and all electricity sales to be carbon-neutral by 2030. In Illinois a bill was introduced to put the state on a path to 100% renewable energy by 2050, and in Maine a 100% Renewable Energy By 2050 bill has been put forward by the office of Governor Janet Mills as well as a 100% clean energy component in the omnibus energy bill that has passed the House in Minnesota. The 100% Clean Energy Movement now includes nearly 1/5 of the population of the United States within a timeline to decarbonize. While Rhode Island does have a stated goal of increasing their renewable energy production

tenfold by 2020, and is 81% of the way there as of December 2019, that plan lacks the determination and rigor in many other states legislation. Relying on legislation to lead the way in Rhode Island has proven ineffective thus this proposal cultivates the movement from the ground up, in hopes that the people of Rhode Island will lead the clean energy economy.

B. The Feasibility

The naysayers of 100% renewables are known as the all-of-the-above faction. They agree with the need for deep cuts in carbon pollution and acknowledge that the coal industry is finite. But they argue that we will continue to need nuclear power, and need to replace coal with natural gas plants equipped with technology to capture carbon and store or sequester it deep in the earth. They say an all-renewable grid would be too expensive, and that there is no convincing evidence it is feasible.

However, those arguments contain multiple flaws. The Department of Energy recently estimated that initial costs for carbon capture at natural gas plants would increase the cost of power by half. Studies show it could not be applied at great enough scale to justify the costs, and it would only slow down the transition to renewables. The extraction, transport, and burning of natural gas releases methane, a much more powerful greenhouse gas than carbon. And the current natural gas boom depends on fracking, which uses toxic chemicals that pollute air and water, threatening the health of nearby communities. In addition, the U.S. taxpayer subsidizes about $20 billion a year to the fossil fuel industry which artificially keeps the true cost of fossil fuels low, while major fossil fuel companies average tax payments around 50% of the stated tax rate each year.

A 2015 analysis conducted by researchers at Stanford University and the University of California at Berkeley found that 100% wind and solar power in conjunction with energy efficiency, energy storage, and other advances to complement renewables — could provide electricity to the continental U.S. more reliably than the current system by 2050, and at lower projected costs.

That study is among 60 from around the world reviewed in a recent paper by an international team of scientists, showing why 100% renewables is an achievable and affordable option. In fact, a Stanford University study released in December 2019 shows that with smart investment and current technology, the transfer to 100% renewable energy would have a payback period of seven years when all costs are factored.

The studies concluded:

- There is more than enough solar, wind, and hydro potential — 30 times more than business-as-usual forecasts for energy demand in 2050.
- Technology already exists to account for the variability of wind and solar generation, so that the lights will stay on even when the weather does not cooperate.
- We do not need to alter the design of the electric grid radically to accommodate 100% renewables; that shift is well underway and accelerating.
- Costs will not be overwhelming. A grid based on 100% renewables can compete in cost with fossil fuel systems, even before factoring in the tremendous costs of pollution, healthcare costs, climate change and water usage.
- A number of nations and regions are at, or close to, 100% renewables already, including Denmark, Norway, and parts of Germany. Canada is at 62% renewables and Brazil at 76%.

In addition, major cities like San Francisco, Washington, D.C., Atlanta, Cleveland, Kansas City, and Salt Lake City have already made the pledge to go 100% renewable and more than 160 companies worldwide have committed to 100% renewables, including Apple, Bank of America, Facebook, General Motors, Microsoft, and Walmart.

Living on 100% renewables is an idea whose time has come. While the transition should have started decades ago, everything is in place to make the urgent and necessary move now. We live in a country that put a man on the moon in less than 10 years when it had no idea how to do so. We can make a transition in energy resources that will help avoid an existential crisis. We can do this, but only if we start right now.

C. U.S. Cities and Towns Are Leading The Way

Across the United States, 100 cities and towns have committed to transition to 100% clean, renewable energy. In December 2018, Cincinnati, Ohio became the 100th city in the nation to establish this goal when its City Council approved a resolution committing to 100% renewable energy by 2035. Cincinnati's community-wide commitment builds upon its Green Cincinnati Plan which commits the city to powering its municipal operations with 100% renewable energy and advances other climate measures aimed

at creating an equitable energy system. Recently, Cincinnati was announced as a winner of the Bloomberg American Cities Climate Challenge. Cincinnati is the second city in Ohio to commit to an equitable and just transition to 100% clean energy, after Cleveland. Providence, to use a Rhode Island example, has a stated goal of being carbon neutral by 2050, but pledging to be 100% renewable by 2030 and in line with where the science says that they need to be would send a strong signal to other cities and towns across the state and the Northeast demonstrating that if they want to see the benefits of the explosive clean energy economy they will need to lead the way on legislation and regulation that will put them in line with other communities leading the way across the country.

