

UNIVERSITY OF CALGARY

Development of an Analytical Tool to Assess a Community's Sustainable Energy Needs

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Abstract

Governments and industry support community energy initiatives with various funding sources. However, we have observed that some proposed renewable energy projects are not properly identified, evaluated or implemented, especially in indigenous communities, resulting in mistrust among the beneficiary communities, project proponents, consultants and funding sources, as well as increasing the risk of project failure. Therefore, our research question is, “What are the factors to be considered in determining the sustainable energy needs and priorities of a community?” A solid project proposal requires proper project identification which in turn requires a properly conducted needs assessment centered on and driven by the community. A solid framework and sound analytical tools are required to determine a community’s baseline and effectively identify its needs and priorities, following established project development methodologies, to properly evaluate and identify the most appropriate sustainable energy project for a given community.

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List of Acronyms and Abbreviations

BREEAM - Building Research Establishment Environmental Assessment Method

CEC - Commission for Environmental Cooperation

EIA - Environmental Impact Assessments

IIRC - International Integrated Reporting Council

KPI - Key Performance Indicators

LEED - Leadership in Energy and Environmental Design

LCA - Life Cycle Assessments

MCDA - Multi-Criteria Decision Analysis

NREL - National Renewable Energy Laboratory

SIA - Social Impact Assessment

SROPTTC – Site, Resource, Off-take, Permits, Technology, Team, Capital

UNDP - United Nations Development Programme

UNESCO - United Nations Educational, Scientific and Cultural Organization

Chapter 1 - Introduction

1.1 Background

The need to properly identify a project in the context of community sustainable energy development cannot be over emphasized. Funds are available from governments and other sources to promote renewable energy development in communities. Communities need sustainable energy for economic and social development, especially indigenous communities who are being left behind or have been deficient in meeting their energy needs due to location or other factors.

The project identification approach is typically from the point of view of an interested third-party as the project proponent who intends to build a renewable energy facility in a community. It has been observed that most of the proponents already have preselected potential projects based on their own agenda and then try to fit it in the community. A third-party project proponent who does not consider the key elements of a sustainable energy project from the community's perspective will have a high risk of project failure. Our position is that the community must be the main project proponent and it is the members' point of view from which a proper needs assessment must be conducted.

The available funds from government also attracts ill-intentioned project proponents whose main purpose is to obtain the funds with less regard for project success. This creates mistrust with all parties involved. On the other hand, some well-intentioned communities have a very small chance of obtaining funding as project proponents since they often do not have the capability or access to the resources with right expertise to properly package a project proposal.

A solid project proposal starts with a proper project identification. A proper project identification requires a properly conducted needs assessment for the project proponent community. To be successful, a needs assessment must include key factors to consider in establishing a baseline. As a minimum, the needs assessment must consider: 1) what natural resources does the community have and what potential technologies are in place to harness it, 2) what is the community's development plan and/or what does the community need, 3) what resources does the community have access to, 4) what capacity or capability does the community have 5) how does the community intend to be organized to support the project and 6) what should be the business structure to optimize the project's economic benefits to the community.

General guidelines and frameworks for the criteria and factors to consider have been developed by government, international development institutions and academe in support of initiatives to properly conduct a community sustainable energy needs assessment. However, there are gaps in terms of operationalizing these frameworks and guidelines to make it an effective tool for implementation.

1.2 Goals and Objectives

The main goal of this research is to develop a worksheet that can be operationalized at the ground level for establishing the baseline in assessing a community's sustainable energy needs. The worksheet will be used as an analytical tool to identify the optimal project for the community, as the project proponent, considering other factors such as organization, capacity building, business strategy and ownership structure, which the community can pursue with the highest level of confidence. It will result in a project that has complete buy-in from the community with a solid foundation for a project proposal that can be used to raise funds and

make the project a reality. A community's energy needs assessment process will be based on inputs from its active engagement and participation, the initial resource assessments in the community, the potential environmental implications of the resource and technology options, and how all these can be optimized to provide maximum social benefits to the community

1.3 Inter-Disciplinary Aspects

Our research looked at the combined dimensions of energy, environmental and social aspects, along the expanded view of the five capitals model, in conducting needs assessments for project identification. The five capitals model provides a foundation to understand sustainability in view of the economic concept of value creation, or 'capitals'. The five capitals are: human, social, natural, manufactured and financial. A community needs to maintain or possibly enhance its capitals rather than degrade or deplete them to be sustainable.

For the energy dimension, our worksheet will gather data from the community's manufactured capital on aggregate energy demand which will be based on all its members' household energy consumption, including any other non-household energy demands such as administration buildings, community center, sports arena, etc. The community's total energy demand data will be used to analyze and forecast demand growth, excess capacity and other calculations. The worksheet will also identify the community's current energy resources, both renewable and non-renewable, as well as potential technologies to harness these resources.

For the environmental dimension, the worksheet will gather data regarding current state of the community's natural capital including water, air and land conditions. This will be used to establish a baseline to analyze the impact of potential technology options, mitigate risk, address any adverse

effect or a basis for technology selection. The community's natural capital includes its traditional knowledge of the ecological systems which will have a significant impact in project selection.

For the social dimensions, the worksheet will cover the human and social capitals to identify current organizational structure, skillsets, income level, organizational capacity (or lack thereof) of the community and its members. The baseline social data will be used to analyze and determine the connections, the required level of social development (skills, capacity, etc.) necessary to support the energy infrastructure project as well as establish other human and social development programs.

Chapter 2 - Methodology

We conducted a review of community sustainable energy development methods, frameworks and standards from peer-reviewed journals, publications from international development institutions and prior academic research on the subject to determine what had been developed both in terms of specific objectives, i.e. energy demands, infrastructure development, environmental impacts, social/cultural effects, stakeholder engagement as well as other holistic frameworks. We then looked at the foundational concepts of sustainability, community capacity and needs assessments in their own respective areas in greater detail.

We observed various overlaps, connections and relevance to our research that could be integrated to address our research goals. Recognizing the scope and depth of our observations, we consciously narrowed our focus to an area of study that would have the most impact, which we determined to be the identification of the criteria to develop a baseline for community needs assessment. Then we built on the findings from the reviews and drew from our own firsthand professional experiences to determine the most appropriate factors necessary for a proactive assessment. We examined these factors deeper to determine the data and information required as well as the sources and methods of collection to establish that baseline. We determined that the most suitable form for data gathering is a worksheet outlining specific information required as well as a listing of open-ended questions.

Lastly, we availed ourselves of the opportunity to gather inputs and feedback from various community representatives regarding their experiences on community energy needs assessments and proposed development projects in general to refine and validate the worksheets.

We have not come across a seminal reference in terms of the combined aspects of community needs assessments in sustainable energy development that provides a holistic perspective.

However, there are several excellent reference materials with respect to community needs assessments, energy project development or sustainability assessment separately. We examined each of the following separate subject areas in detail to understand their general concepts, focus and purpose.

2.1 Community Needs Assessments

We researched for a framework on community energy needs assessment that will meet the interdisciplinary objectives of this project. We found several academic and practical references available on the topic of community needs assessments that we reviewed, e.g. Director of Military Family Services (2004), National Resources Center (2010), Kievelitz, Schaefer, Leonhardt, Hahn, & Vorwerk, (2004), Silva & Nakata (2009) and UNDP Post-Disaster Needs Assessments Guidelines, Volume A, (2013) but the primary focus of these resources is addressing social issues such as poverty and health and/or mitigating natural disasters or conflicts. We found two authorities in particular, Watkins, Meiers & Visser (2012) and Soriano (2013), to be most useful and relevant for our research objectives on community needs assessments.

In the paper “A Guide to Assessing Needs” published by the World Bank, Watkins et al. (2012) provided a solid general guide about needs assessments that can be applied in any situation. The paper provided excellent foundational knowledge and references on data collection with tools, techniques and checklists for consideration to make informed decisions and achieve tangible results but does not expressly include sustainable development.

In his book *Conducting Needs Assessments: A Multidisciplinary Approach*, Soriano (2013) provided a more in-depth look at the concepts with a multi-disciplinary perspective in a community-based setting, with actual examples that provide valuable learnings and applications. Soriano's emphasis is on the planning aspects of needs assessment looking at the socio-political realities in communities as well as the social and cultural diversities that come into play when planning for needs assessments. See Chapter 3.1 for more details on conducting community needs assessments.

