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Community Wind Power – A Tipping Point Strategy for Driving Socio-Economic Revitalization in Detroit and Southeast Michigan

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1. Introduction

Since entering this new century, our global society has faced unprecedented challenges in energy production. It is more urgent than ever to address our ever increasing thirst for energy and the resultant environmental impact caused by the energy production. Today, electricity is one of the most common commodities of energy. The generation of electricity is, consequently, one of the largest global sources of environmentally concerning emissions. According to the U.S. Energy Information Administration (EIA), the overall electric power consumption in the United States has increased from 3302 billion kilowatthours (kWh) in 1997 to 3974 billion kWh in 2008. As a result, more than 2477 million metric tons of CO2 were emitted in 2008 simply due to electricity generation, which accounts for about 40% of the U.S. total annual CO2 emissions. In his 2011 address of the State of Union, President Obama mentioned an ambitious goal of achieving 80% of electricity from clean energy sources by 2015 [1]. A majority of states in the U.S. have passed Renewable Portfolio Standards (RPS), which set aggressive goals to achieve given percentages of electricity generated from renewables by particular deadlines [2]. To address the aforementioned challenges and to achieve the clean energy goals, given the ecological and social stagnation that we are experiencing in our urban centers, we will have to come up with innovative, cost effective, community energizing and ecologically friendly complementary additions and alternatives to our traditional power generation methods.

Before introducing what we call the Detroit and Southeastern Michigan Community Wind Power Cooperative Model (henceforth referred to as the "Detroit model"), we shall first describe the traditional community wind farm model upon which it is historically based. We shall also include some of the key refinements and improvements made to the traditional model which subsequently led to the development of the Detroit Model, in order to first familiarize the reader with the foundational concepts of community wind.

Traditionally, community based wind power has involved placing medium to large commercial sized (250 kW-2MW) wind turbines into rural settings to provide electric power for local communities or to be sold externally to make a profit or both. These turbines range in height from 150 to 425 feet and have rotor diameters of between 100 - 300 feet [8].

There have been many forms of ownership throughout the history of community wind, however the most prevalent forms, and for our purposes, most important one's have

involved either direct community ownership of the wind turbines or land lease rights of ownership of the land upon which the turbines are built.

Most if not all traditional wind farms were developed in rural areas in Europe and North America. They usually consisted of individual farmers or groups of farmers and local community members pooling money together for investment into wind farm initiatives with the intent of providing power for the local community.

This ownership model, which usually took the form of an LLC (Limited Liability Corporation), in North America, eventually evolved to the point where not only was power provided for the local community, but there became a realization that excess power could be sold externally on a "for profit" basis with the revenue from these endeavors going back to the community. Ultimately this in turn grew into the concept of providing all of the power that the wind farm generated to be used in the external marketplace. By selling power this way the local community could derive revenue just like hydro-electric, coal fired and other utility providers do. The difference was that the revenue generated was intended to be shared by the community members as investors in the project as opposed to paying it out to remote stockholders of a corporation or to a private business investor group that had no interest in, or in many cases even knowledge of the community.

Later the concept began to expand further as the local community members allowed neighbors, friends and outside "community interested" investors to join their cooperative in order to attract additional investment dollars for projects. Profits were shared with them as well.

Fundamentally there was a difference in how these cooperatives operated as opposed to traditional companies and corporations. The purpose and intent of the cooperatives was to provide the "local community" with electric power and/or a source for profit which was intended to be shared locally amongst the community members.

There have recently been efforts to extend the "community" benefits of the cooperative model even further between cooperatives, communities and even entire countries (especially in Europe) with what are known as Tariff Feed In laws [8]. Tariff Feed In laws benefit communities as well as electric customers by paying the cooperative a predetermined, overall regionally or nationally averaged, and regulated base rate of revenue, which allows for fair competition between cooperatives regardless of size or affiliation. The payment is provided by the utility and government in partnership. It is a plan that also provides competitive electricity rates to the outside grid, market and ultimately the customer as well.

This is not the only intent of the Tariff Feed In laws, but it is a definite by-product of them and one in which the community benefits. These laws actually level the playing field so that small and large wind power providers benefit in a fair manner. This is accomplished by insuring that large and small producers alike receive appropriate adjustments in their revenue rate depending on economies of scale and the efficiencies that they provide.

The general idea is that the revenue rate paid goes down as efficiencies go up and vice versa relative to an established baseline "fair average rate" based on all of the turbines in a large geographic area in order to keep everyone's rates equally competitive in the marketplace for all of the providers in that area. It keeps prices competitive based on laws of efficient averages which theoretically should also result in consumer electric rates that are as low as possible for the customers who buy the power.

In order to better understand how the community members benefit from the direct versus leased methods of ownership previously introduced, we now provide the following

simplified example to demonstrate the respective financial benefits of each method to the community. The revenue provided to the community can vary greatly as described in the example depending on many factors, but for the purpose of conveying the basic idea it should suffice.

Under the direct ownership method, a hypothetical 2 MW turbine could theoretically produce gross revenue of $ 400,000/yr. for its owner if the electricity can be sold for $0.10/kWh, [8]. From this amount the owner would deduct the aggregated costs of building, operating and decommissioning the turbine over typically a twenty year estimated life. This is usually referred to as operating the turbine at its rated capacity factor which is the proportion of the actual/estimated energy it is capable of generating while taking into account all of its 20 year lifetime amortized cost and performance factors, then comparing this as a proportional ratio to the theoretical amount of energy it is rated to generate for one year, After completing this accounting exercise the turbine could potentially produce a gross profit EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization), of approximately $200,000/yr. for the community. Depending on the cost of ownership factors involved in determining the EBITDA the net profit to the owner could range between $100,000 and $200,000 yearly assuming that there are no catastrophic financial events and the project is managed in a reasonably responsible financial manner.

If leasing the land is the preferred method, the community can generate royalties, obtain electricity and derive other financial benefits that can total between 0.5-5% (typically $2,000 to $20,000 per turbine) depending on size of the turbines, the terms that they negotiate with the power company and other factors defined in the contract. Then there is a "shared ownership" arrangement where the community and the wind turbine power company share ownership and split the expenses and profits between them. This is the ownership model that we prefer and is the base upon which we build the Detroit Model.

The Detroit Model builds and expands upon the above shared ownership definition by adding "community partnership" to the base model. This addition requires that the partners must declare their fiduciary duty to, and be dedicated to the best interests of the community first and foremost. These "community investor / partners" may come from within or outside the community, they may also include the utility, the municipality, corporate investors or any combination there-of. The important idea is that all of the partners have a mutual and fiduciary duty as well as interest in making sure the local community benefits socio-economically and environmentally from the collaboration.

The socio-economic and environmental aspects of the model are crucial additions. The model emphasizes the direct engagement of the community in the development, deployment, execution and in its ongoing commitment to its basic tenet that socio-economic and environmental sustainability benefit the community [28], as a prime directive. It focuses this commitment by insuring that the reservation of jobs, providing education and technical training as well as environmental and community sustainability are incorporated into its fundamental principles [3, 8-10, 13, 14, 16-19, 27, 28].

The socio-economic tool we employ to accomplish the above is known as the 3 E's + 1 (Economic, Socio-Economic, Environmental + Educational) community sustainability concept [5]. The model demonstrates how community wind power can be coupled with the latest socio-economic management tools to provide jobs and education for the community while simultaneously giving them the opportunity to participate directly in the ownership of the business with their chosen partners. It is a model that promotes community self-

determinism and creates a partnership between the community and its utility, municipal, financial, educational, special interest and business institutions.

We now introduce the concept of Community Based Wind Power as a test bed solution to couple electric power generation with social and community development initiatives. As previously stated, the idea is to provide individuals within a community an alternative model for the provision of their electric energy as well as socio-economic needs. It is a popular urban sustainable community development concept that has been implemented successfully many times in Europe [3, 27, 30]. As a great alternate to centralized large wind farms, community based wind power systems for sustainable development of communities has also been the subject of increased interest in the United States recently [3, 8, 16, 27, 30] due to its potential for locating power at its point of application, that is to say close to the community it serves.

It is a model which encompasses all of the steps required to initiate, plan and manage the processes required for developing a community cooperative based wind power system and business partnership model for application in the Southeastern region of Michigan.

A unique feature of the Detroit Model is that it takes a community cooperative business approach which gives individuals within a local community the opportunity to take a direct ownership position in any wind energy venture (optionally along with other investors and/or the local utility) that may benefit their community. This type of business model provides the community with a direct way to benefit economically as business owners from the venture. At the same time it provides the community with employment opportunities as well as gives them a direct say in how their electric rates should be calculated as seen from a rate payer/cooperative owner perspective. The goal of course is to potentially lower their electric energy bills through effective self-management of costs. It is a concept that truly supports community self-sustainability in the best democratic sense.