In addition to the now 100+ cities that have made the commitment, the states of California and Hawaii have adopted goals to be powered entirely by renewable sources of energy, like wind and solar. About 48.7 million people, or 15.1% of the U.S. population, live in places that are committed to transitioning to 100% renewable energy. These cities, counties, and states will collectively reduce carbon pollution by 120 million metric tons as they move away from fossil fuels and repower themselves entirely with renewable energy—the equivalent of taking 26 million cars off the road or retiring 30 average coal fired power plants.

Cities' commitments are already shifting local energy systems toward clean energy. This year, utilities like Xcel Energy and Platte River Power Authority have responded to the growing number of 100% renewable commitments established by cities in their service areas by issuing ambitious goals to achieve carbon-free resource portfolios by 2050 and 2030 respectively. They are now working in tandem with customers to deliver 100% renewable electricity.

Many cities are also working to ensure a clean energy transition that is equitable and just; empowering all communities while moving away from fossil fuels:

- Voters in Portland, Oregon passed the Portland Clean Energy Community Benefits Initiative, a measure that will require large businesses to help fund clean energy projects that will benefit frontline communities and ensure the city puts local residents first as it meets its 100% goal.
- In Southern California, San Diego and cities in L.A. and Ventura Counties are pursuing Community Choice Aggregation as a pathway to reach climate and clean energy goals, allowing communities to have greater control over where their energy comes from.

- Atlanta is prioritizing energy efficiency and local solar generation as it charts its path to 100% renewable energy, which the city created with the intent to establish a local clean energy economy and reduce electricity burdens for all residents.

Many of the 100 committed cities are currently mapping their own paths to 100% clean energy.

D. Economic Growth Opportunity

A rapidly increasing number of people are employed in renewable energy jobs globally. There are almost 10 million of them employed in the sector around the world. Slightly over 3 million are employed in solar power. Large hydropower employs about 1.5 million people, and 1.2 million are in wind power employment. Advanced energy — which includes solar, wind, energy efficiency, energy storage and Electric Vehicles — contributed $1.4 trillion to the global economy in 2016 (the U.S. portion of this amount was $200 billion).

The U.S. coal industry now employs just over 76,000 workers, which is less than many other industries. For example, used car dealerships have a total of about 138,000 workers, casinos employ about 99,000 people, as do travel agencies. Museums, radio stations, breweries, and wineries all have more workers than the coal industry currently provides. So while we do need to provide training for those workers in the coal industry to help them find equal or better paying energy jobs in the renewable sector, it would be a manageable program with relatively minimal displacement.

On the other hand, 260,000 Americans are employed by the solar power industry and that number continues to climb year after year. An example of a high demand job in the sector is Solar PV Installer and according to the Bureau of Labor Statistics, the median pay for PV installers is around $40,000/yr to start. The wind power industry now employs over 100,000 nationally. In 2017 NREL stated that wind power technician was the fastest growing job in the country and the average pay for a wind power service job was $52,000/yr.

In keeping with the discussion regarding the growth of wind power and Rhode Island's positioning as a leader in the industry, the U.S. Department of Energy estimates that to achieve only 20% wind power by 2030, the United States will require more than 100,000 additional wind turbines, creating more than 500,000 new jobs. According to the Wind

Vision Report, wind has the potential to support more than 600,000 jobs in manufacturing, installation, maintenance, and supporting services by 2050.

Another recent report looked at the 23 largest wind farms in Illinois, finding that they will add almost $6 billion to local economies over their lifetimes and have resulted in the creation of more than 19,000 jobs during the construction periods. The projects will also support 814 permanent jobs in the state. Right now, Rhode Island supports only a fraction of that number of wind power jobs, but the installation of two large scale offshore wind projects currently in the approval stage could change those numbers drastically.

Currently, wind power contributes about $20 billion a year in value to the US economy, and it has been projected that amount will rise to $24 billion by 2020. Wind power is more stable than fossil fuels in this regard. “Because the electricity from wind farms is sold at a fixed price over a long period of time (e.g. 20+ years) and its fuel is free, wind energy mitigates the price uncertainty that fuel costs add to traditional sources of energy.” The Solar Foundation also released a report saying that due to many of the same factors, the U.S. solar industry added $154 billion in economic output in 2016 alone.