2.2 Energy Project Development

With respect to energy project development, the goal of our research was to find guidelines from subject matter authorities on how energy development projects are approached and implemented. The Commission for Environmental Cooperation (2010) developed a guide to assist communities in the development of their own small-scale renewable energy projects and covers all stages of project development. This guide also covers the community engagement process, discusses renewable energy technologies and resource assessments, and suggests business models and structures. However, it lacks the elements we are looking for in terms of a decision-making process that is grounded in the community's needs. In a technical report, "A Framework for Project Development in the Renewable Energy Sector", published by the National Renewable Energy Laboratory (NREL), Springer (2013) identified seven essential elements for project development which collectively make up the acronym SROPTTC (p. 6) :

- 1) Site – including physical location, legal description, survey, property rights;
- 2) Resource – including availability, quality and characteristics;

- 3) Off-take - the existence of an economic and executable agreement (e.g., power purchase agreement);
- 4) Permits – including all regulatory approvals and permissions required for construction and operation of development;
- 5) Technology – the incremental and on-going evolution of the development of technology relating to the project at all stages i.e. design, equipment selection, construction procurement;
- 6) Team – the assembly of an experienced a qualified team of experts to address all aspects of the development including business, technical, financial, legal and operational; and
- 7) Capital – financial resources necessary to effect all stages of development including predevelopment, development, financing, construction and operations.

This is also an excellent reference for project development after a project has been identified.

However, both references are silent about project identification based on the community's needs.

According to Esteves and Vanclay (2009), social impact assessment (SIA) is another mechanism that is often used for energy project development as “a means of integrating development and sustainability into core business strategies and can assist in building collaboration between the company and communities and government, [but] in practice its application is typically limited to being a project planning tool”. (p. 137) Similar to the references above, there is significant value to be gleaned from the research done with respect to SIAs but, as Esteves et al. (2009) acknowledge, there is a need to change the orientation of SIAs “from predicting and mitigating the negative social consequences of projects towards facilitating positive social development outcomes within a sustainable development framework” to have them be consistent with a

sustainable livelihoods approach (p. 137). See sections 3.3 for more details on sustainable livelihood approach.

2.3 Sustainability Assessments

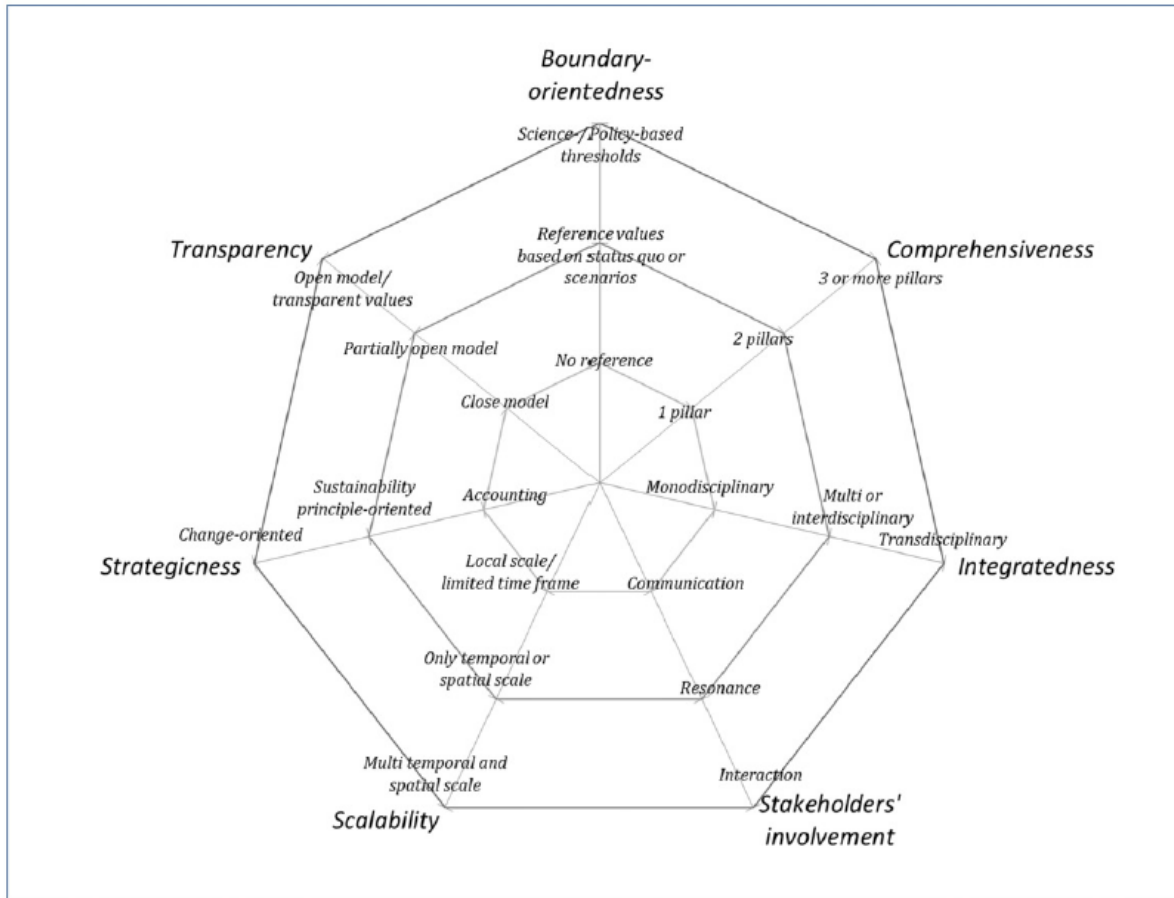
With respect to the concept of sustainability assessment, our research goal was to look for indicators and methodologies for the measurement and evaluation of sustainability. Although there is significant theoretical groundwork that has been completed with respect to sustainability and it being “an integrative function of environmental protection, economic viability and social equity” (Vaidya & Mayer, 2016, p. 1), there are still “diverse conceptualizations of sustainability and no clear rules for its empirical measurement” (Gallego Carrera & Mark, 2010, p. 1031). This is also true with respect to the concept of sustainable development. For example, Robert, Parris, & Leiserowitz (2005), outlined twelve different sustainability indicator initiatives that have been developed to measure sustainable development and created a comparison chart to identify number of indicators used, what was to be sustained and what was to be developed. The initiatives Robert et al. (2005) compared included the Commission on Sustainable Development, Consultative Group on Sustainable Development Indicators, Wellbeing Index, Environmental Sustainability Index, Genuine Progress Indicator, Global Scenario Group, Ecological Footprint, U.S. Interagency Working Group on Sustainable Development Indicators, Sistema de Indicadores sobre Desarrollo Sostenible (Costa Rica), Boston Indicator Project, State Failure Task Force and Global Reporting Initiative. (pp. 14-15)

Recognizing the plethora of methodologies and models such as social cost analysis, ecological footprint analysis, exergy analysis and multi-criteria decision analysis (MCDA) (Özdemir, Härdtlein, Jenssen, Zech, & Eltrop, 2011) that have been developed over the last 30 years, Sala,

Ciuffo, & Nijkamp (2015) developed a systemic framework for sustainability assessment overall that confirms the complex nature, and validates our initial assumption that there is not a single one-size-fits-all framework, of addressing community sustainable energy needs assessment. According to Sala et al. (2015), “the analyst often needs to combine different methods, models and indicators” (p. 320). The main challenges in integrating and combining various methods include: 1) the actual integration of multi- and inter-disciplinary perspectives while achieving meaningful results, 2) the creation of a tool that is able to measure and assess emergent properties, 3) uncertainty propagation, 4) replicability of evaluation considering its dynamic complexity and 5) transparency (Sala, Ciuffo, & Nijkamp, 2015).

There appears to be a variety of strategies and approaches based on what is compelling the investigation into sustainability, rather than from the goal of sustainability in and of itself on first instance. Sala identifies the spectrum of criteria for assessing the capability of the various methods to address sustainability as shown in Figure 1.

Figure 1. Spectrum of criteria for assessing the capability of methods to address sustainability



(Sala, Ciuffo, & Nijkamp, 2015, p. 317)

For example, Environmental Impact Assessments (EIA) are strong on transparency and comprehensiveness but relatively weak on integratedness. Whereas Life Cycle Assessments (LCA) are stronger in integratedness but weaker in transparency and comprehensiveness (Sala, Ciuffo, & Nijkamp, 2015).

It is important to acknowledge that there are some systems developed as standards to evaluate sustainability and/or community baselines focused on the review and/or modification of existing structures and/or communities with focus on energy efficiency, e.g., Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment

Method (BREEAM), and Pearl Rating System (Deeb, AbelGalil, & Sarhan, 2015), specific infrastructure development such as that of the World Bank (Bouabid & Louis, 2015). These are useful references but not directly relevant to our research objective.