For sustainable community development programs to be successful, it is crucial that the various constituencies within the community be tightly coupled via effective collaboration between each of their respective social networks within the community. The questions are then, who are these partners and how do we develop effective collaboration between them? In order to answer this question lets first start with a discussion of the history of community collaborative efforts in order to put our current effort to build the Detroit Model into context.

2. Literature review of community cooperative models

There has been a long and arduous history of attempted collaboration between government, community and business that dates back in post modern history to just after the Civil War. Examples exist of early successes and failures that are worth note. Chicago during the 1870's and 80's had extreme problems with filthy smoke and soot from coal used to power homes, steel plants, trains and many other endeavors as well as with stench from the numerous slaughter houses in the city [16]. This was one of the first opportunities for the "Business Community" to rise to the occasion and try to put reforms into place to mediate and control the pollution which they did by organizing the Chicago Citizens Association. They were successful in passing city ordinances to limit smoke from such businesses by passing key smoke ordinances in 1881. There were other successes as well, showing that business led consortiums could self-regulate to a limited degree.

On the other hand, there have been many notable failures and even deceptions that occurred when business colluded with government to manipulate the development and/or

application of regulatory laws put in place. This behavior provided numerous grounds for the community to not trust business to "go it alone" when developing ordinances and regulations. More recently many of the same negative lessons were more recently re-learned in the 1970's through the 90's when environmentalists clashed with business and industry over oil, forests and other natural resources [16]. People in the cities also felt that they were being disenfranchised in terms of having a voice in their communities economic well being and development as all the direction seemed to come out of Washington and to a lesser extent their local government. Little direct individual community involvement was tolerated nor were they invited to participate in the decisions that directly affected them.

In recognition of the above history as well as understanding that people from the community and their collaborative partners constitute the first of four key pillars that are necessary for successful community planning a mutual understanding must first be established between each partner's perspectives, agendas, intentions, goals and objectives for their shared vision of and for the community. The question now becomes, who are these partners and how do we develop effective collaboration between them in order to develop successful sustainable community development programs.

To start, all of the partner members within the community must begin by taking a "team approach" to be successful at building their communities. Thus, community outreach has become a key factor in this arena. We find ourselves today in a place that includes environmentalism, community sustainability, recognition of the value of human capital and corporate stewardship as part of our community consciousness. This level of working together is opportunistic to the point where we have a synergistic possibility of uniting previously embattled and opposing forces to a degree previously not thought possible. Recognizing this fact may allow us to accomplish advances on a community development level that just a few short years ago would not have been thought possible.

It is important to note that the above principles mesh to support the community sustainability model based on the 3E's (Economic, Socio-Economic, Ecologic) + 1 (Educational). In addition, there are 6 formally structured community sustainability models that particularly support the above principles: These include: The ORTEE (Ontario Round Table on Environment & Economy) Model, Minnesota Local Model, Netherland Model, Natural Step Model, Houston Model and the CERES (Coalition for Environmentally Responsible Economies) Model have been proposed and used as guiding principles for building sustainable communities [5]. The first three models are community level government focused while the last three models are business oriented. The details of the models are given in the rest of this section. Of these we shall select the best attributes of each to incorporate into the Detroit Model. But first let us review each of the older models before submitting our hybridized model for presentation.

The ORTEE Model defines 12 guidelines for "local" communities to achieve consensus, which is a locally focused model [5]:

1. Growth limits based on carrying capacity
2. Value cultural diversity
3. Respect for other life forms & biodiversity
4. Shared values with others in community (education)
5. Ecological thinking embedded in governmental decisions
6. Make balanced fair and informed decisions
7. Make best use of local efforts and resources

8. Use renewable resources
9. Minimize harm to environment
10. Use materials in continuous cycles
11. Not compromise other communities sustainability
12. Not compromise future generations sustainability

The Minnesota Model defines 5 guidelines for "local" communities to achieve consensus at a *regional* level [5]:

1. Global Interdependence - Consists of 4 factors - Economic prosperity, ecosystem health, liberty and justice.
2. Stewardship - Caretakers of our environment.
3. Conservation
4. Indicators – Clear Goals and Measurable Indicators.
5. Shared Responsibility – All take responsibility for sustaining the environment and economy.

The Netherland Model defines 11 guidelines for giving value and connecting local and regional sustainability issues to the national agenda [5].

1. Intergenerational equity
2. Precautionary principle – Not allow decisions to compromise environment.
3. Standstill principle – At a minimum environmental conditions within the community shall not be allowed to further deteriorate.
4. Abatement at the source
5. Polluter pays principle
6. Use best applicable technology
7. Prevent all unnecessary waste
8. Isolate, manage and control wastes that cannot be processed
9. Internalization – Environmental considerations are to be integrated into the actions of all responsible parties
10. Integrated lifecycle management
11. Environmental space – Recognize the limits of each resource that people can consume.

The three models previously discussed are considered community through national level government focused models. The following three are business focused. The key concepts of local community emphasis and partnership with business from these models are coupled in the Detroit Model.

The Natural Step Model is scientifically based on 4 "system conditions" for sustainability. This model combines business management and science to state rules for sustainability [5]:

1. In order for a society to be sustainable, nature's functions and diversity are not systematically subject to increasing concentrations of substances extracted from the earth's crust.
2. In order for a society to be sustainable, nature's functions and diversity are not systematically subject to increasing concentrations of substances produced by society.
3. In order for a society to be sustainable, nature's functions and diversity are not systematically impoverished by physical displacement, over-harvesting or other forms of ecosystem manipulation.
4. In a sustainable society resources are used fairly and efficiently in order to meet basic human needs globally.

The Houston Model takes the Natural Step model to an additional level by combining the business and science perspectives with the linkage of the labor and environmental movements. It asks for corporate, labor and environmental accountability. In essence it states in its charter that a healthy economy and environment for a sustainable community must require a "dynamic alliance" between labor, management, and environment advocates and sectors and quite importantly the agents from each of these sectors are required to sign the principle document and agree to work together in a spirit of cooperative partnership [5].
The CERES Model is less strident and demanding in its accountability requirements than the Houston Model and also less formal in its legal compliance requirements than the Houston Model in that it is voluntary. It does however focus on cooperative collaboration between the aforementioned groups as outlined in the Houston Model and also affirms support of protection of the biosphere, sustainability, reduction and disposal of wastes, energy conservation, risk reduction, dedication to safe products and services, environmental restoration, keeping the public informed, requires management commitment and relies on formal audits and reports.

3. Model template

The Detroit Model is based on the fundamental premises that community collaboration and direct democratic involvement is essential for the model to function properly. There are four key pillars and a community collaborative foundation that supports the scalable model in order to make it effective. The four pillars are:

1. Neighborhood/Municipal/Business/Utility/Financial/Educational Collaborative partnership model to support community sustainability.
2. Job creation model to support the community.
3. Educational model to support the community.
4. Mutually beneficial financial model for all partners.

The base foundation must be established first before the 4 pillars can be implemented. This foundation is the recognition by all of the stakeholders that effective communication must exist between them before any meaningful group trust, interaction and partnership can occur. It is of utmost importance to first recognize that it is the people from the community and the businesses within it that constitute one of the pillars that is necessary to have success when a team is charged with developing a community sustainability plan. It is crucial to recognize early on that the various constituencies within the community be tightly coupled via effective collaboration between each of their respective social networks within the community. The question is then, who are these partners and how do we develop effective collaboration between them in order to develop successful sustainable community development programs. To answer this question it is necessary to first understand that communities have recently begun to realize that it will take a "team approach" to be successful at building their communities. Outreach has become a key factor in this arena.
It is also important to recognize that we are currently at a tipping point in Southeast Michigan's history due to economic, topologic and demographic shifts as well as social, educational and corporate shifts that have all recently converged to allow us a unique opportunity for rethinking what our future might be if we work together to redefine it. The opportunity to take advantage of this convergence indicates that if effective outreach is made between the community's members and their municipal, educational, and business community partners in a collaborative "action based" way it will allow us to redefine the

foundation of what our socio-economic infrastructure is based upon [6, 22-24, 26, 27]. We may then be able to achieve socio-economic, community and environmental gains previously thought unattainable. Once the foundation is established, then each of the three remaining key pillars can be more effectively addressed.

It is crucial to recognize early on that the various constituencies within the community be tightly coupled via effective collaboration between each of their respective social networks within the community. The question remains then, who are these partners and how do we develop effective collaboration between them in order to develop successful sustainable community development programs. In order to answer this question we need to first understand how to establish the group dynamics necessary to build a strong foundation for each of the four pillars. To accomplish this we provide the following group dynamic insights, experiences and guidelines as being an essential pre-cursor to any effective group collaborative effort.