Another area of focus is the level of manufacturing that takes place here in the U.S.. “Now, more than 50% of a U.S.- installed turbine’s value is produced in the U.S., a twelve-fold increase from a few years ago. Some turbine manufacturers plan to make 100% of their components in America, and the trend is expected to continue.” (National Renewable Energy Laboratory, 2017 Cost of Wind Energy Review). This report and roadmap is having that same positive effect in Rhode Island, even in the early stages, as our Onshore Wind partner is looking at expanding manufacturing operations to the Ocean State as phases of the suggested roadmap move forward. This would create high paying jobs, significant tax revenue to the state, and it would reduce the cost of production as well as the overall cost of transition to the state.

The Union of Concerned Scientists stated in one of its recent articles on renewable energy: “Compared with fossil fuel technologies, which are typically mechanized and capital-intensive, the renewable energy industry is more labor intensive. Solar panels need humans to install them; wind farms need technicians for maintenance. This means that, on average, more jobs are created for each unit of electricity generated from renewable sources than from fossil fuels.” That is true even when wind and solar power are *cheaper* for the customer.

Renewable energy contributes economically beyond jobs and pollution reduction. The IRENA 2017 report includes a reference to how stimulating renewable energy investment can increase global GDP: “Doubling the share of renewables in the global energy mix by 2030 would increase global GDP by up to 1.1% or $1.3 trillion USD.”The report shows that such a transition increases global GDP in 2030 between 0.6% and 1.1%, or between around $700 billion USD and $1.3 trillion USD compared to business as usual.

Another relevant benefit is how renewable energy investment can impact trade. For fossil fuel importers, the switch to a greater share of renewables has potentially favourable trade implications. Reducing fuel imports can improve trade balance and improve GDP. The EU33 improves its net exports by $15 billion USD when the renewables share is doubled.

According to an analysis conducted by the Union of Concerned Scientists, implementing a national 25% renewable electricity standard by 2025 would result in the following benefits: “$263.4 billion in new capital investment for RE technologies, $13.5 billion in new landowner income from biomass production and/or wind land lease payments, and $11.5 billion in new property tax revenue for local communities.”

Rhode Island

Rhode Island became the first state in the country to establish an offshore wind project in 2016, and the state’s labor and job-training department is now building out a career pipeline program for students at local schools who are interested in the offshore wind industry. Susanne Greschner, Chief of the Division of Municipal Finance in Providence, says the whole energy sector has a lesson to learn from GRID Alternatives’s work in integrating workforce development into clean energy deployment.

Currently The U.S. Department of Energy has projected that Rhode Island will see a major increase in energy sector jobs. Employers in Rhode Island are more optimistic than their peers across the country with regards to their job growth over the next year in Electric Power Generation (10.6% vs. 7.1% nationally). Electric Power *transportation, distribution, and storage* has a growth projection almost 2.5 times the national projected growth (7.2% vs. 3.2%). Energy Efficiency employers expect to add 914 jobs in Energy Efficiency (7.2%) and Motor Vehicles employers expect to add 196 jobs (4.0%) over the next year.

Table RI-1.
Projected Growth by Major Technology Application

Technology	State Projected Growth Next 12 Months (percent)	U.S. Projected Growth Next 12 Months (percent)
Electric Power Generation	10.6	7.1
Electric Power Transmission, Distribution and Storage	7.2	3.2
Energy Efficiency	7.2	7.8
Fuels	--	3.0
Motor Vehicles	4.0	2.2

From the same report, a number of employers are finding it difficult to find quality candidates due to a small talent pool and a lack of experience or training . If Rhode Island provided workforce retraining for the Green Energy Economy the amount of wealth coming into the state would rise significantly.

Over the last year, 31.3% of energy-related employers in Rhode Island hired new employees. These employers reported the greatest overall difficulty in hiring workers for jobs in Electric Power Generation.