Chapter 3 – Analysis of Literature

There is a noticeable gap in the literature with respect to a community-first approach for sustainable energy needs assessments. It appears that the most prevalent approach is to evaluate a community with respect to targets that are intended to be achieved or in the context of potential impacts of a project that is being proposed. However, our approach and intention are to start with the community first, then establish goals and targets and identify projects that would be optimal for it. We found very little information and details from the initial literature reviews that we can operationalize for this purpose. Therefore, we looked more closely on literatures focused on the following: conducting needs assessment, sustainable development and sustainability, and needs assessment in sustainable energy development.

3.1 Conducting Needs Assessment

On a conceptual level, needs assessments refer to the well-planned, systematic process of collecting objective data and information that reveals or enhances understanding of the need for services or programs (Soriano, 2013). Needs are the issues that are revealed through a systematic process. Needs assessments involve identifying gaps between the current state versus the desired state. Thus, it is critical to first establish a starting point, or a baseline, which is an inventory of the current conditions, or state-of-affairs, to do a proper needs assessment. Needs assessments identify how wide the gaps are, independent of the premature selection of a potential solutions to bridge the gaps. Needs assessments can be used to determine the community's goals or evaluate a project based on gaps that have been identified in the process.

Gaps are the differences between the baseline and the desired level, condition or performance (goals). It will be difficult to identify gaps if the goals or desired state is not established or not

properly understood. The needs assessment process can also be used to properly identify goals and is an excellent tool for strategic decision making.

3.1.1 Engagement Process and Methods

A critical part of the engagement process is the identification of key stakeholders from the onset during the planning phase. Key stakeholders have roles to play in the entire process and are identified by the nature of their participation, expectations, influence on the outcome of the research and the goals of the needs assessments. Key stakeholders are mostly internal to the community but may also involve external parties such as government or nongovernmental organizations, potential lenders and other third-parties.

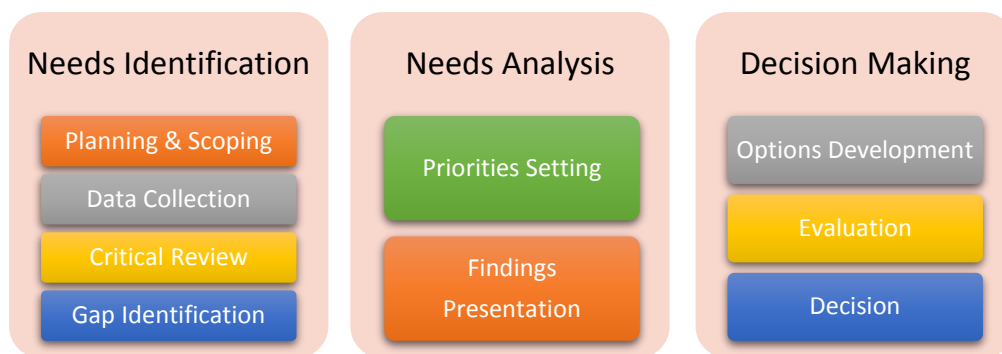
Some important primary information for needs assessments comes directly from individual community members and requires an effective engagement process that will facilitate data collection, verification and confirmation to ensure accuracy and relevance of information. There are various methods of collecting direct information but the most common are direct forms of conversations such as individual interviews or focus group discussions. It is important to first establish rapport with individual respondents before asking questions. Direct interviews can be time consuming and therefore costly. However, it is the most reliable means of getting the most valid and comprehensive response (Soriano, 2013). Open-ended questions solicit insights from respondents that may not be realized with structured close-ended questions. This is particularly important when invoking subjective responses such as preferences and level of significance which could vary widely. Surveys and observations, another form of collecting primary information, may be appropriate in some situations.

It is important to maintain communication with key stakeholders to enhance rapport and build on the trust established throughout the engagement process. Keeping the community informed of the progress is necessary in building confidence and promoting the credibility of the research team.

3.1.2 Three-Step Needs Assessment Process

Watkins et al. (2012) provides a three-step process to ensure that: a) assessments focus on results before solutions, b) needs are studied before making decisions and c) decisions are informed and justified. This is illustrated in Figure 2 below.

Figure 2. Needs Assessment Steps



Adapted from Watkins, Meiers, & Visser, 2012 and modified

- Needs Identification

Planning and Scoping - As in any organizational activity, the first step in needs assessments is to develop a plan. The plan will guide, identify and direct resources required along the way. At a high level, the plan must contain a scope definition, the required information and data, a list of activities and estimated durations, the required resources to carry out the activities and a budget. Scoping sets the boundaries of the research, identifies the research parameters, the key stakeholders, potential sources of information, the research team and confirms the purpose and

goals of the needs assessment. Once the scope is defined, it must be confirmed and agreed with the sponsor in the community.

Data Collection - Data collection is a crucial next step in needs assessments. Most likely, some data and information are already available for other purposes, unwritten or resides within the general knowledge of the community and must be extracted, organized and analyzed. Some data are from primary sources such as community members or leadership while others are available from secondary resources or databases from government agencies or nongovernmental organizations.

Critical Review of Baseline - Once the baseline data and information are gathered, they must be presented to the community representatives for verification and confirmation. This step is crucial to minimize subjectivity, bias or any misunderstanding or misinterpretation on the part of the research team before any analysis is performed. The collaborative and critical review will establish acceptance of the baseline information as true representation of the current state. The review will also encourage an initial reflection on what the ideal state should be as well as assist in goal setting.

Gap Identification - Gaps are the differences between the present and the desired condition or performance. The initial needs will be revealed from gaps which will be analyzed using the steps in the succeeding sections.

- Needs Analysis

Priorities Setting (Establish the priority for each identified need based on relative importance, impact, size, time horizon and scope) - Not all needs that are initially identified require action, have the same level of urgency or importance so this could be a challenging exercise and must be

properly done. Stakeholders may have varying level of importance based on individual impacts of the needs and may not unanimously agree on the priorities. It is critical to see the different perspectives of the needs from various stakeholders. It is also important to identify the inter-relationships of the needs to see any links or dependencies to assist in prioritization. Urgency is also an important consideration as some needs are pressing or have critical tactical implications. Addressing one need may result in indirectly addressing other needs thereby placing it on a higher priority based on its impact. This will also be the time to negotiate and compromise on the criteria for further decision making. The priorities will guide decision making along the way.

Findings Presentation (Synthesize the key information and initial prioritization of the needs and present the findings to the stakeholders) - This provides another level of verification and confirmation with stakeholders, establishing stronger acceptance of the results of the process at this point.

- Decision Making

Once priorities are identified and agreed upon, decisions must be made on the solutions to address the needs. Solutions are activities or projects to achieve the desired results, condition or state.

Options Development - Options are potential solutions to address a need, problem or concern. It is important not to be fixated on a single solution until all options have been considered and analyzed. Therefore, broaden the options without judging or evaluating and consider specific and general alternatives. The use of various brainstorming strategies and techniques can facilitate this stage of the process.

Evaluation - Options must be evaluated primarily based on its ability to directly address the need, the cost, effort and time involved. Multiple options must be considered and compared against the agreed criteria such as impact, urgency or other factors. There are various evaluation techniques and methodologies that can be used for this purpose.

Decision - The final stage is to select the option or combination of options that will most effectively address the needs previously identified.

3.2 Sustainable Development and Sustainability

To fully appreciate sustainable energy development, it is important to understand the key concepts around sustainable development and sustainability. The intent of this section is to provide enough foundational understanding of these key concepts which provide the philosophy behind the design of the needs assessment process as it relates to sustainable energy development. It is not the intent of this section to provide an exhaustive discussion about sustainable development and sustainability.

3.2.1 Sustainable Development

In terms of the topic of sustainable development, the Brundtland Commission's report "Our Common Future" (Brundtland, 1987), provided the starting point for our research. Although not without its own criticisms, Brundtland's definition of sustainable development is the most referenced definition and the most widely used and accepted definition of sustainable development, as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 37). This definition implies the need to preserve and maintain the ability of the natural systems to provide the resources required for economic development. As economic development requires inputs from

the natural environment, it makes sense to preserve and maintain it to sustain economic development. Sustainable development is not only limited to the preservation of natural environment but also includes the human and social aspects.