Also note that the socio-economic aspects of the model are intentionally designed to be extensible [9, 16, 17, 28]. Thus, before we explore the community wind power concept further the reader should note that the model is intended to be extended to other sustainable as well as regular community development efforts. These community business development efforts include but are not limited to: Alternative energy initiatives such as solar, geo-thermal and landfill gas, as well as development of regular businesses including retail establishments such as pizza shops, drug stores, and boutiques, and on to commercial ventures such as city parking lots and structures, city farming and many other potential cooperative community ventures.

The key to the overall concept is that it is based on "shared ownership/responsibility" within the "local" community [9, 10]. It includes all of the various community partners working in concert with the local municipality and educational institutions to effect positive and mutually beneficial socio-economic results for all of the partners sharing the community.

Before the group can work effectively together in order to achieve their goals and objectives we must first address the group dynamics with specific methodologies that can be used to influence and insure their effective interaction as a team.

The following discussion describes the internal and external influences that affect the group dynamic and addresses the methodologies that can be used to positively influence it. The process breaks down to understanding the following key concepts [11, 17]:

1. The model employs "actors" who are defined as interested or disinterested parties that are affected or involved in the collaborative process involved in building the community project.
2. There are realities, individual experiences and expectations that each member of the group has brought to the table in regard to how they perceive the project within the context of how it affects them and their community. Each perspective must be carefully understood by the group before any effective collaboration can begin. External real world factors and processes impact how each person sees the reality of their community's situation. Internal psychological factors influence how they internalize and perceive the meaning of those factors. The idea is to get everyone as close to a common understanding of the situation as possible before beginning to discuss how to improve it.
3. The process involves first teaching the group why "instruments" (formal documented processes, procedures, laws and ordinances and project plans) are necessary for defining and attaining the key objectives of the group.

4. The implementation phase accounts for what is needed in terms of cost and effort to implement the instruments in a practical manner to achieve the objectives of the group.
5. The group must be taught that there needs to be a measure of effectiveness of the information produced in order to account for their impact on the project.

There are two major instrument categories for understanding, managing and directing community behavior: 1) Classic Instruments; and 2) New Environmental Policy Instruments [17]. These two categories equally and categorically break down into the following 5 major instrument "types" as follows:

1. Command and control instruments which are legal and regulatory in nature in order to influence behavior.
2. Economic instruments which are monetary and supply and demand based in nature and which rely on such "economic" laws and theory to influence behavior.
3. Service and Infrastructure instruments attempt to influence behavior by physically manipulating the environment to change or motivate behavioral changes.
4. Collaborative Agreements which seek to influence behavior by using either legally or non-legally binding commitments that seek to engage private and governmental entities in mutually beneficial collaboration in order to achieve behavioral change.
5. Communication and Diffusion Instruments which seek to initiate behavioral change by force of marketing and other public information dissemination techniques.

In addition when using the traditional approach in applying these instruments it is necessary to reassess the usefulness of using traditional policy instruments that are solely based on making decisions by using "public" community/government based analysis instruments only. We replace that model with a new one that also incorporates and couples them to the use of "private" business based instruments that together provide a much more comprehensive, cohesive and coordinated approach for doing the analysis. Many of these new private instruments address how the business world should interact with collaborative groups in the public sphere and government as well as how to become leaders and good partners with communities and ecological interest groups. In addition these instruments add technical and business process experience to the partnership. As an example, Six Sigma, Lean and ISO 14000 methodologies are now being added to the discussion making the resultant combined solutions much more robust and effective [20].

Next, our model proposes using the simplified model of human action as discussed by Ruth Kaufmann-Hayoz and Heinz Gutscher in their book Changing Things-Moving People [17] for explaining how people perceive information, react to it and then interact within the group based on these perceptions. The readers are referred to the book for more details about the Human Action Model and Group Dynamic Management.

We believe and emphasize that it is imperative that any community group first, engage in exercising these concepts before tackling the actual community wind project development. As previously stated, without setting the foundational stage for establishing the proper group dynamic, most group efforts of this complexity fail. It is also worth noting that group dynamics vary based on many factors such as their homogenous localized culture such as in small farming communities versus large diverse urban areas or because they are in areas that may or may not have large population densities or a complex non-homogeneous corporate/municipal/community/utility/special interest group mix where stakeholder agendas may conflict to a greater or lesser degree due to the constituency or interests that they represent. Basically group dynamics can be (but are not always) easier to accommodate in simpler more homogeneous circumstances when everyone knows everyone else within

the community and/or deals with one another on a regular basis due to the locality of their geographic circumstances and closely knit social networks. Essentially group effectiveness largely depends on how well the stakeholders know one another from a social networking perspective. It is this level of intimacy that the Detroit Model seeks to establish between the partners by first addressing the group member and constituency backgrounds, learned behaviors and expectations and assessing their dynamic interactions, abilities and capabilities in order to show them how to attain and instill within the group the levels trust, accountability and sense of common cause necessary for their community project to be a success.

There is a correlation between how complex the mix of social, economic and cultural factors is and how complex the management of the group dynamic may be within the group. These factors are addressed in the model by teaching the group how to refocus and manage their dynamic interactions, differences and energies in order to become a tightly knit and unified collaborative that has a new common sense of purpose and aim toward optimizing the community's potential for success instead of wasting it on group infighting and dissonance.

4. Project management and technical aspects of the combined model

There are several key and important project management steps that must be understood before undertaking the development of a wind power community cooperative. The most important of these is the recognition of the fact that the technical and project management goals cannot be achieved without putting "first things first", and that means attending to the group dynamics of the model first and foremost.

From a technical level we must consider the trade-offs required for using a central, distributed, localized or hybrid energy model for urban communities. For the type of urban design we are addressing i.e. urban community wind, a localized distributive model fits best. There are several reasons for this choice. First the currently favored and generalized model of bringing power into the community from the grid involves significant infrastructure costs (between $500,000 and $1,000,000 per mile), operational and maintenance issues and not least also involves a lack of convenient access or local control over its management and operation. These concerns take the issue of where to locate the power generation equipment out of the community's sphere of influence to a large degree and certainly do not require their involvement in its operation. It is "out of sight and out of mind". A legitimate argument can be made that this is a good thing and it is the traditional way that we have managed the power flow to our neighborhoods up to now. However, in the 21st century, this traditional approach may not make the most economic, environmental, technical or community sustainable sense in terms of how it impacts localized urban communities. These communities are distributed throughout a given geographic region and could benefit from the lower emissions given off of the power plants (i.e. wind turbines), the improvement in system reliability as the distributed electrical system model being superior to the centralized model currently used would have much more backup capacity and capability if power interruptions were to occur and the communities themselves would benefit much more from local jobs and financial offshoots from the projects put into their neighborhoods. In addition, instead of "out of sight, out of mind", the Detroit Model is designed to bring more "in sight and in-mind" awareness to the community of what the benefits would be for having an electric power company in their neighborhood.

Like any other business case, be it building a remote power plant or siting and installing a small wind turbine or solar array, it is important to remember that each case requires a technical, economic and social implication study before any of them can be either eliminated from contention or found to be a superior solution relative to other options. In the current business environment, these decisions are largely made solely by bigger businesses, utilities and government and not by local communities which given the current system makes significant sense, however we are now at a point where other options are available and at a point where society is looking for the best solutions it can identify for these new paradigms that are evolving.

In a sustainable community we are attempting to "empower" the community to have much greater say, control and awareness in the way energy is produced and consumed in order to provide them with an economic engine that can help support the community [28].

By employing a local owner/operator distributive hybrid model in partnership with the utility, the community has more control over costs as well as the benefits made available through education, local jobs and distributed profits from the endeavor to the participating community members. Reliability is also an issue and because local generation backed up by the grid and directly supported by the onsite workers in the community, we propose that the reliability would have the opportunity to improve because of the models distributed yet localized nature, if managed correctly in partnership with the utility.

One risk is that different communities would not have the same baseline electric cooperative building standards. For this contingency we propose that the state and federal government establish minimum standards through their electrical standard regulatory agencies such as the DOE (Department of Energy), FERC (Federal Energy Resource Commission), MISO (Midwest Independent Transmission System Operator) and on the state level the MPSC (Michigan Public Service Commission) for urban community wind just as they always have for the current traditional power generation and distribution model.

In addition not all technical choices make sense to implement on a local level based on a myriad of factors such as wind speed, amount of sunlight, noise, vibration, aesthetics, available land space, proximity to people and other factors. However, with proper community, municipal, business and utility involvement many favorable locations exist even in high density population areas. It is just that there has been very little actual research or attention paid to properly analyzing the business or technical cases for putting these systems in such areas. There has of course been a tremendous amount of discussion and opinion regarding the topic, but as of yet little empirical data has been actually collected in order to properly address the subject.