Table RI-2
Hiring Difficulty by Major Technology Application

Technology	Very Difficult (%)		Somewhat Difficult (%)	
	State	National	State	National
Electric Power Generation	--	20.7	100.0	54.8
Electric Power Transmission, Distribution and Storage	--	21.9	100.0	46.1
Energy Efficiency	42.9	21.3	28.6	48.1
Fuels	--	37.9	--	43.0
Motor Vehicles	--	30.0	100.0	46.4

Employers in Rhode Island gave the following as the top three reasons for their reported difficulty:

1. Lack of experience, training, or technical skills
2. Competition/ small applicant pool
3. Insufficient qualifications (certifications or education)

Employers reported the following as the three most difficult occupations to hire for:

1. Technician or Mechanical support – $25.08 median hourly wage
2. Electrician/construction laborers – $26.85 median hourly wage
3. Sales, marketing, or customer service – $57.74 median hourly wage

E. Where the Energy & Vehicle Markets are Trending

Energy

In 2018, the U.S. renewable energy sector remained remarkably resilient, gaining ground despite uncertainty about the effects of federal tax reform legislation and a slate of new import tariffs. Output from utility-scale wind and solar capacity topped 8% of total U.S. electricity generation through the third quarter of 2018, compared with 7% for the same period in 2017.

The fundamental drivers of this growth are poised to continue in 2020, but there are also three trends coming into sharper focus that are likely to shape renewable growth in the coming years. Those trends include emerging policies that support renewable growth, expanding investor interest in the sector, and advancing technologies that boost wind and solar energy's value to the grid, asset owners, and customers.

Some of the core fundamentals that drove growth in 2018 were declining costs of wind and solar generation, advances in battery storage technology, and grid operators' growing expertise and expanding toolset for integrating intermittent renewable power into the grid. Perhaps most significant, was the robust demand from most market segments. Utilities demonstrated strong "voluntary demand," as opposed to the demand driven by policy mandates seen in the past. Voluntary procurement represented 52% of utility-scale solar projects in development and 73% of projects announced in the first half of 2018. This demand was partly driven by corporations' rapidly growing appetite for renewables. As of mid-October 2018, corporations had purchased nearly five gigawatts (GW) of renewables through a variety of procurement routes.

Demand from consumers was also robust in 2018, and the findings of the Deloitte Resources 2018 Study demonstrates some of the sentiment behind these trends. More

than half of all residential survey respondents (53%) indicated that it is extremely or very important to them that part of their electricity supply comes from renewable sources, trending upward since 2013. And about half (48%) of business respondents are working to procure more electricity from renewable sources.

Potentially accelerated project schedules ahead of tax credit phase downs suggest a favorable outlook for renewable growth in 2019, while tariffs could continue to create headwinds. Developers may hasten to begin solar project construction by year end to qualify for federal tax credits before the investment tax credit for solar falls from 30% to 26% and expedite in-service dates for wind projects before the production tax credit for wind phases out entirely in 2020.

Federal trade policy will likely continue to stifle renewable energy component imports, specifically the 30% import tariff on crystalline-silicon solar cells and modules, and tariffs on imported steel, aluminum, and inverters from China. The solar tariff is scheduled to decline 5% annually, eventually falling to 15% in 2020, and may delay or cancel some projects, particularly utility-scale ones. Steel and aluminum tariffs could increase the levelized cost of energy for new U.S. renewable plants by an estimated 3-5%. However, exclusions on finished goods and geographic exemptions for Mexico and Canada may blunt the overall project cost impact. Against the backdrop above, three additional trends appear poised to strengthen renewable energy growth prospects in 2020: Emerging policies, expanding investment interest, and advancing technologies.

Vehicles

More than 750,000 electric cars were sold in 2016 and the global electric car stock grew to more than 2 million, according to the International Energy Agency (IEA). As people become more environmentally conscious, major motor manufacturers are making big changes. Every Volvo from 2019 on, for example, will have an electric motor, while Ford recently announced that it would increase its planned investments in electrification to $11 billion by 2022.

One of the current challenges for electric vehicles is ensuring there are enough charging stations for longer journeys to be completed. Efforts are being made to remedy this. In January 2019, for instance, BP Ventures invested $5 million in FreeWire Technologies, a U.S. company that specializes in mobile electric vehicle rapid-charging systems. BP said it planned to use the units at a selection of BP retail sites in the U.K. and Europe this year. In the U.K., the Office for Low Emission Vehicles is providing more than £900 million to place Britain at “the global forefront” of the development, manufacture and use of ultra-low emission vehicles.

While the energy sources that some charging stations use may not be regarded as “sustainable,” it is true that, in terms of direct emissions, electric cars do have their advantages. Electric vehicles come with zero pollutant emissions at the tailpipe — There is no tailpipe. The DOE has said that electric vehicles can cut emissions that contribute to both smog and climate change, thus boosting public health and reducing ecological damage.