3.2.2 The Triple Bottom Line of Sustainability

John Elkington on the other hand, expanded the idea of sustainability with his concept of sustainable business in his book “Cannibals with Forks: The Triple Bottom Line of 21st Century Business” (Elkington, 1997), presenting a broader picture of corporate social responsibility.

Expanding further in the sustainability area, the Forum of the Future’s Five Capitals provided an expanded interdisciplinary view of sustainability in the context of capitalism. The amalgamation of the economic, environment and social aspects of development into corporate responsibility has become known as the triple bottom line, also known as the three pillars of sustainability, originally coined by John Elkington. According to Elkington (1997), a business is sustainable when it fulfills the expectations of the triple bottom line of economic prosperity, environmental quality and social justice. Elkington’s model became the foundation for sustainability reporting standards such as the Global Reporting Initiative (GRI). However, Elkington just recently fine-tuned his framework and acknowledged that the focus needs to shift from “best in the world” to “best *for* the world” (Elkington, 2018) and this requires consideration of scale, efficiency and wealth distribution (Daly, 1996). Daly (1996) refers to scale as “the physical size of the economy relative to the ecosystem” (p. 160), while efficiency refers to the allocation of resources corresponding to effective demand and “distribution refers to the apportioning of goods produced among different people” (p. 159).

3.2.3 The Five Capitals Framework

From the concept of the triple bottom line, the five capitals framework expands the idea of the economic bottom line as the financial and manufactured capitals; the social bottom line as the human and social capitals; and the interprets the environmental bottom line as the natural capital (Visser, Matten, Pohl, & Tolhurst, 2010). According to Maack and Davidsdottir (2015), “[c]apital is an asset that produces future benefits in the form of flow of services. The five capital theory states that human well-being depends on service flows from five conceptualized stock categories, where financial capital is seen as a liquid asset to facilitate interchange between the other categories. The stock [categories] are the natural, manufactured (durable), human and social capitals.” (p. 1342).

From a corporate perspective, “capitals are the basis of an organization’s value creation. . . . the capitals are not entirely independent. The exact nature of their interaction is a function of organizational focus and beliefs.” (International Integrated Reporting Council, 2013, p. 3).

“To link capitals to sustainable development, Pearce and Atkinsons suggested that countries are sustainable if its combined capital assets are non-declining.” (Maack & Davidsdottir, 2015, p. 1342). “[I]t is worth noting that these capitals interact across space and time . . . this interaction between capitals is not limited to the immediate space where people live but can also occur amongst people separated by space. . . . Thus, it is necessary to view capitals not in isolation or static but as dynamic.” (Morse & McNamara, 2013, p. 35).

Furthermore, “[q]uantitative indicators, such as key performance indicators (KPIs) and in some cases monetized metrics, can be very important in explaining an organization’s uses of and effects on various capitals..” (International Integrated Reporting Council, 2013, p. 4).

- Human Capital

Communities and organizations depend on humans, individually as well as collectively, to function. Human capital refers to the “sum of human capacity, including the knowledge and skills that can be used in the production of wealth and that form the basis of a collective and purposive human endeavor” (Onyx, 2005, p. 2). Thus, human capital is the determinant of resource productivity, product quality, labour efficiency and sustainability (Slaus & Jacobs, 2011) (Maack & Davidsdottir, 2015). In the community level, human capital is the quantity and quality of accumulated knowledge, skills and experience to effectively manage the community’s functioning or development. The community’s population demographics provide an insight into its human capital’s capability and capacity.

Sharpe (2001) identified two basic types of human capital indicators; outcome and input indicators. Outcome indicators “measure the actual outcome of investments” in human capital while input indicators “capture the magnitude and quality” of the investments (Sharpe, 2001, p. 7). Thus, it is important to establish a community’s human capital baseline and conduct an assessment based on key indicators to identify gaps or required enhancements in the context of its development goals.

- Social Capital

Social capital is a complex and multi-layered concept (Onyx, 2005). There have been various approaches at defining social capital, all of which fall along the line of social license, social connections, social agency, diversity, structure and governance. The core concept in social capital is the “networks that facilitate collective action” (Woolcock, 2001, p. 70), in other words the relationships that are embedded in the social fabric. The network itself has no underlying

value but its “potential for such collective action to occur” (Onyx, 2005, p. 4). According to Maack and Davidsdottir (2015), “[i]t shows as general trust, common norms, mutual aid and reciprocity that raises society’s productivity and lowers transaction costs.” (pp. 1346-1347).

As the saying goes, it is whom you know, not what you know that matters more. Someone who is well connected has tremendous benefits from their connections. Networking and social media platforms have demonstrated the power of connections in the past decade. Through connections and associations with groups, organizations or institutions, people are able to parlay what they know into opportunities that would not have been possible without the proper connections (Ramsey, 2016). Therefore, social connection is a type of intangible resource, asset or capital that could be used, or invested in, to gain other benefits or create value for the individual, community or organization. Those who have a wider social network also have access to more information through this network. Thus, information and network reinforce each other. Strong social capital enhances access to information, enabling better decision making (Ramsey, 2016). According to Adler and Kwon (2002), “Social capital is the resource available to actors as a function of their location in the structure of their social relations”. (p. 18).

One perspective of a community’s or an organization’s social capital is that it is the collective of all the social capitals of its members. Another dimension looking from Adler and Kwon (2002) is that it is a community’s relationship with other communities. Social capital, in the project development context, lowers transaction costs, avoids costly mistakes or wrong decisions, shortens cycle/feedback time, and creates access to a broader resource base, among others, that all translate back to enhancing a project’s success or lowering associated risks.

Thus, it is important to understand a community's social capital, or lack thereof, to determine how it can take advantage of this asset, or develop it, in the overall context of community capacity building.

A World Bank published paper by Grootaert, Narayan, Jones, & Woolcock (2004), "Measuring Social Capital: An Integrated Questionnaire", provides very good material on measuring social capital for the purposes of understanding living standards and conducting poverty assessments based on quantitative data on various dimensions. Although Grootaert's paper focused on social needs assessments, it is an excellent reference to develop the worksheet on social capital for community needs assessments.

Lastly, network structures include governing structures as UNDP (2014) describes "[g]overnance [as] broader than institutions and includes relations between state and people" (p. 2).

- Natural Capital

Natural capital is defined as "any stock or flow of energy and material that produces goods and services" (Costanza & Daly, 1992, p. 38). It also refers to the "various ways that the environment power production and supports most aspects of human existence" (Ekins, Folke, & De Groot, 2003, p. 160). In a broader sense, it includes the natural ecological resources and life-supporting systems in the natural environment to produce the products or deliver services, also known as ecosystem services. In the context of sustainable energy development, natural capital contains both the non-renewable and renewable dimensions, and "acts both as a source and sink for economic activities" (Maack & Davidsdottir, 2015, p. 1344).

It is important to measure a community's natural capital to determine its potentials, constraints and carrying capacity for sustainable energy development. The objective of the measurement is

not so much as to assign a value to a community's natural capital but to establish an inventory and analyze its potentials for sustainable energy development.

- **Manufactured Capital**

Manufactured capital refers to the infrastructure, networks, production facilities, manufacturing systems, machineries, tools and technologies that the community controls, owns or leases that are used in the production of goods or provision of services. According to the International Integrated Reporting Council (IIRC) (2013), “. . . the efficient use of manufactured capital enables an organization to be flexible, responsive to market or societal needs, innovative and faster in getting its products and services to market. Secondly, manufactured capital and technology can reduce resource use and focus more on human creativity, thus enhancing both efficiency and sustainable development” (p. 6).

It is equally critical to have a plan how to use these assets to achieve the community's goals and objectives. Conducting an inventory of a community's manufactured capital allows for the assessment of its current industrial or productive capability vis-à-vis its broader development goals. Within the context of sustainable energy development, it is important to assess and understand how efficient the community uses its manufactured capital, in terms of energy efficiency, production throughput, where and how energy is used. From the assessment and analysis of its manufactured capital vis-à-vis its energy profile, the community can determine its course of action and make important decisions in relation to its sustainable development goals.