These projects as well as the Detroit and Southeastern Michigan model that we present here follow similar project path planning methodologies. It is important to emphasize the use of the concept of "process building" as central to the community building concept. Every task and project outcome is to be assigned and treated as a "process". This is so that each process can be documented and optimized as the project progresses. In addition it is also important to make sure that the project is based on setting key milestones, goals and follows an "action oriented and accountable" methodology. In short good project management, communication and team building skills are a prerequisite for successful project planning and implementation. All of the above project planning and execution functions are embodied in the principles of Six Sigma, Lean and Professional Project Management. We propose and require that each of these methodologies be incorporated into the Detroit Model.

Goals and key project decisions are made up front and must include attention to "process" details such as how will the collaborative team be assembled and managed, how will the decision making processes be implemented, what process is to be used to choose 3rd party stakeholders, what criteria shall be used to determine investor participation, how is the grid interconnect process to be handled, how shall the site selection and permitting process be conducted, who and how will the administrative side of the business be organized, how will the procurement process work, how will the legal aspects of the project be managed, who and how will the political issues be managed between the community and municipality. These and many other processes need to be managed in a parallel fashion as the project progresses. A brief overview follows of some of the more important details that should be paid attention to.

There are several excellent community alternative energy projects and planning models which provide excellent guidance for building strong collaborative efforts for implementing wind power. Two examples are the Windustry Community Wind Toolbox project [3] and the LACCD (Los Angeles Community College District) project for community sustainability [16].

A project management plan is crucial for effective communication of the projects status to all of the stake-holders. A master plan is required for the Detroit Model and should be developed to include all of the necessary steps listed below [3, 5, 9, 20].

- Provide a project master summary document that outlines the goals and vision of the project.
- Identify the community members involved in the project including the business, community, academic and municipal partners and provide them with a communication and relations plan specific to each.
- Provide a "Group Dynamic" management plan and include upfront training to address group dynamics and project management skills.
- Develop a business structure and plan appropriate for the community. i.e. LLC, Corp., Sub Chapter S, etc.
- Develop an environmental risk, action and improvement plan.
- Develop a project risk plan.
- Develop a legal issues planning document.
- Develop a community and utility business partner plan.
- Develop a project management plan, flow and Gantt charts to manage construction, logistic, supplier schedules and other important project timelines and functions.
- Develop a community jobs, education and socio-economic development plan.
- Provide a community and business partner analysis plan showing the overall benefits to the community. Include all relevant economic, social and environmental benefits and potential detriments.
- Provide a wind and resource assessment plan.
- Provide an economic, social and demographic analysis plan.
- Provide a finance model and plan for the project.
- Provide a community revenue sharing plan.
- Provide an electric rate adjustment management plan.
- Provide an electric rate estimate projection plan.
- Manage the Power Purchase Agreement (PPA).
- Provide guideline for turbine selection and purchase.

- Provide a construction plan
- Provide a community architectural plan
- Provide a community sustainability plan
- Provide a long term power development plan
- Provide a grid interconnection plan.
- Provide a plan to address all legal, tax and insurance issues.
- Develop a plan for identifying financing resources and investors.
- Develop a financing plan for the purchase of the system
- Develop an operations, financial management and ongoing maintenance plan.
- Provide an end of life plan.

It is also important to carry out a risk management analysis of the cooperative. It is imperative that all of the various risk factors be identified and continually monitored throughout the project. Key early risk factors include determining the suitability of the site for a wind project, i.e. is there community, local business, special interest, banking and municipal support for the project. Is there a convenient grid interconnect available for the system, does a substation need to be built, is the wind speed and quality of sufficient magnitude to justify a system, do the zoning laws and or federal restrictions prohibit a wind farm from being built, is the community favorable to having a system put in their backyard, are the financial institutions favorable to the economic viability of the venture. These factors are important and must be addressed before committing the extreme amount of time, effort, financial risk and community good will to a project that may be doomed before it is even begun. So doing the preplanning and homework are critical to the success of the project right from the start [22].

Next, the wind site and resource assessment plan is critical in determining the success of the project and should be conducted upfront before any substantial investment is made in the project [3, 19, 31]. It includes assessment of wind speeds, site potential and identifies any barriers that would preclude building the system. The resource assessment should take into account the electric grid resource locally available. It should also account for any legal issues or protected environmental issues that would preclude building the project.

The economic assessment should account for all of the economic benefits and detriments that would be expected for the community. Particular attention should be placed on quantifying and explaining the potential benefits and detriments (emphasizing the potential detriments), in a very clear and concise manner so that everyone in the community is made aware of and can understand all of the personal as well as public risks they are taking on as an individual as well as a community. The public disclosure of these risks should include ongoing and regularly scheduled discussions of the projects financial, economic, safety, liability, environmental, legal, social and community disruption risks that the community may encounter. Initial and continuing meetings to keep the community informed on a personal as well as community level is imperative.

In addition close attention should be paid to the social and demographic aspects of the site. The community will have this installation in their backyard for 20 to 30 years and all of the social, economic, architectural, security and safety issues and impacts that it will have on the community need to be studied, documented, publically addressed and presented to the members of that community.

Financing options for community based wind power projects are first and foremost restricted to community ownership in our model [29, 30]. This is because the intent of the

model is to provide the members of the community with all of the financial advantages of shared business ownership between them and their community business partners, i.e. the utility, local businesses and possibly the municipality. It is a model that works quite well in rural areas already in the form of rural privately held community cooperative wind farms, electric cooperatives, public and private community/municipal wind and electric cooperatives, and other forms of mutually beneficial cooperatives.

The main idea of all types of cooperatives of this nature is that the "members": the community members and special interest groups, community business partners, utility partner or municipal partner, share in the ownership and also enjoy receiving income and in many cases more competitive electric rates than would normally be provided by outside electric power providers. Much of this has to do with the idea that in a cooperative it is the members or a board of directors that the members elect who decide how the company will be run, how the rates will be set and how any profits will be distributed.

With the community wind power cooperative model we propose going even further [27, 29]. The members shall not only share in all of the above mentioned benefits of cooperative ownership, but will also have more direct say and involvement in the management and governance of the business. Those choosing to be non-active participants will still have voting and ownership rights. All members within the designated area of the community will be eligible for education and training provided to support the company. Those desiring to actively participate in the business will have the opportunity to do so based on paid or voluntary positions being available.

Owners will benefit financially from stock ownership in the cooperative as well as from their membership in their cooperative banking/credit union used to finance the project (to be discussed in a later section). People just outside the geographic area of the cooperative shall also have an opportunity for participating in the profitability of the business via reduced prorated levels of profit based on how close they live to its boundaries. They will not however be entitled to the direct community benefits of jobs, education, training or participative ownership. This is done so that neighboring communities are financially re-numerated for allowing the wind systems to be built in proximity to their neighborhoods. It is a model that has been successfully used in Europe.

Because the model involves community ownership it necessarily excludes some of the standard options that would normally be pursued. Specifically, "exclusive" outside investor ownership is not allowed, nor is "exclusive" utility ownership. These exclusions vastly change- the business ownership landscape from that of the traditional utility ownership model. Now the local community must find a way to obtain financing. This is solved by using the partnering models as mentioned earlier. The challenge then becomes whether or not the venture can be made financially attractive enough for either the community alone or the community in partnership with the investor and utility together as one entity [8, 29].

The model provides financial options and resources to accomplish this as can be seen below [3,8,9,16,21,30,33]:

1. Utility financing/partnership
2. Outside investor partner financing/partnership
3. Sustainable Community "Common Good Bank" bank financing/partnership [21]
4. External public/private stockholder financing [8]
5. Municipal financing/partnership
6. Bank financing

7. Local credit union financing
8. Federal/State Government financing/grants
9. Industrial and commercial parks

Each of the above finance partner options has its pros and cons, those that we will focus on and incorporate into the model shall have the "partnership" element attached. The others, credit union and bank financing as well as self financing through federal grants follow a more traditional path of finance and are mentioned only to display, compare and contrast the other options that may be available.

We first consider the Utility financing/partnership concept. This potential partner has the benefits of possessing available land, financial resources, a moderate willingness to partner with the "right" partner, the know-how for understanding the financial picture required to build a community wind farm, the expertise and trained personnel to service/operate/maintain the wind farm, the ability to offer the community a long term loan to be able to finance the community's half of the venture, and are in need of renewable energy sources to fulfill their Renewable Portfolio Standard federal gov't requirements. They are eager to find capital investment programs that provide PTC (Production Tax Credits) and ITC (Investment Tax Credits) such as wind power projects offer to be able to offset their tax liability by up to 30% and are interested in any state and/or local government incentives that might be available to them [4,34].

All of the above factors combined result in lower costs for the utility should they maintain ownership of the system. These cost savings can be shared or passed on wholly or in part to the community/utility partnership if it makes economic sense to the utility to structure the endeavor in such a manner.

Another option is for the utility to provide the community partnership a lease arrangement. This allows the payments to be more predictable over a period of years because all costs are established up front for the duration of the lease versus being variable if the system were to be bought outright. The utility is agreeable to this arrangement in some cases because it is able to take advantage of the tax credits, incentives and depreciation because they own the assets.