Commercial Vehicles

Total greenhouse gas emissions from U.S. freight activities grew by more than 50% between 1990 and 2013 and greenhouse gas emissions from global freight movement are expected to quadruple by 2050. Adopting efficiencies in shipping cargo, logistics optimization, and intermodal transport can significantly reduce greenhouse gas emissions from the global movement of goods while also providing significant savings. Switching to alternative fuels and transitioning fleets from traditional gasoline and diesel-powered vehicles to hybrid and electric vehicles can reduce or eliminate greenhouse gas emissions from ground fleets. There are about 70 new technologies available on the market that can increase truck efficiency, with an opportunity to save between 30-40% on fuel costs. For example, capturing just half of under-utilized truckload capacity would cut truck emissions by 100 million tons per year (about 20% of U.S. emissions), and save more than $30 billion per year in diesel fuel expenditures. And making use of intermodal transportation such as truck to rail can reduce emissions by a whopping 75 percent.

“If just 10% of the freight that moves by truck moved by rail instead, fuel savings would exceed 800 million gallons per year, reducing greenhouse gas emissions by more than 9 million tons — equivalent to taking around 1.8 million cars off the road or planting 215 million trees.” - Association of American Railroads

Companies have both the power and a financial incentive to reduce their environmental impact from the movement of goods to market. We need all hands on deck from the business community to leverage these trends and build the momentum.

Part 4:

RECOMMENDATION THAT CRANSTON COMMIT TO 100% RENEWABLE ENERGY AND A VISION OF OUR POTENTIAL ENERGY FUTURE

A. New Smart Grid Alongside

Smart Microgrids are modern, small-scale versions of the centralized electricity system. They achieve specific local goals established by the community being served such as reliability, carbon emission reduction, diversification of energy sources, and cost reduction.

Why is this important?

The New England electrical grid was designed and installed in 1957, it is the oldest electrical grid in the U.S. today. As a result, it is considered a dumb grid, meaning that it was designed for one way traffic, from generation to transportation to consumer. In order for renewable energy to really take hold there needs to be major infrastructure upgrades to account for multiple sources of power generation.

Reasons for a Microgrid

Resilience: In October 2019, after a "Bomb-Cyclone" hit New England, Rhode Island was without power for 256,000 residents and businesses for over 30 hours; most of these due to lack of manpower to enact the repairs. A smart microgrid solution can enable communities and towns to be their own independent power grid when weather events happen, and they are happening more frequently as our world changes. Renewable energy generation systems, paired with a smart Lithium-Ion battery storage solution, means that life can get back on track faster.

Reduce Carbon Emissions: A smart microgrid solution powered exclusively by renewable energy generation means that the carbon footprint for the town to Cranston, Rhode Island shrinks significantly. The carbon emissions of this type of system are offset by the zero-emission of the generation itself.

Diversity of Energy Sources: The current electrical grid was designed for one-way energy distribution to the end point customers. Today's energy market has evolved to the point where there are now multiple, omni directional, sources of power

generation available. Smart microgrids take this into account. Our system proposal calls for solar, wind, and tidal energy generation systems.

Cost Reduction: Smart Microgrids optimize the way that consumers and suppliers of electricity transactions occur, down to the millisecond/milliwatt. In a community microgrid, the generation and distribution take place in the same area, so the transportation cost is lowered. Likewise, in the form of an electrical co-op, once community needs are met any excess power can be sold/placed on the larger grid.

Components of the Smart Microgrid

Local Power Generation: The Ocean State Community Energy project has identified a power generation package made up of municipal, commercial, and residential solar, small wind, and tidal solutions. These solutions will be placed in strategic areas around the city of Cranston to ensure maximum efficiency with minimal impact to the surrounding environments.

Local Power Storage: By utilizing a shared Lithium-Ion battery storage solution we ensure resiliency, in this time of climate uncertainty. This battery solution can be a centrally located facility or can utilize the storage space of customer solutions connected by a smart controller.

Controller: A smart microgrid controller are redundant components that talk to all the other components in the microgrid solution and using software, optimizes them to get the peak results based on the system needs. The controller is the brains of the smart microgrid solution.

Cost of a Smart Microgrid

There is no cookie cutter cost for a smart microgrid, however, Ocean State Community Energy has begun the processes of finding a scalable solution for the entire state, based on this case study of Cranston. While the number and placement of the components will vary from town to town, this proof of concept will show that a smart microgrid can reduce the cost of electricity for everyone.