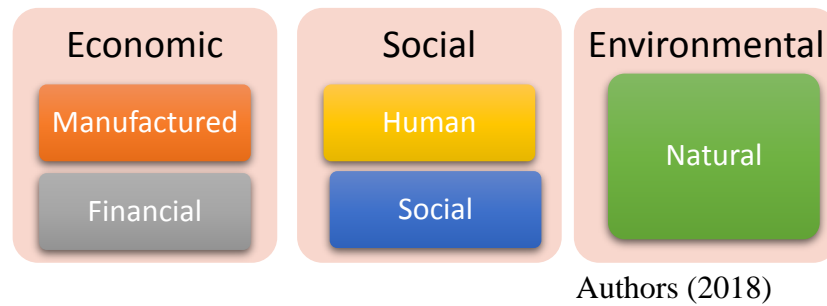
- **Financial Capital**

The financial capital refers to the resources in terms of the financial instruments (banknotes, bonds, stocks) or funds which is a representation of the values of the assets and economic output

of the community. It enables the creation or enhancement of the other capitals to create or derive more benefits. It is also important to assess the sources and uses of a community's financial capital to analyze its capacity to carry out any form of development projects or continue to pay for its operational costs, forecast its trends and understand areas of financial risks that could threaten its financial position, or identify areas for improvement. According to United Nations Development Programme (UNDP) (2017) in the context of livelihoods, there are two main sources of financial capital: available stocks and regular inflows of money. Examples of available stocks include cash, bank deposits, liquid assets, livestock and jewelry, whereas examples of regular inflows of money are pensions or other transfers from the state. “[F]inancial capital is [also] used to facilitate movement of assets between capitals. But [it] also has its own costs in the form of interest rates” (Maack & Davidsdottir, 2015, p. 1348).

In essence, it is logical to look at energy development in the same lens as any other sustainable development activities. Energy development is the development of energy resources, including its extraction, production, storage, transportation and all associated activities, to bring the energy from source in the form required for consumption. To be sustainable, development of energy must live up to the expectations of the triple bottom line as reflected on the five capitals. Figure 3 provides a graphical representation of the triple bottom line and its alignment with the five capitals.

Figure 3. The Triple Bottom Line and Five Capitals of Sustainability



3.2.4 Governance - Influencing Policies, Structures and Processes

In addition to assessing the capitals themselves “. . . it is necessary to examine the policy and institutional context within which these capitals exist, including the legal context and what ‘rights’ may, or may not, exist” (Morse & McNamara, 2013, p. 36). “For development to be sustainable – economically, socially and environmentally – and equitable, a [new] approach is needed that addresses the political, as well as the technical, aspects of development solutions” (UNDP, 2014, p. 2). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2013), institutional arrangements “refer to policies, procedures and processes that countries have in place to regulate, plan, and manage the execution of development, rule of law, measure change and such other functions of state” (p. 25).

It is suggested that good governance processes incorporate meaningful participation “to ensure that political, social and economic priorities are based on a broad consensus in society and that the voices of the excluded, poorest and most vulnerable are heard in decision-making” (United Nations Development Programme, 2014, p. 4). Thus, it is important that any baseline being developed for a community assessment also collect the necessary information to ensure that decision-makers understand the governing structures and processes that are in place and have direct and/or indirect impact on a community’s capital assets.

3.3 Needs Assessment in Sustainable Energy Development

As previously mentioned, proper needs assessments provide solid justification for project identification and development. According to Watkins et al. (2012), the value of needs assessments is in the “logical and disciplined methods it provides for collecting useful information and making decisions based on that information” (p. 2). Therefore, proper needs assessment ensures that the right project is identified and thoroughly assessed before a decision is made to pursue the project. The project must address a fundamental need that came out of the needs assessment process. It provides the foundation upon which early decisions are made based on relevant information and critical considerations. It prevents wasting resources and avoids costly mistakes down the road. Needs assessment is the critical link between the present condition and the desired future state or performance, guiding decisions throughout the process (Watkins, Meiers, & Visser, 2012).

Needs assessment helps in setting priorities. The needs that have been identified could be varied, conflicting, of varying importance or impact, have short or long-term implications, have small or large financial requirements and so on. Setting priorities will rank the needs based on critical considerations and parameters to guide decision making.

A practical example of the significance of needs assessment in setting priorities can be seen in proposed development projects in indigenous communities. We were approached by indigenous communities in Northwestern Alberta and Northeastern British Columbia regarding several third parties proposing potential renewable energy projects in their communities. The third parties propose varying benefits and partnership arrangements with the communities in response to the mandate, funding and incentives provided by government. How will the communities respond to

this opportunity? How do the communities know what is in their best interest? What are the key considerations to make the right decisions? How will the communities optimize the benefits of development projects?

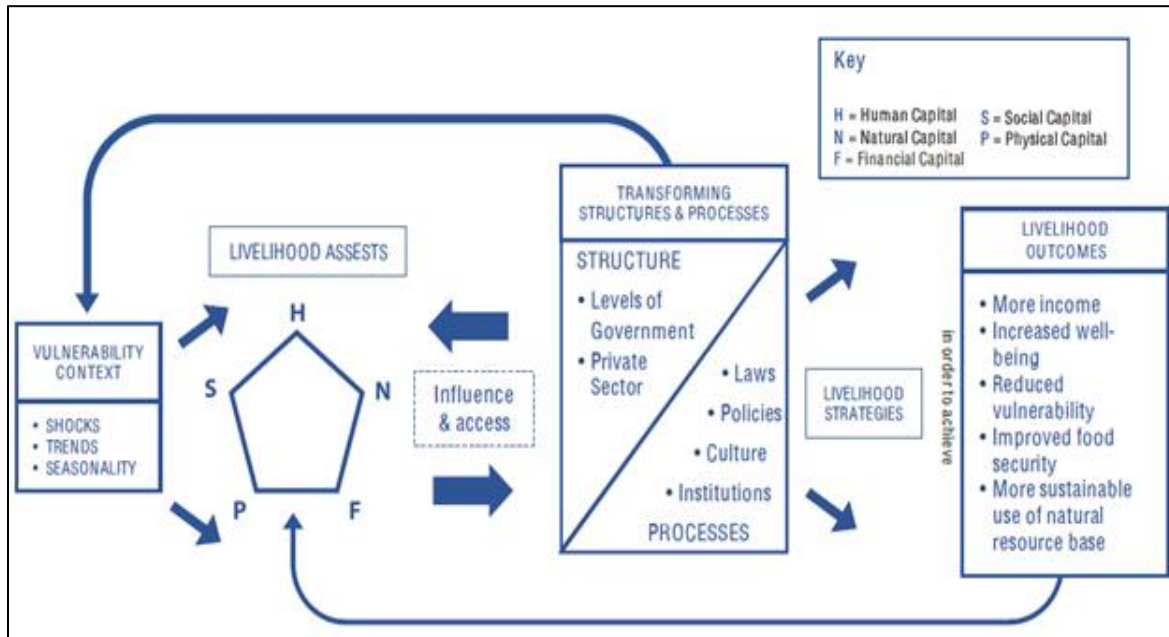
To optimize the potential benefits of any development project, a community must look deeper into its core values and determine what are its underlying issues and concerns to identify the right type of project and partnership arrangement. The best decision will be based on the solution what will address a cross-section of issues. Therefore, the community needs to identify its underlying issues with an interdisciplinary perspective. The community must also understand its constraints, strengths and weaknesses to best address its needs.

To ensure that a sustainable energy development project is indeed the right project, there is a need to conduct a proper needs assessment that is consistent with the sustainability, project development and needs assessment frameworks as discussed in previous sections. Incorporating the concepts of sustainable development with the logical and methodical approach of proper project development and needs assessment for decision making would make perfect sense.

A critical part of the needs assessment process is data collection to establish the baseline. Thus, collecting key data using the five capitals framework will establish an interdisciplinary baseline information as it relates to sustainable development. It should also identify the risks and opportunities within each of the capital as it relates to the magnitude and nature of the gaps.

This is validated by several authorities such as MacKendrick and Parkins (2004), Sprague and Parkins (2012), and the United Nations Development Programme (2017) Figure 4 shows an integrated framework that represents the five capitals as 'livelihood' assets, which reinforces the initial reasoning of our approach.

Figure 4. Sustainable Livelihoods Framework



(United Nations Development Programme, 2017, p. 2)

As shown in Figure 4, there are several core concepts that establish the foundation of this framework. This model aspires to understand all facets of the stakeholders' livelihoods by identifying livelihood assets, i.e. five capitals, while also incorporating the various elements that can restrain the optimization of the assets that are not necessarily within the exclusive control of the stakeholder, i.e. vulnerability context and transforming structures and processes. The vulnerability context includes shocks (e.g. natural disasters and health epidemics), trends (e.g. population and technological), and seasonality (e.g. of price, production and health). The model also shows the role of transforming structures and processes not only as influencing factors on the assets (and vice versa) but also as potential mitigators on the vulnerability context (as shown by the arrow going back). An example of the latter is government policy to increase access to health insurance to mitigate a health epidemic. The appeal of this framework to us is that it is

holistic, dynamic and people-centered. It also bridges the gaps between macro and micro levels so it is as realistic as possible when developing feasible livelihood strategies.