There is also the option of using a buy-back arrangement where-by the utility is able to "own" the wind farm for a period of years (usually for at least the accelerated depreciation period allowed for wind of 5 years), during which time they take advantage of the tax credits, incentives and accelerated depreciation available to them. The community partnership pays the utility only the cost of the electricity sold to them, its initial capital acquisition costs and ongoing maintenance costs on a cents/kWh basis which is often less if the community owned the turbines outright. At the community's option after a minimum holding period that usually corresponds with the 5 year depreciation period (during which the system had in most cases been paid off by the utility), the community takes full ownership, the only remaining costs are the ongoing operation and maintenance fees. It is only these fees that must be paid on a cents/kWh basis for the monthly bills to the community. Typically these bills are substantially less than what they were prior to the utility paying off the system, or even for the scenario where the community has outright ownership from the beginning.

On the other side, many utilities prefer to provide the community with power as they historically have and prefer to retain profits from 100% of the community as opposed to sharing 50/50 with them. Utilities also may not be inclined to loan the community funds for the community's half of the venture. This could be for many reasons not the least of which is

that they may not see themselves in the lending business or are not willing to accept the risk. In addition, note, that utilities are looking for a minimum 15-20% ROI (Return on Investment), a 17-23 IRR (Internal Rate of Return) on their investments. All of this leads up to the fact that as you attempt to work with a utility as a business partner, it will require substantial work above and beyond that required to obtain financing from traditional lending sources. The reasons for this are clear from the previous discussion, however considering what the utility brings to the table in regard to the partnership may well be worth the effort.

Outside investor/partner financing in our model requires partnering with investors outside the community. These types of investors come in many forms such as individual investors, investment clubs, investment companies, energy fund companies, angel investors, investment partnerships and a myriad of other groups. However, they all have a couple of things in common. (1) All outside investors want and need to make money from what they perceive as being a solid investment in wind power projects. (2) Most people want a large share of ownership and profits and three many prefer to take a lead role in their investment, keeping their own company's best interests above that of the community partnership. This is not to say that the other partnership models are significantly different, but here it is a matter of degree. Expect to negotiate at the most direct and intense levels with this investment group. Their fiduciary responsibility is to their own company and the community wind partnership is an investment for them that they need to maximize to their greatest advantage. However, if negotiations are managed carefully and in the best interest of the cooperative, this is the most likely group that will give the partnership access to capital funding.

The purpose of forming a partnership with an outside investor is to gain access to funding, therefore in keeping with our models principles insure, that in no case voting rights, management, and distribution of profits be inequitably distributed to them. It is important that the partnership be fair and equitable for all parties. It is especially important that the decision making and voting rights of the community hold balance in a democratic way against the voting rights of the outside investor. This may mean that the deal be struck such that the investor be given their 50% or less share of the profits, but hold only one vote amongst the other community members individual votes. This requires difficult negotiations up front when the partnership is being formed. It is equally important that the investor not be given management authority beyond that which is balanced by management authority on behalf of the community. Essentially then, it is access to funding that is the key to this working relationship. Beyond that, unlike the utility partner model, alliances must still be sought outside the partnership in order to aggregate land, develop expertise and deal with the power utility for access to their grid.

It is of equal importance that the agreement between parties explicitly states that the intent of the project is not only to produce profit for both parties, but also to provide access to business ownership for the community members as partners of the cooperative. The partner must be agreeable to hiring to the maximum extent possible all manner of employees from the local community for the construction, supply of material, management and ongoing operations, maintenance and service of the community utility for the duration of its life. They must also be amenable to the collaborative providing educational opportunities via the partnership for the local middle schools, high schools, community colleges and universities in support of educational programs that support their employees and the community's educational needs in order to support the project.

Having stated the above, it is still advantageous to partner with outside investors if they will agree to become a true partner and support the community initiative's goals and objective unfailingly. It is in this manner that jobs, investment and profits can still be kept within the community and the partnership still produce exceptional results for both parties.

All of this is accomplished under the direction of the banks chartered collaborative members. It is the members who become shareholders by becoming depositors just as in credit union cooperatives. The members must adopt the by-laws of the chartered bank which gives each member one vote which is valued the same for each member. Each member uses their vote to decide how to organize, operate and determine how loans shall be lent out for projects in the community. It is the community member stockholders who run and operate the bank, with local community members providing the workforce. All interest and profit derived from the income from the specific loans for the wind project are returned to the stockholder members. This banking business ownership concept is in exact harmony with the concept we are presenting for the operation and management of the community wind power cooperative [3, 16, 21].

The public/private stockholder/partner financing option involves soliciting funds through public and or private stock offerings. It is an excellent way to raise capital financing. It usually involves seeking financing to raise enough money to put a down payment on a loan. Usually this involves 20-50 % down. Then loan carrier then finances the remainder of the loan. However, in some cases higher levels of stockholder funding does occur. The main difference with this type of financing is that the "stockholders" do not have day to day management involvement in the project and only hold the shares as an investment just as they would any other stock or mutual fund investment. There are however tight restrictions to offering this type of financing arrangement. Now you are making a public/private stock offering which requires a specialized lawyer that is familiar with federal stock exchange laws. These specialists are necessary because they are familiar with how to structure a deal of this nature so that it meets the federal and state legal requirements for offering stock ownership in the company. Having said the above, this is a good way to raise capital in order to qualify for a loan for any outstanding balance while not having to take on an active partner in the business.

Municipal financing and partnership is considered an adjunct to each of the other forms of community cooperative partnership. It takes its form by making the municipality a partner early in the formation of the cooperative effort. The benefits of partnering with the municipality are that they bring potential locations for siting and development of the wind farms to the table by giving the community access to public properties for minimal or no cost in many cases. The main goal of the municipality is to put their underused properties to their "highest and best use" as well as add them to their tax roles. In many cases school properties having adequate open space can be added to the tax roles as well as provide real life science laboratories for educational and trades training purposes. Coupled with the potential for federal and state grant funding to supplement and support the public education and community outreach efforts they can be a powerful incentive and symbol in the community for promoting and teaching the public about alternative energy, business and technology as well as an avenue for providing jobs.

5. Economic, socio-economic, ecological & educational aspects of the model

In regard to the socio-economic aspects of the model, there are currently quite a few (several hundred in the world) real world examples of entire communities that have become sustainably energy independent [16, 28].

A key goal in achieving that independence is to keep income from the venture within the community to the greatest extent possible for the direct benefit of its members. The traditional investor/owner/operator model is one that largely is owned by outside investors, run by outside management, operated and maintained by employees from outside of the community and dictates that profits be distributed not to the community but back to the outside investors in return for their involvement. This model rationalizes that the outside investors are relatively heavily capitalized, have the political and influential connections to be able to effectively take the risk and lend money to these types of ventures. As such the model also rationalizes that because of these factors that the outside investors deserve 100% of the profit returned from the investment in order to compensate them fairly for the risk that they take.

The community model re-balances this relationship by engaging both groups in a mutual partnership arrangement. The aim of such an arrangement is to provide economic and socio-economic advantage to both the community and it's outside investor, be it the utility, municipality, business partner, bank or outside investor such that all parties derive fair and equitable benefit. It is a model that recognizes the risk taken by the outside investors and compensates them fairly for their investment while at the same time adding a new dimension to the "recognition of risk" factor taken by the community as well.

Here-to-fore there has not been much emphasis on the "risk factor" that is being undertaken by the community. In fact it is the community where the endeavor is being built, will operate for 20 or 30 years, impacts them by either providing or not providing direct company jobs, or impacts them by upsetting them to see the jobs go outside the community, it impacts commerce within the community, i.e. trucking, maintenance services, package delivery, and many other commercial offshoots, it directly affects the design and aesthetics of the community, it impacts the educational opportunities provided to the community, affects the return of profits and corporate benefits to the community, influences how community members think of themselves no longer as passive bystanders, but now business owners and financial partners with a say in determining a vision for the future of their community.

It also influences how the community members think of the possibilities for their own and their family's futures in regard to business ownership, jobs and careers. It also empowers them to recognize that it is their community's partnership with the municipality that has the potential to open up opportunity to provide land and resources to be able to share in determining how these resources might be best shared with the community to serve to benefit it and its partners to the maximum extent possible. It is both the community and their chosen partner's that are equally impacted by the decision to build a community wind power system in the neighborhood. It is the purpose of this model to demonstrate that with some new and out-of-the-box thinking that there can be a much more effective way to maximize the financial as well as societal benefits beyond those currently enjoyed by both partners being separate as is in the model.