A phased implementation, spread over 10 years will reduce the upfront cost. The big costs of a microgrid are the generation and storage solutions. The controller, while the brains of the system, needs those to fulfill its purpose.

Since we are designing a renewable generation system, that will be where the majority of the cost will be. Followed closely by the storage system. Both of which will cover their cost within 7-10 years. By creating a community energy system, the cost can be offset by consumers using their own power and/or selling it to their neighbors. By shifting the

money that consumers pay to the utility company for consumption, they can turn around and pay that money to a municipal utility. The purpose for this municipal utility would be two fold:

Create Jobs: This would create a number of different positions for the maintenance, administration, and operation of the smart micro grid.

Controller interface: This would be the entity that would integrate with the macrogrid and maintain system optimization.

Realtime Benefits

A Smart Microgrid provides substantial usage data to tailor pricing and service programs. It also provides real-time operational awareness and accurate power status calls, as opposed to the past, where often the utility did not know a customer was without power unless the customer called them. Additional realtime benefits include:

1. Enables efficiencies for the grid system's need to balance power
2. Reduces costs of manual meter reading, and an increase in the accuracy of the reads, thereby reducing the estimated bills, which can be very inaccurate and can result in unmanageable bills
3. Enables time-based programs such as demand response and time-of-use rates – that can result in optimizing peak load
4. Avoids service calls when the problem is on the customer side of the meter because the utility is better able to pinpoint the source and nature of problems
5. Expedites turn on of service
6. Identifies location of low voltage or other difficulties on the system in real time, enabling proactive maintenance that can avoid outages and verification of voltage complaints
7. Enables tailored energy efficiency programs that show customers how their usage compares to similar residences in their neighborhood, which has demonstrated to be a powerful tool to help customers understand and moderate their power usage with more accurate planning data for the utility by identifying parts of the distribution network that need refurbishment or could benefit from alternative technology
8. Shares data for status of distributed generation, such as rooftop solar, allowing for better planning of how to support variable energy sources

The overall aim is to reduce the energy supply from the grid by allowing homes to exchange their surplus renewable energy and by optimally planning energy amounts used. Each smart grid home can both buy/sell energy from/to the grid until full

implementation is completed, then there is no need to buy/sell your own energy. You simply use it, store it, and share it as needed.

B. Our Recommendation & General Approach

A proposal as innovative and rigorous as this will need to be rolled out in phases and include state and local officials, public/private partnerships, federal funding, utilities, and local businesses, as well as all members of the community. We are pushing this goal of reaching 100% renewable energy within a decade in order to meet the deadlines set in place by the top scientists across the globe while ensuring that Rhode Island is positioned as a leader in the renewable and clean tech sectors. Many municipalities across the country that have begun the transition to 100% renewable energy to date have set their targets between the years 2040 and 2050 and many have not included heating and transportation in their projections. We are advocating for the city of Cranston and the state of Rhode Island to meet this goal in 2030 and include these two sectors that account for well over 50% of our overall Greenhouse Gas emissions.

The basic facts and challenges of this transition are similar to those faced by other municipal and state entities making the transition to 100% renewable energy. The fact is we have the technology and systems available to us today that make this goal of a 100% renewable energy powered Cranston and Rhode Island, feasible. It is important, as we launch this process, to acknowledge that because we have hesitated in this transition as a society, we are now in a position where the option of a gradual transition has been replaced with the challenge of an immediate and urgent one. There is much debate taking place across the country on how to best make this transition and that will be no different here in Cranston and across the state. This proposal demonstrates that, in fact, this is feasible, and that this proposal is simply one viable option.

Over the next year the people of Cranston and Rhode Island will certainly debate how we will navigate, implement, and finance this transition, but hopefully they will do so with the acknowledgement that one way or another this is a discussion about how and by when we aim to succeed, and no longer a debate over whether we should even try. Throughout its history, Rhode Island and Rhode Islanders have pushed forward and blazed a trail of progress that showed a way forward for others to follow. Rhode Island was the birthplace of the American industrial revolution so why not position itself to someday being known as the birthplace of the renewable energy revolution? This is a state of just over one million people and it is made up of the smallest land area of any state in the union, but those numbers and scale make it all the more probable that the state will be more flexible in the ideas and technologies it implements, identify what is

not working and fix it or demonstrate what does work and deploy solutions more seamlessly.