The importance of establishing a baseline for community needs assessment is also reinforced in the reference entitled *Conducting a Community Assessment* by the National Resource Center (2010) “[T]o effectively serve a community, it is important to understand the community . . . findings from an assessment will define the extent of the needs that exist in a community and the depth of the assets available within the community to address those needs” (p. 4). Also, as defined in the *United Nations Practitioners’ Guide to Benchmarking*, a benchmark is a “point of reference against which change and progress can be measured . . . [it] is used to avoid analyzing performance in a vacuum. Through the use of set references, benchmarking supports more robust and credible monitoring and decision-making” (IAP Working Group, 2014, p. 126).

Thus, if we are to understand a community, it is critical to understand the entire context of all its assets (five capitals) in order to develop a baseline from which to assess its sustainable energy needs.

3.3.1 Key Considerations

- Inter-Disciplinary

Needs assessments with an interdisciplinary perspective facilitates a holistic approach “for understanding the dynamic interactions between nature and society and assessing vulnerability and resilience of complex social-ecological systems” (Sala, Ciuffo, & Nijkamp, 2015, p. 316).

This is a key strength of conducting needs assessment using the five capitals framework. It provides insights how gaps within each capital influence or impact each other.

- Project Neutral

Needs assessment is conducted to identify and evaluate development projects. Thus, needs assessments must be project neutral to avoid any bias. In the context of community development, the community can proactively identify sustainable energy development projects from a community-focused needs assessment process instead of from an outside party pursuing its own agenda or wanting to sell its products or services.

- Collaborative Approach

Needs assessments must be collaborative to establish ownership, initiative and leadership on the part of the community. By default, the five capitals framework facilitates a collaborative approach in needs assessment from the nature of what each of the capitals looks at and its interdisciplinary aspects. Stakeholder participation elicits trust as participants also become advocates for the assessment and, as Ross and Ben Jaafar (2006) observe, there is actually the development of a “reciprocal relationship: organizational trust [i]s both a contributor and a consequence of participatory needs assessment”. “[P]ersonalization contributes to utilization” (p. 148).

Furthermore, “every society creates protocols as part of establishing order and maintaining control, and [it is] observed that protocols associated with Indigenous and sustainability sciences can be rather different” (Whyte, Brewer II, & Johnson, 2016, p. 26). Thus, to ensure that the most robust assessment is conducted, it is critical that there is a complete and transparent collaboration so that all perspectives and dimensions are accounted for in the assessment.

In summary, there are many perspectives and dimensions that may determine the priorities and goals for the development of a sustainable energy project. This is reflected in the volumes of research that exist and continue to develop under the disciplines of community needs

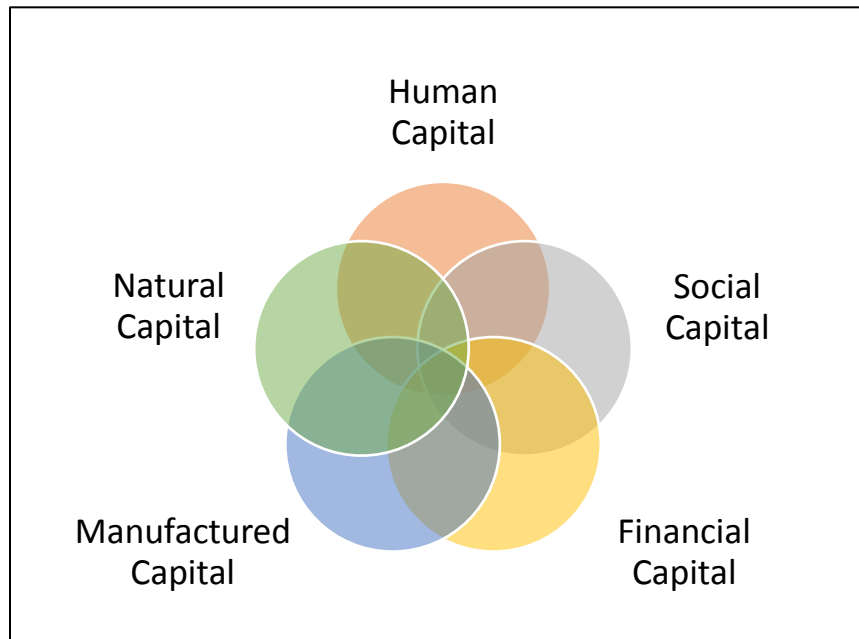
assessments, energy project development and sustainability and sustainable development. However, for the purposes of this capstone project, we submit that optimal, sustainable energy development in a community requires a community-centred approach. We propose that, to maximize a community's ability to understand its capacity and potential and in turn determine and develop the project that best suits it, a baseline that integrates all the relevant considerations of the various specialties and perspectives should be developed. Based on our analysis of literature, the five capitals are the most robust foundational concept to build a tool to facilitate the establishment of a community's baseline and the tool can then be further enhanced by adding specific elements and/or indicators that have been developed by the research and findings in the other disciplines that are driven by other criteria and objectives, e.g. financial profitability, environmental conservation, and eradication of poverty.

Chapter 4 - Findings

As previously mentioned, a critical part of the needs assessment process is the data collection to establish the baseline. It is important to recognize the scale of what is being assessed, i.e., population, community, region, country, etc., as it determines the scope and type of indicators considered. The worksheets in the Appendices have been developed to facilitate data gathering within each of the five capitals to establish a community's baseline. Several references were considered in the development of the worksheets, including but not limited to: Corder (2015, p. 49), Singer, Hoang, & Ochiai (2015, p. 212), International Integrated Reporting Council (2013, pp. 13-15, 17), Morse & McNamara (2013), MacKendrick & Parkins (2004, pp. 13-15), UNESCO (2013), United Nations Development Programme (2017), Department for International Development (UK) (2001), UNDP Post-Disaster Needs Assessments Guidelines (2013, p. 23) and Maack & Davidsdottir (2015).

The questions and information collected are related to the indicators within each of the capitals and may be directly or indirectly relevant to the subject of sustainable energy development. However, it may or may not be immediately obvious. We deemed it better to have information on items that may seem to be irrelevant in the beginning than not having a piece of information and realizing the need for it later. The worksheets aim to gain understanding of the current inventory and conditions within the subject capital. Figure 5 shows how the five capital worksheets are interrelated where information gathered from one worksheet may have relevance to another capital.

Figure 5. The Five Capitals Worksheet Inter-relationships



Authors (2018)

4.1 Human Capital Worksheet

The human capital worksheet establishes basic demographics focused on the following core areas: education, health, support facilities, investments, lifestyle and social issues. The core areas influence each other as they impact human capability, productivity and capacity. While health and education are highly important indicators, other indicators such as the support systems, investments, general lifestyle and social issues, which affect the individual holistically (physically, emotionally, psychologically and spiritually), are equally important in establishing the human capital baseline. A community's human capital baseline provides an indication of the quality and quantity of available, or lack of, human resources for development projects. It also helps identify the community's goals and objectives in terms of human resource development.

Practical Insight Example. A key consideration on development projects and impact on human resources is job creation. It is often assumed and even required that development projects create jobs. However, in a discussion with a community representative, Mr. Greg Gauchier, job creation from development projects is not always a key consideration for a community. Mr. Gauchier identified the potential preference for projects with minimal operating requirements and maintenance personnel (G. Gauchier, personal communication, March 24, 2018). This demonstrates that a community may have other concerns and/or priorities that may impact any development projects negatively if not addressed properly. It also emphasizes the importance of robust data collection from primary as well as secondary sources. See Appendix A for the Human Capital Worksheet.

4.2 Social Capital Worksheet

The social capital worksheet covers the following areas: the political and legal structure, social connections, social capacity, informal networks, trust and solidarity. The political and legal structure of the community provides valuable insights on how the community operates based on social hierarchy, influencers and actual decision makers. It also recognises the dynamics of decision making. The worksheet aims to identify social connections internally and externally and establishes the nature and importance of the connections. Informal networks, associations and connections are also identified to gain understanding of the implications of these associations in decision making. Informal connections are less structured but can sometimes provide more beneficial information.

Another aspect that provides important understanding of the community's social dynamics is the trust and solidarity among its members. This provides an indication of the level of participation,

commitments and confidence of the community in its internal affairs. A community that lacks trust with its members and leadership will struggle to execute any development projects. On the other hand, a community with high participation in past events or projects will have a higher success rate in any undertaking.