In order to accomplish the objectives stated above, there are several key lessons learned that are significant enough to mention here before continuing in order that best practices can be appreciated and more so applied to future projects. First and foremost, the better designed community sustainability collaboration schemes have in common the fact that they put the interests of the community first. It is this crucial fact that seems to elude many communities that attempt to employ a sustainability effort in their own backyard, and fail. The better run collaboration schemes go to every length to plan, collaborate and enjoin not only people

within their small sphere of influence or social network but also include all of the key actors and outside influences in their plan. Many of the very best go so far as to reach out to their traditional opposition and try to get them to join the group, not to convert them but to get their balanced input so that should the community plan be developed it will have the very best pro and con perspectives and observations incorporated into their key documents. These groups actually "reach out" to other community members and request not only their opinions but also their active participation in the development of the community.

As discussed earlier, it is important to pay particularly close attention to the dynamic we call collaboration. It can and does determine whether projects succeed or fail regardless of the technical merits and planning that may have gone into the project.

Next we consider the Community partnership aspect of the model. Our partner model relies on the concept of the community members taking action and organizing their combined community strengths including their, intellectual and financial capital, political will, business acumen, educational and technical expertise for a common vision and cause that benefits all of its members equally. Those members include the community and activist organizations at large, the utility, municipal, educational, financial, legal, and business owners that have a stake in the community and have its best interests first and foremost in their hearts [4, 9, 15, 28, 30].

The model we propose is to develop legal partnerships between the project partners in the community that will come together for the specific purpose of developing, operating and maintaining wind power and its associated infrastructure for the benefit of the community. The partnership and resultant benefits that we propose are as follows:

- All community members and partners participate in the development board to insure all opinions are accounted for and addressed properly.
- Employ a Cooperative legal business structure that provides financial opportunities for its community members. Consider either for profit or non-profit model. Either way the financial benefits go directly to the community members and their business partners.
- Lower electric bills.
- Puts the community and its partners in charge of business decisions giving them a sense of control over their utility spending and allowing them to think like a business thus keeping expenses in check.
- The cornerstone community partnership in the model is that of the community and local utility in which a 50/50 business partnership is created. Revenue is shared equally.
- Excess revenue generated by the turbines is returned to the community to lower their electric bills or reinvest in other parts of the community.
- Operational, managerial, technical and maintenance responsibilities are also shared by forming a mentor/apprentice style relationship between the community members and the utility that apprentices community members in all aspects of the operation of the community utility.
- Municipality partners with community to provide zoning and political assistance and provide access to available community land for locating the turbines.
- Develop an educational community partnership to provide K-12, community college and university training in support of all aspects of operation of the community utility including business activities, technical, operational and maintenance/service activities. Include job, career and professional training as well as community and professional seminars inclusive of activities for K-12 and college level clubs, extra-curricular activities and competitions [12, 15, 16].

- Community construction and ongoing operational jobs to be legally reserved via ordinance for only the community members that live within the bounds of the community. Use the concept of community enterprise zones to accomplish this task. These are to be modeled similar to the business enterprise zones currently being used in the State of Michigan.
- Commitment to financing through local member banks and credit unions located only in the community area.

The prime directive of the community collaboration is to create an economic engine that will add value to the community by providing business partnership opportunities to the community members as well as jobs [29], technical and business education, apprenticed partnership and mentorship in all aspects of the operation of the system as well as provide direct cooperative style financial benefits

The educational aspect of the model includes training appropriate for middle and high school, community college and university levels that is either preparatory in nature or required to fulfill requirements to support job functions within the cooperative. These job functions include the technical disciplines such as the skilled trades as well as service and maintenance jobs, on through clerical, administrative, and professional disciplines such as finance, management, accounting, human resources, engineering and others [29]. It is necessary when planning the project that the educational program be developed in support of its long term viability.

To support the educational aspect of the Community Wind Power Cooperative model a formal alternative energy/sustainable community program should be set up by the community cooperative in partnership with the State of Michigan for grades K-12. Each school should be funded to develop its own independent alternative energy/community sustainability program. Funding to support alternative energy champions at each high school within the community should be provided. Ideally two or three of the champions should be assigned as to be liaisons between the schools, cooperative and municipality to insure that the school program is meeting expectations. This is a model that has been successfully applied in California schools [4, 12, 15, 35-37].

In terms of the community college and university training it should be closely coordinated with the wind power cooperative management and labor force. This is in order to be sure that all of the necessary trade, administrative, business, finance, engineering, and other professional disciplines required to run the business are being properly supported and that the curriculums are appropriate to meet the businesses needs for producing local talent to support the business.

Beyond paying attention to education we propose doing smaller projects, first which is a proven method in Asia with which to gain experience [16, 17]. From that experience we propose developing a template which includes all of the best practices identified on the smaller projects. From there we grow the model and expand its deployment in a controlled and measured manner in order to insure incremental and ever increasing success. Our model demonstrates community collaboration can be not only be profitable but also provide jobs, security, socio-economic benefits but also ecologically sustainable community benefits for everyone in the community. Also employed is the use of a PPA Power Purchase Agreement with its utility. This agreement allows for the cost of the system to be paid back in a new way. First the power used is all that is charged by the utility as one part of the payment. Second the capital costs are treated separately and a 2nd payment schedule is charged for the cost of the capital, after all tax credits and rebates have been applied [16].

The effective use of this concept has allowed the district to be charged a lower rate. For instance, the Los Angeles Community College District (LACCD) example shows that the district is charged at 13 cents per kWh instead of the standard 16 cents per kWh [16]. This has resulted in a $9 million dollar savings for the district per year. In addition because an accelerated 5 year depreciation schedule is being used and the original contract allowed for the district to purchase the entire system after year 5, that after that time if they decide to execute their option to buy, that they would now take ownership and have reduced its energy use bill to nothing at that point. Of course the system will be older and require maintenance, but it would be at a much lesser rate than would otherwise be available to them [16]. As previously stated the people part of this equation or "partnership" is by far the most important element of making this project a successful one at the community level.
Financing part in the Detroit Model shall consist of 3 components as in the LACCD model [16]. First is the "power unit used" payment model that is composed of the monthly per kilowatt hour charge we pay for the power we use that is associated with the financed components of the project. The second component is the payment that is charged for the financed component of the project that is amortized over a period of usually 15 years or more. This model provides a financing package that allows the loan portion to be paid off over time at which the payments go to zero. The last component is a buyout component that allows the city to purchase the system after five years or optionally anytime thereafter. This model also gives 3rd party financial investors an opportunity to provide the financing to the community and take the depreciation, incentives and tax rebates while assuming the risk of the project financing. It also however provides the ability for the community to benefit from the financial investors by way of receiving lower payment terms than would otherwise be made available to them by using this method [16].

6. Detroit and south eastern michigan community cooperative wind energy model: an example

A discussion of applying the proposed model in the Detroit area is given in this section. The model shall be put in the context of providing direct economic, social, and ecological benefits for the community via implementation of solar, wind and hybrid infrastructure projects within the community. The goals are as follows:

- Develop a model for the implementation of renewable community based wind power as related to sustainable community development synergies, their effectiveness, costs and acceptance.
- Promote and integrate the 3E's + 1E sustainability dimensions previously referenced, into our model [5].
- Include an optimized continuous improvement process in our sustainable community development model [17, 20].
- Define the community impacts and outcomes [9, 10, 16].

Before presenting the details of the model we present a brief review of Detroit's current socio-economic, geographic, demographic and environmental state of affairs. We hope this will give the reader a contextual understanding of why we are now at a critical tipping point where truly innovative socio-economic initiatives can be launched to provide previously unheard of levels of advancement for the citizens of Detroit and then copied and applied in other communities throughout the state of Michigan.

Detroit in 2011 is a city of 713,777 residents living in a 139 square mile area. This is an area that would include the combined areas of San Francisco (46.69 sq. mi.), Boston (48.43 sq. mi.) and Manhattan (22.96 sq. mi.) leaving 20 over square miles left over [6]. It is a city that has lost 61.4% of its population since 1950 when it was at its height of growth. It has a population density of about 5,135 people per square mile on average which is high compared to other cities such as Dallas with 3,400/sq. mi. and Phoenix with 2,900/sq. mi. However, Oakland County a suburban neighbor of Detroit has a population density of 1,400/sq. mi [6]. The greater Detroit region including its combined suburbs has a population of 4.4 million and has grown to that level from 3.9 million in 1960 [6]. Its form of government is referred to as a strong mayoral/city council form of government. Detroit has an average of 2.74 persons living in each household.

Of the total of 139 square miles of property within the city limits, 40 square miles is vacant. Most of this land is defined by smaller parcels ranging from 40′ x 40′ to 2.5 acres in size [6]. However much of that land is adjacent to municipal owned property, school property and utility and commercial/industrial park owned property. With the above in mind there are several aspects of the Detroit Model which aspire to take advantage of the above opportunity which is unique in Detroit's history and to benefit the local members of Detroit's communities and neighborhoods.