In looking at the Cranston energy footprint we were given access to pertinent energy use data from 2017, 2018, and 2019 that allowed us to operate with confidence on two major numbers with which to base our proposal. As we launch into Phase II of this project in the first week of January 2020, we will work to build a mutually beneficial relationship with National Grid, the city, and state agencies, to gain even more granular data.

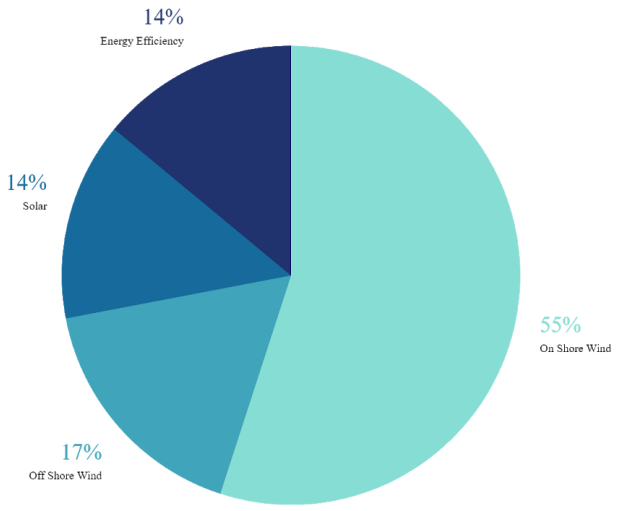
For our purposes the numbers we modeled on showed that in 2018 Cranston experienced an energy demand total of 473,457 mWh for the year. In order to demonstrate the most conservative numbers possible following site visits, pouring over previously released data, and through our satellite composites, we made a conscious decision to use the peak wattage number for Cranston for 2018 which was the top usage number at any one time throughout the year, and use the absolute lowest measured energy output numbers for each panel, turbine, or device. This means that the number we are attempting to cover is higher than actual usage and that the renewable energy generation output numbers used in our calculations are lower than the systems will most likely produce.

We then built energy generation to cover that peak MW usage while understanding that overall we had to ensure that we design the system to supply the 473,457 mWh that the city used in 2018. After looking at a number of current efficiency and renewable energy technology options we settled on residential, municipal, commercial, brownfield, rooftop, ground mount, and canopy solar, small onshore vertical wind, offshore wind, updated energy efficiency tech solutions, and energy storage all accompanied by a new, efficient smart grid to replace the near end of life and inefficient grid that is in use today.

This report was modeled to not only demonstrate that it was possible to cover current electricity demand in Cranston, but to also demonstrate a possible pathway of generation that could cover the transition of heating and transportation to electric power, and provide additional energy that could be exported and produce an additional revenue stream. We planned a path forward keeping in mind the idea that this process will need to be rolled out in phases and working the issue of load management at each phase. Moving in logical order from the technologies that are easiest to implement with the least demand on the grid to the most difficult aspects of the transition, we began with energy efficiency. Rhode Island currently has the third lowest energy use per capita in the U.S. today and the state has a robust energy efficiency program already in place.

When we looked at the fact that the average building can realize a 10% to 20% electricity use reduction and some even can see up to 50% reduction, we decided to use a lower target number of 14% which would reduce the city's 2018 energy usage by 66,284 mWh, We then looked at solar and designed a series of potential systems that would produce a total of 61 MW and would provide another 66,284 mWh also covering 14% of the total need. Next, we mapped onshore vertical wind systems to fulfill 55% of energy that would provide 260,401 mwh. The modeling and plans for the total solar and vertical wind footprint in Cranston would require less than 5% of the total area of Cranston and does not make use of any green space. Finally, we factored in 5% of the offshore wind power generated off the coast of Rhode Island once the planned 300 MW and 400 MW systems are online in the mid-2020s and that would account for 80,539 mWh to handle 17% of the 2018 demand. This clearly demonstrates to Rhode Islanders the importance of the offshore wind solution when it comes to powering the Ocean State well into the future.

Cranston, RI Power Usage 2018 - 473,757 MWh



This mix of efficiency and production does not take into account the massive increase in efficiency gained through the necessary implementation of a smart micro grid with shareable storage solutions. These efficiencies from the modernized grid coupled with the surplus energy produced from the sources highlighted above will cover a significant percentage, if not all, of the transition to non-fossil fuel heating and the electrification of transportation in Cranston as well.