Practical Insight Example. We observed that in some indigenous communities the elders have very strong influence in decision making. This is not obvious to an outsider. Furthermore, the decision-making process varies from community to community. Thus, it is important to understand these dynamics and their implications to development projects.

Another example is regarding the power of connections. This is demonstrated by our recent introduction to a Metis settlement community in Alberta through a mutual colleague which resulted in a collaboration for a potential solar development project. See Appendix B for the Social Capital Worksheet.

4.3 Natural Capital Worksheet

The main goal of natural capital worksheet is to provide a baseline of a community's natural resources and its potential for energy development. However, there are other important key considerations that have implications on any energy development activities relating to the natural environment. The worksheet is not project specific. The intent is to gather initial ecological or environmental information to identify environmental factors that could affect any potential energy development activities right at the onset. Typically, environmental assessments of large development projects spend considerable time and resources in field studies of flora and fauna to establish baseline for impact studies for a specific project. The initial environmental information gathered using the natural capital worksheet will assist in scoping subsequent studies, provide

priority areas to focus on and reduce cost of the studies thereby optimizing the entire environmental impact assessment process.

The significance of certain species of flora and fauna, its habitat and migration pattern may be more important to a community than any development project in the same area. Knowing this significance beforehand can assist in project identification, avoid potential conflicts, delays or any other negative implications on development projects prior to spending significant resources.

Practical Insight Example. A significant portion of the natural and ecological baseline can be found from a community's traditional knowledge. For example, key geographical features may have cultural and historical significance. Hence, it is important to have this information during data collection as it would determine the constraints on project site selection. See Appendix C for the Natural Capital Worksheet.

4.4 Manufactured Capital Worksheet

The manufactured capital worksheet establishes a community's physical and intellectual asset base and its potential (or constraints) for further value creation. Although it is not a capital in itself, a community's economic development plan is identified in the worksheet as it can provide valuable insights into the utilization of the existing physical assets, the community's goals and strategic direction as well its priorities and time horizon. It must be recognized that it is a relevant information source for the other capitals as well. It is also important to establish the community's current energy profile (i.e., sources and uses) to understand its carbon footprint and consumption trends.

Practical Insight Example. We gathered a community's aggregate electricity consumption for the past 12 months to estimate the capacity of a solar photovoltaic plant for a potential micro-generation project. Although not a manufactured capital, legislation and enabling laws play an important role in economic development and it is important to identify and understand all laws that affect the community, especially in community energy development, so it included in the worksheet for the purposes of collecting this information. See Appendix D for the Manufactured Capital Worksheet.

4.5 Financial Capital Worksheet

The financial capital worksheet primarily looks at the financial resources of the community based on its revenues, including grants and financing. It also looks at the community's financial risks and ability to get low interest loans and attract outside investments. It will provide insights into the community's financial ability to implement any large, capital-intensive development projects. See Appendix E for the Financial Capital Worksheet.

In summary, the five capital worksheets will facilitate information gathering to establish a community's baseline with a holistic, inter-disciplinary perspective and provide an understanding of the interrelationships among the five capitals throughout the entire needs assessment process. The human capital worksheet aims to establish the community's basic demographics, the quality and quantity of human resources available as well as its human resource development goals and objectives. The social capital worksheet aims to establish a community's organizational structure, capacity, connections, decision-making dynamics, trust and its member's level of participation in community activities. The goals of the natural capital worksheet are to identify the community's current and potential energy resources, gather initial

ecological and natural environmental information to understand the implications of energy development projects, identify critical flora and fauna species, and culturally significant geographical land features that will be impacted by energy development projects of any type. The manufactured capital worksheet aims to identify the community's physical assets, its utilization and energy footprint as well as its economic development plan, if any. Lastly, the financial capital worksheet primarily looks at the community's financial resources and financial risk to gain an insight into its capacity to implement development projects.

Chapter 5 - Conclusions

Merging the logical and systematic approach in needs assessments with the concepts of project and sustainable development appears to be a strong tool in project identification. The five capitals worksheets are a means to establish an interdisciplinary baseline with a holistic perspective from the community itself. It will serve the purpose of having a community-led project identification tool starting from understanding its needs in a collaborative and integrated process.

Conversations with representatives from various communities affirm the value of using the five capitals worksheets in proper engagement to guide the research efforts for needs assessments. Information that may seem irrelevant at first instance can be instrumental in revealing underlying issues and concerns that may have significant implications on energy development projects.

The interrelationships among the five capitals may not be obvious when viewed independently. Therefore, the worksheets must be used concurrently as part of an entire suite of tools. The questions within each of the worksheets are extensive but not all encompassing. Thus, it is important to go through each of the worksheets during the planning and scoping phase to evaluate the need, relevance and importance of each line item and possibly identify more questions, layers or subsets of questions.

The worksheets are useful tools in helping communities start in the right direction. They involve active participation on the part of the community and establishes ownership of the process as well as of the results. Ownership is a critical consideration in the process of project identification as it validates the need for the project coming from the community itself.

Chapter 6 - Limitations and Future Research

The worksheets developed in this paper for community sustainable energy needs assessments has its own limitations.

Firstly, the worksheets may not reveal conclusive results due to absence of reliable data on key sections or misunderstanding of the key questions. To address this, the information or data being collected using the worksheets must be thoroughly understood both by the data collector and the data source. When lack or absence of data is encountered, it may be necessary to conduct estimation which must be based on solid assumptions. There might also be reluctance to provide, admit or reveal first-hand information due to personal bias or concerns, or simply unwillingness to participate in the process. That is why it is important to achieve buy in of the community or participants even before the start of the process.

Secondly, the worksheets are designed individually but must be used concurrently as a collective of tools. Not using the worksheets jointly as a single tool will defeat its main purpose, could potentially miss critical pieces of information and will not paint a complete picture of the community's baseline. This will result in making ill-informed decisions based on incomplete or misleading information.

Thirdly, the actual deployment of the worksheets will also provide opportunities for enhancement and optimization for future use in various applications.

With respect to future research, as with any scientific field of research and practice, needs assessment is not static but an evolving field where tools, techniques and new models are constantly being developed. There are numerous scholarly works done on needs assessments that

have been adapted by international organizations such as the United Nations and the World Bank focusing in finding the right community improvement projects in the areas of health, public safety or poverty reduction or a higher level of application in strategic planning and project evaluation. Needs assessments for sustainable energy development could benefit from more research on new or improved tools and techniques borrowing from and/or integrating the developments from other fields of application and practice.

Likewise, sustainable energy development is an evolving field driven primarily by technological advancements and policies directed towards the transition to more renewable types of energy sources. More research is required to explore the linkages between sustainable development and community self-determination with the use of tools and techniques in needs assessments to enhance a sustainable energy development project's chance of success.

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Appendices

Appendix A: Human Capital Worksheet

Objective: Assessment of the Community's Human Resources and Capacity

Community Name: _____

Item	Data/Information Required	Data Type	Data Source	Comments
1	Demographics			
1.1	<i>Community profile?</i>			
	-age distribution			
	-gender distribution			
	-educational level			
	- no. of households			
	-nature of household ownership (own, leased, etc.)			
	- income distribution			
1.2	<i>How important is job creation in the community?</i>			
	- employment (jobs types and levels)			
	- skills profile			
	- net migration (in -out) (on vs. off reserve)			
	- religion / faith			
1.3	<i>Health indicators / status?</i>			
	- incidence of diseases (types)			
	- birth rate			
	- morbidity rate			
	- physical disability rate			
	- work absentee rate (related to health issues)			
2	Support Infrastructure			
	<i>Educational Infrastructure</i>			
	-Schools and levels?			
	- Average distance to households / community			
	- school population			
	- courses offered / levels			
	- enrollment level			
	- graduation level			
	-certification/designation achieved			
	<i>Healthcare infrastructure</i>			
	- types of facilities / equipment			
	- size (no. of beds)			

	- <i>level of care</i>			
	- <i>types of procedures performed</i>			
	- <i>distance to households / community</i>			
3	Investments			
	<i>How much (amount) investments in education and training (\$/yr)?</i>			
	- <i>period of investments (one time / continuing)</i>			
	- <i>types of investments (facilities/training programs)</i>			
	- <i>amount of investment in health care</i>			
	- <i>types of investments (facilities/health programs)</i>			
	- <i>what returns are they getting for their investments?</i>			
4	Lifestyles			
	- <i>incidence of smoking</i>			
	- <i>incidence of heavy drinking</i>			
	- <i>incidence of extreme stress</i>			
	- <i>ways of counter-acting stress</i>			
	- <i>incidence of physical activities/ fitness / cultural activities/arts/entertainment</i>			
5	Social Issues			
	- <i>incidence of drug addiction/ substance abuse</i>			
	- <i>incidence of alcoholism</i>			
	- <i>incidence of domestic violence</i>			
	- <i>crime rate</i>			
6	Others			
	- <i>Time use (working, commuting, leisure, volunteering, etc.)</i>			