The model as we have previously stated and which we further elaborate upon later in this chapter is predicated upon the partnership between local communities within the Detroit region and their municipalities, utilities, schools and local businesses. In support of this effort the model proposes the use of land banking, an idea of Dan Kildee the treasurer of Genesee County, MI [6]. It simply states that vacant land be put back into productive use by giving it back to the community for free via annexation, for worthy community projects. It is an offshoot of the tried and true homesteading philosophy that our country was founded upon. By allowing the community to use this property for the generation of electricity for their members it would provide them with all of the afore-mentioned socio-economic benefits. This property can also be coupled with other municipal, school, utility, and local business properties to create urban wind and solar farms consisting from 1 to 10 (100 kW – 2 MW) wind turbines and from 5kW up to 100 kW solar arrays as well.

The property that is given to the community can but does not have to be located within the community itself. It can consist of one large parcel; or, it can be made up of several smaller geographically disconnected parcels located in different parts of the community or even the city.

The important thing is that each of them be annexed and put under the jurisdictional ownership of a particular community for their use and benefit.

Typically a given parcel or geographically dissociated parcel(s) located within the community or elsewhere in the city will have between 1 and 10 turbines of from 250 kW to 1 MW each and possibly 1 to 5 solar arrays of the similar size in power. Also note that hybrid models such as using wind and solar power together are capable of providing power than either of them are alone. When the wind is blowing the sun may or may not be shining and vice versa.

Thus, together they can supply power for longer periods than either can provide by themselves. However, if the wind is not blowing or the sun is not shining then neither can provide power. In this case the grid would still supplement the required power.

Furthermore, a typical Michigan home as of 2009 uses about 644 kWh of energy in average per month based on the statistics provided by the EIA (U.S. Department of Energy's, Energy

Information Administration). This means that a 1 MW wind turbine or solar array could support under average circumstances (i.e. 25% capacity factor, meaning that it can supply 25% of the 1 MW of rated power for the turbine on average throughout each day) about 250 homes could be supported per 1 MW turbine. This is a rough "average", and doesn't consider peak usage periods, or better capacity factors, but is sufficient to demonstrate how many houses in Detroit, MI might be able to be supported by each turbine. Now remembering that the average population density in Detroit is very high at 5,135 people per square mile and that the average household has 2.77 persons living in it. In other words, there would be approximately 1,853 households per square mile that we would need to provide power to within that area. This would require an average of 7.5 1-MW turbines per square mile.

The Detroit Model does require however that the units be located close enough to the community that they are easily accessible to the community workforce and visible to the members of the community. This could mean that they are up to 5 miles away depending on their size as they are highly visible for quite a distance. Preferably however land could be provided adjacent to the community given the amount of vacant land, utility, school, business park and municipal property previously discussed.

All of these turbines would also power the grid and add to its present capacity within the city, making it much more robust, reliable and capable of withstanding power failures because each turbine in the grid is backed up by all of the others. The main point is that the Wind Cooperative location is annexed or the property owners are given ownership rights by the municipality to take advantage of the Community Enterprise Zone benefits discussed earlier.

Larger turbines (e.g. 2-3 MW) would of course allow for fewer turbines to be required, however for aesthetic and social reasons we choose to use the smaller units so that they are not as imposing and don't cause as much controversy as the larger units potentially could.

The power generated shall provide the community with "member cost managed" electricity for the benefit of local housing, public community projects such as urban farms [25], local community organizations, schools, and businesses [6]. It shall also provide its members with income from the sale of excess energy not used by the community, but sold on the external market for profit or as REC's (Renewable Energy Credits) which can be traded on a renewable energy commodity exchange.

In addition the partnership shall provide local education, training and jobs for the members of the local community. These jobs shall include the skilled as well as professional positions needed to own, operate and manage the wind collaborative as a business in partnership with the utility. The jobs and educational programs needed to support them include: accountants, business/operational and technical managers, electrical, construction and mechanical skilled trades, electrical, mechanical and service technicians, engineers, community outreach personnel, school alternative energy liaison's and many other disciplines.

All of these career opportunities shall be reserved for members of the local community, who live within its "Community Economic Enterprise Zone", that being a specified geographic zone defined by the local community and municipality by ordinance. The municipality and state shall provide, via legislative action tax incentive to those living within the zone for a period of 7 to 10 years just as they presently do for businesses willing to establish operations within the currently popular "Economic Enterprise" and "Free Trade Zones" within the state of Michigan. The difference here is that the tax benefit will be provided to the

individuals within the community as an incentive to commit to live, work and participate in the community wind collaborative for a stated period of years. This part of the Detroit Model is intended to bring intrinsic value to the community that is to be viewed as a tangible benefit for people wanting to become part of the community while at the same time providing them with the socio-economic and educational benefits that the community has to offer its residents.

In the long term the model's "local community member's only" zone concept first stabilizes and then enhances property values, brings attention to the neighborhood and provides the magnet for being a desirable place to live, find educational opportunities, jobs, potential for business profit, lower electric rates, community pride of ownership and community sustainability. These values are specifically intended to be reflected in the enhanced worth of the household properties within the neighborhood should they ever be put on the market for sale by the individual owners. Favorable tax incentives are intended to attract people to become members of the community. Ultimately the intention is to provide a desirability and quality of living for each member within the community that impacts them in a very personal and yet community oriented way.

When considering the Detroit Model it is important to recognize that it is first of all a localized neighborhood based model. It is a model that is intended to be championed and driven by the local residents of the community. It must ensure that the "residents drive the process" [24]. It is imperative that there be effective community involvement at every stage of the process and that their concerns are addressed at every level. It is equally important to garner the support of the local municipality and seek guidance from it in order to achieve the goals of the project as defined and championed by the community members [10, 22, 23].

In order to accomplish the above the Detroit Model proposes using "Community Champions" to represent the voice of each of the key constituencies within the community. These champions are people nominated by their constituency to actively represent, engage, and ultimately integrate each of their particular group's interest's and vision into the fabric of the community wind power cooperative. The objective is to have these champions interact on a regular basis which consequentially will then result in a most effective tool for promoting the goals and objectives of the cooperative as a whole. In this way all of the constituencies within the "community" are genuinely represented and their voices heard. More so however as the project progresses throughout its life, each of these constituencies have ongoing involvement in the project which allows for more effective communication between each of their groups.

This aspect of the champion idea is where its true power resides. The champion board is not only expected to have its regular member meeting, but also is expected to take their meetings to each of the member constituencies to inform them of the group's progress on a regular basis. In this manner each of the individual constituencies will be assured to have regular input into the process as well as be regularly informed of the progress of the group as a whole. Mean while the individual champion for each group are expected to regularly inform their own constituency of their individual progress. In this way each constituency has the opportunity to voice their individual concerns while also being able to contribute their unique abilities and talents to the project.

The concept of using an ongoing board of directors insures that open communication of the goals and objectives of the collaborative are being effectively met throughout the life of the wind power collaborative.

Yearly elected collaborative board of directors (i.e. champions):

- Community Champion(s) [26]
- Community Special Interest Champion(s) [26]
- Religious Community Champion
- Municipal Champion – Mayoral and City Council Champion [22, 26]
- State of Michigan Champion – Representative of congressional district staff
- Utility Champion
- School Champion(s) – One per school, where alternative energy curricula is being taught
- Business Community Champion
- Bank/Financial Institution Champion
- Legal Community Champion

The Detroit Model is based on a localized community enterprise zone concept that is especially well suited to meet the socio-economic needs of many Southeast Michigan communities today. We believe that because the state of Michigan is currently experiencing here-to-fore unheard of negative dynamics in regard to its socio-economic viability that it is precisely due to these factors that the region is optimally positioned for the introduction of the Detroit Model. Perhaps at no other time in its modern history are so many people in the region united in purpose and conviction because of the commonality of economic cause that they have experienced. We believe that because of these factors the model is unexpectedly and yet opportunistically positioned to address the socio-economic needs of the community.

We base this opinion on the fact that in history it has been noted that in many cases that tipping points occur when certain critical streams of events or conditions converge and present themselves in a city's, country's or even a civilization's field of view as they progress throughout history. These "conditions" are temporal and opportunistic. If as time passes these conditions such as population, demographic, economic status or social condition changes, the window of opportunity also changes and in many cases vanishes forever.

Case in point is in our own country's history. Our forefathers, Thomas Paine amongst them had the foresight in his call to arms book "Common Sense" to recognize that our population of 2,500,000 citizens in 1775 was at a tipping point in regard to knowing when it was of optimal size for our country to stage a rebellion. More-over he was able to see that waiting 50 years hence when the population might become 25,000,000 that we would not be able to stage a rebellion because the population would in his opinion be too large, distributed and unwieldy to focus their attention on a common cause. There were of course several other critical factors such as the level of industry and commerce that we had achieved, the support of the population for a popular cause, the experience the new country's army officers had gained over the previous 20 years fighting the Indian Wars, and not the least of which, the will of the people in both the U.S. as well as lack there-of in England, as well as other factors that opportunistically converged and were so very obvious to Mr. Paine for him to express that it was exactly the right time to attempt the rebellion. He intuitively knew that our country had reached a tipping point and just like in our own times there was the recognition that certain critical factors and circumstances might never converge again. As a man with foresight, vision and not afraid to lead, he intuitively knew that if these temporal factors changed in the predictable manner that he anticipated, that the window of opportunity could and most probably would vanish forever, unless he acted upon the opportunity. We

need to heed this lesson and apply its wisdom in modern times when we see these opportunities borne out of painful experience that confront us and make use of them in order to take action and leverage our cause.