C. A Vision of Cranston's Energy Future in 2030 & Beyond

In order to achieve this ambitious but necessary goal by 2030 local and state government leaders must continue to put policies in place that encourage and encode efficiency and renewable energy transitional action. Policy changes and funding at the federal level is also going to play a key role in legislation like the infrastructure bill that has been languishing for years. The good news is that locally and regionally those policies and actions are already in motion and producing significant momentum to build upon. Rhode Island's businesses and residential communities will also play an important role as they follow the new policy and regulation while searching for the technologies and systems that will reduce their energy costs the most.

Market based forces such as the Regional Greenhouse Gas Initiative (RGGI) require the member states to cap and reduce CO2 emissions from the power sector (RGGI, 2018). TCI or the Transportation & Climate Initiative is looking to build on the success of RGGI and explore all the mechanisms that can be used to reduce emissions in the transportation sector. Rhode Island is a member state of both initiatives. Finally, ISO New England and other governmental and NGO players in the current energy market will need to be open to changes and sometimes even the reimagining of systems that have been in place for generations.

The opposition to the renewable energy transition in this state will not be hard to find, especially when it comes to wind and solar farms. The objections come from several sources and political viewpoints; some are concerned about a perceived correlation between new technology and high electric rates, some will oppose any plan that mentions the words "climate change" because of how politicized that conversation has become in 2019, and for others it will just come down to the problem of basic human nature and the resistance to any large scale change or any implementation of a new market (which also comes with high cost).

The first point we need to impress upon the detractors is the potential cost savings that would come in the short term and especially in the long term from a renewable energy based economy. Next, we need to demonstrate further the job creation that will come about from this clean energy transition. Right now there are already 16,021 Rhode Island clean energy jobs that range across many different sectors and that number will

swell with the implementation of this plan. In addition, no longer depending upon the import of energy from out of state will lead to the significant expansion of energy independence, fuel security, and revenue that remains in Rhode Island.

While a place at the head of a robust clean energy economy, and the positive health and social impacts from this transition are exciting, we can not ignore the driving force of human caused climate change. In Rhode Island in recent years we have witnessed rising sea levels and extreme precipitation already causing increased flooding across the state. Based on the latest climate models sea level is expected to rise by 9.6' by 2100, Rhode Island summers are expected to become an average of 9 degrees hotter by 2100, heat danger days above 105 degrees are expected to increase to at least 12 days a year by 2050, and mosquito and tick seasons are getting longer due to changing weather patterns.

We believe there is no longer time to delay nor are there any other viable options. We have two targets in mind: the first is 100% renewable electricity reliance by 2030 for current electric power needs, and the second is 100% heating and transportation reliance on renewables very soon thereafter. We believe that energy and environmental justice must be solidly placed at the very center of this transition. As we have demonstrated and will work to significantly bolster throughout Phase II, The benefits of Cranston transitioning to 100% renewable energy significantly outweigh the issues of difficulty around the process.

There are a number of questions that still need to be answered in Phase II and with the wisdom of Rhode Islanders throughout the process in order to make this energy transition vision a reality. These are just a few:

● Where will the ground solar panels go? And how will that be decided?

● How will electric cars be charged outside of the home?

● How will we get people to volunteer their time to come out to open-sessions?

● How will we go about ensuring energy to those of the old energy system? (fossil fuel industry)

● Will the local city governments exercise their powers to encourage the transition? (set higher building codes for efficiency or something else)

● Can city residents, city government, and commercial/industrial businesses work together so that they all benefit from the energy transition?

● What other outlets will people have to ensure energy justice besides open sessions?

D. On To Phase II

From January 2, 2020 until August 1, 2020 the Phase II work of the Rhode Island 100% Renewable 2030 Feasibility Study & Road Map will be taking place across the state. The OSCE team will be researching, mapping, and executing site analysis in each of the 39 municipalities in preparation for the comprehensive state-wide study due to be completed August 1st. In addition, specific feasibility reports and road maps for municipalities that are interested can be produced and will include a much more detailed assessment of sites, technology options, cost/benefit analysis and more. A pdf package detailing all of this will be available through the Rhode Island Progressive Democrats website on January 8th.

OSCE partner, ReVenture, will also be working on the development of an online tool for the State of Rhode Island and all municipalities to assist in areas such as the planning, phased deployment, cost analysis, revenue mechanisms, latest technologies, project management, decentralized grid analysis, and much more. Access to this tool will be provided at zero cost to the state and any municipality that contracts OSCE to provide them with a detailed municipal report. This tool should be available in early 2021.

In addition, the Rhode Island Progressive Democrats are looking at options to form a financing mechanism within the state to help municipalities and businesses make the transition to 100% renewable energy.