Authors (2018)

Appendix B: Social Capital Worksheet

Objective: Assessment of the Community's Social Capital

Community Name: _____

Item	Data/Information Required	Data Type	Data Source	Comments
1	Political and Legal Structure			
	<i>What is the legal framework of the community?</i>			
	<i>What is the current political structure of the community?</i>			
	<i>How often are elections held?</i>			
	<i>What are the authorities of the positions?</i>			
	<i>How are major decisions made (decision-making process)?</i>			
	<i>Who are the decision makers?</i>			
	<i>How long does it take to make the decisions?</i>			
	<i>How does members of the community participate in decision making?</i>			
2	Social Connections (Network Access and forms of participation)			
	<i>Do any of the community leaders have membership with outside organizations? (List memberships / positions of every leaders)</i>			
	<i>Does the community have any other associations?</i>			
	<i>Does the community have connections with government? (List connections and nature of relationship)</i>			
	<i>Does the community have industry connections? (List connections and nature of relationship)</i>			
	<i>Are there any family ties or relationships to social connections?</i>			
	<i>Are social connections limiting or enabling development?</i>			
	<i>What are the top two most important memberships and why?</i>			
	<i>What type of support does the community provide to the top two connections?</i>			
	<i>What are the main benefits from the top two connections?</i>			
	<i>What is the nature of the social connections (religious, economic, academic, civic, professional, political, cultural, etc.)</i>			

3	Social Capacity			
	<i>What are the required qualifications of the management team?</i>			
	<i>What are the community's social programs? (i.e., financial support, healthcare, etc.)</i>			
	<i>How effective are the social programs?</i>			
	<i>What are the community's social priorities?</i>			
4	Informal Networks			
	<i>What are some of the informal networks in the community (youth, sports, cultural, traditional, etc.)?</i>			
	<i>How does informal network get formed?</i>			
	<i>How does one become a member of the informal network?</i>			
	<i>Is there a real or perceived hierarchy in the informal networks?</i>			
	<i>How does the informal networks influence the formal or official social structures of the community?</i>			
	<i>How do the informal networks interact, meet or gather?</i>			
5	Trust and Solidarity			
	<i>Does community members contribute time and money to projects that may not directly benefit them?</i>			
	<i>What level of participation from members did past community projects received?</i>			
	<i>Was participation voluntary or required?</i>			
	<i>Is information freely shared within the community? (How much information is gathered through the grapevine)?</i>			
6	Other Information			

Authors (2018)

Appendix C: Natural Capital Worksheet

Objective: Assessment of the Community's Natural Resources, Traditional Knowledge and Its Potential for Energy Development

Community Name: _____

Item	Data/Information Required	Data Type	Data Source	Comments
1	Natural Energy Resource Inventory			
	<i>Potential/undeveloped non-renewable energy resources (oil and gas)</i>			
	- <i>What are the potential / undeveloped non-renewable resources in the community?</i>			
	- <i>Have there been any studies conducted by third-parties on the potential non-renewable energy resources?</i>			
	- <i>Have there been any third-parties that expressed interest to develop the resource?</i>			
	- <i>Does the community have any plans to explore or develop the potential non-renewable energy sources?</i>			
	<i>Existing/developed non-renewable energy resources</i>			
	- <i>Are the developed non-renewable energy sources / facilities properly functioning?</i>			
	- <i>What is the participation / ownership structure of the community in the developed resources?</i>			
	- <i>What are the benefits / impacts to the community?</i>			
	- <i>What is the outlook / operating time horizon?</i>			
	<i>Potential / undeveloped renewable energy resources</i>			
	- <i>What are the potential / undeveloped renewable resources in the community?</i>			
	- <i>Have there been any studies conducted by third-parties on the potential renewable energy resources?</i>			
	- <i>Have there been any third-parties that expressed interest to develop the resource?</i>			
	- <i>Does the community have any plans to explore or develop the potential renewable energy sources?</i>			
	<i>Existing / developed renewable energy resources</i>			
	- <i>Are the developed renewable energy sources / facilities properly functioning?</i>			
	- <i>What is the participation / ownership structure of the community in the developed resources?</i>			

	<i>What are the benefits / impacts to the community?</i>			
	<i>What is the outlook / operating time horizon?</i>			
2	Flora and Fauna			
	<i>- What are the species of animals found in this area?</i>			
	<i>- What is the estimated population and its trend?</i>			
	<i>- What is their migration pattern?</i>			
	<i>- What is the significance of the animals to your community?</i>			
3	Water Bodies			
	<i>- What are the key features, types, classifications?</i>			
	<i>- What is the water quality?</i>			
	<i>- Are there any issues with water quality?</i>			
	<i>- What are the historical and cultural significance?</i>			
	<i>- Navigable or non-navigable?</i>			
	<i>- What are the aquatic life and its significance?</i>			
	<i>- Species of aquatic life, distribution, migration?</i>			
4	Land			
	<i>Land area (official/titled)?</i>			
	<i>- Traditional territory area?</i>			
	<i>- Land natural characteristics (hilly, prairie, lakes, rivers, forest)?</i>			
	<i>- What are the key topographical features ?</i>			
	<i>- Historical and cultural significance?</i>			
	<i>- Flooding potentials</i>			
	<i>- Land use (farming, etc.)</i>			
6	Air			
	<i>What is the air quality?</i>			
	<i>Are there any air quality concerns?</i>			

Authors (2018)

Appendix D: Manufactured Capital Worksheet

Objective: Assessment physical and technological resources and its impact to the environment

Community Name: _____

Item	Data/Information Required	Data Type	Data Source	Comments
1	Physical assets (plant, property and equipment)			
	<i>What are the community's real estate assets (commercial/industrial/residential) and its energy consumption?</i>			
	<i>Does the community own and operate any industrial plant facilities?</i>			
	<i>Does the community own any industrial or commercial patents or copyrights?</i>			
	<i>What is the condition of the transportation network within the community?</i>			
	<i>Does the community have other facilities? (community center, recreation center, water and waste water treatment facilities, etc.?)</i>			
2	Economic Development Plan (ECDEV)			
	<i>Does the community have an ECDEV plan?</i>			
	<i>What are the primary focus areas of the ECDEV Plan (energy development, self-sufficiency, etc.)?</i>			
	<i>What is the time horizon of the ECDEV plan?</i>			
	<i>How often is the ECDEV plan updated?</i>			
	<i>Is there are land use plan?</i>			
3	Community Energy Profile			
	<i>What are the primary energy sources of the community?</i>			
	<i>How is energy used by the community (breakdown)?</i>			
4	Government Policies & Enabling Laws			
	<i>What legislations or regulations affect the community?</i>			
	<i>- Federal laws?</i>			
	<i>- Provincial laws?</i>			
	<i>What are the current policies on community development?</i>			
	<i>What are rules on community energy development?</i>			
	<i>What are the customary laws?</i>			

Authors (2018)

Appendix E: Financial Capital Worksheet

Objective: Assessment of the Community's Financial Capital

Community Name: _____

Item	Data/Information Required	Data Type	Data Source	Comments
1	Financial Statement			
	<i>What are the revenue streams for the community? (Grants, Royalties, Product Sales, etc.)</i>			
	<i>What are the community's Operating & Maintenance Cost Items?</i>			
	<i>What are the largest cost items?</i>			
	<i>What is the trend of these cost items (decreasing/increasing)?</i>			
	<i>What are the planned capital expenditures?</i>			
	<i>Are these consistent with the overall economic development plan (if applicable)?</i>			
	<i>How are the CAPEX financed?</i>			
	<i>How are the investments handled and managed?</i>			
	<i>What is the value of the assets?</i>			
	<i>What does the key financial ratios indicate?</i>			
2	Financial Risks			
	<i>What are the financial risks of the community?</i>			
	<i>Does the financial statement accurately reflect the community's financial condition?</i>			
	<i>Does the community have access to low interest credit?</i>			
	<i>Are the land and other assets being used as securities for bank loans?</i>			
	<i>Insurance coverage?</i>			
3	Others			

Authors (2018)