The point is that when the time is right it takes foresight and leadership to recognize when it is the optimal time to act in order to not miss the window of opportunity being presented to us, even if it is borne out of painful experience. This is what the Detroit Model attempts to accomplish by providing a roadmap for addressing the rebirth of Southeastern Michigan's communities. The difference is only that we use the community wind power collaborative concept as the vehicle to achieve the goal. It is important to note however that it is a model that is untested up to now, in any highly urbanized city setting. There are large projects such as the LACCD project previously mentioned, but none of the smaller, more modular scale and intentionally tailored to be easily replicable as the Detroit Model proposes. As such we propose that the initial project(s) to be limited in size and scope as follows:

- Size will vary but be based on relatively small area neighborhoods or subunits thereof within the city. This is crucial especially in the initial phases of the models introduction to the city. Initially two neighborhoods should be selected via a Six Sigma Process through collaboration with the city leadership and Wayne State Engineering and Urban Planning department personnel.
- All of the previously mentioned pre-project preparation group dynamic management tools shall be applied in the model.
- Six Sigma, Lean and Best Practices including Toyota A3 project status reports shall be integrated into the methodologies of the project in order to optimize results. This includes establishing reliable timelines and formalized process management procedures for all of the key performance goals and milestones established for the project [4, 20].
- Currently there are several community revitalization projects being implemented within the city. The three best of these should be considered as possible implementation sites. And one selected for implementation of the model.
- The size of the neighborhood should depend on the mix of residential, commercial and industrial usage within the neighborhood and its physical footprint should be kept to a relatively small size for sake of simplicity and ease of management for the initial project.
- We recommend 1 square mile quadrants or less. By limiting the project to one of relatively small size such as this, effective understanding of the outcome(s) can be appreciated, firmly understood and finally formalized into a "How To" best practice guide.
- This initial project is to be considered an alpha test site project (with the community's knowledge and buy in of course).
- That "Before" and "After" snapshots of the project should be documented in order to provide a comparative validation to the community, stakeholders, partners and outside observers for the justification of the project. And to provide the project itself with a "Vision".
- Future projects shall then be "cookie cut" with appropriate modifications based on the "How To" best practice guide described above. It is important that this "smaller is better" regimen is adhered to because it provides for the greatest chance for success, as opposed to trying to implement a project on a larger scale. Once the model is optimized, then it is appropriate to expand the size and scope of the future projects to be considered.

- Initially a "community outreach" is required after the sites are selected. Continuous and ongoing meetings shall be scheduled to include, inform and involve the public. All interested and "invested" partners are reached-out to in order to develop a robust collaborative environment and group.
- Initially meetings will focus on conveying the concept of the community sustainability model in order to educate the community on how collaborative efforts of this type are formed and how they operate. This is a crucial step, as it sets the tone, guidelines and behavioral attitudes before commencing with the work of developing the community plan. This phase can take up to a year to complete.
- A "vision" for the community shall be established. It should include the E3 + 1 Community Partnership concept in its charter. The entire focus should be put on how the wind, solar and utility initiative shall benefit the community and its partners.
- Legal entities shall be formed between the community and utility to form a 50/50 community cooperative business structure. This idea is a cornerstone of the model. From it several other key advantages to the community and the utility shall evolve.
- Several key subgroups shall be formed within the cooperative as follows and they shall each be responsible for developing their part of the overall plan:
  - Community/Municipality/Legal to form a partnership to manage the political and legal aspects of the project at local level
  - Community/Federal/State/Local Government and Religious community to work on the socio-economic aspects of the project and grant submission process to the state and federal govt.
  - Community/Utility to form a partnership that will allow for business and technical mentorship, apprenticeship and profit sharing.
  - Community/Utility/Education to form a partnership to develop a K-12, community college and university training program to support the business, operational and technical aspects of the community collaborative.
  - Community/Business/Financial Institution to form a partnership to address the business and financial socio-economic aspects of the partnership. And determine the optimal financial solutions for project implementation.
  - An advisory group consisting of members from each of the stakeholder groups that help guide and focus the project and subgroup activities.
  - The cooperative shall be based on the concept of either a for profit or not for profit model, but the result should be that it provides the community with: Business ownership; Jobs as employees of the utility Educational opportunities to train specifically for all of the disciplines required to operate the power system; Profit sharing from the business opportunity; Lowering of electric bills.; Direct control over the business decisions that are made in regard to management of the power system cooperative thus helping to mitigate the cost of energy for the community.
  - Development of a program similar to the Detroit Edison Green Currents Solar purchase program is a focus and will help the community lower and manage its energy costs. This is a program that gives the community access to funding for alternative energy projects within Michigan communities, which is paid for by DTE.

Ultimately through use of instruments such as those discussed in the LACCD example, the Detroit model shall seek and make every effort to make the project "pay for itself" through carful financial planning of the project financing package. The goal is to lower monthly

energy bills such as the LACCD project did and gradually gain complete financial ownership of the system over a period of years, thus at that point in time allow for even further reductions in cost by separating the monthly energy unit delivery charges from the cost of paying for the assets over time via 3rd party investors (community partners) through optimized financial loan agreements that get paid back over time, thus leaving just maintenance costs remaining for the life of the system, leaving the community with a reduced bill at the end of the month for this aspect of the project as well.

This coupled with the financing being provided by the community's own "Common Good Bank" discussed previously, will allow the community members to not only partake in the wind power project's financial, jobs, educational and socio-economic benefits, but also give them the same opportunity to share in the same type of benefits derived from the community cooperative bank in which they have their own ownership interest.

As previously mentioned we recommend the integration of the Six Sigma and Lean concepts into the model. Six Sigma is a continuous improvement methodology that optimizes processes and quantifies expected results in a very deterministic way in terms of the project's execution as well as its financial return. This methodology has proven to be very successful and has helped to streamline the coordination and implementation of community wind projects in multiple cities all across the country [4, 17, 20].

7. Discussion and conclusion

A socio-economic model of community based wind power systems was given in the chapter. The application of the model in the Detroit area was also discussed in this chapter. In order to "ground" the model in practical and not just lofty terms it is necessary to include a business oriented perspective and approach to solving the challenges that developing community wind power present. This involves understanding the "how to" part of the equation that is necessary in order to take action while using measured and yet community sensitive techniques and methodologies to achieve the goals. Business models exist for satisfying this requirement and will be included in our model as well.

It is also of paramount importance to insure that the group dynamic is stable. The human action model makes it clear that it may be impossible to progress to the stage of effective group collaboration without accommodating group dynamics first. The "group dynamic" must supersede all other dynamics involved in the project including the technical dynamic. As a primary variable in our effort it can prevent us from achieving project success despite the quality or success of other dynamics involved in the project. The human action model provides us with insight and concrete solutions for addressing the group dynamic before "team dynamics" issues become critical.

Above all the Detroit Model is a model for establishing a socio-economic engine that uses community wind power cooperatives as the vehicle for creating community jobs, education, socio-economic wealth and pride of ownership that is supportive of community sustainability ideals that will result ultimately in a vibrant and successful future for the residents of the communities in Southeastern Michigan.

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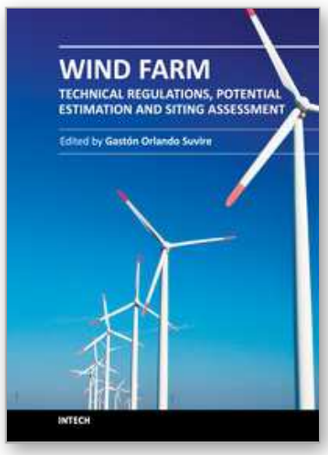

Wind Farm - Technical Regulations, Potential Estimation and Siting Assessment

Edited by Dr. GastÃ³n Orlando Suvire

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The evolution of wind power generation is being produced with a very high growth rate at world level (around 30%). This growth, together with the foreseeable installation of many wind farms in a near future, forces the utilities to evaluate diverse aspects of the integration of wind power generation in the power systems. This book addresses a wide variety of issues regarding the integration of wind farms in power systems. It contains 10 chapters divided into three parts. The first part outlines aspects related to technical regulations and costs of wind farms. In the second part, the potential estimation and the impact on the environment of wind energy project are presented. Finally, the third part covers issues of the siting assessment of wind farms.

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