Experiences with Stakeholder Engagement in Transitioning to an Increased Use of Renewable Energy Systems

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***Abstract*— Transitioning to an infrastructure that integrates a more substantial portion of renewable energy sources into the larger energy portfolio is not effortless or without sacrifice; it has economic, technical as well as social challenges related to the decisions, choices and consequences in trying to establish new energy systems. Those decisions, choices and consequences are highly dependent on the social, economical and environmental context in which they are made. It is of paramount importance to look for a means of involving more sectors in the policy discussions that are taking place in facing the challenges of an increased use of renewable energy. All energy stakeholders should be engaged in discussions about a new energy future. This paper presents lessons learned from experiences with energy stakeholder engagement in Puerto Rico. Both theoretical and practical issues are presented, in the context of a fossil-fuel dependent society which has the added challenge of being geographically isolated from the main sources of fuel. The paper also presents alternatives for broader participation of energy stakeholders in the energy decision-making process as well as education and outreach challenges.**

***Index Terms*— Renewable energy systems, energy policy, energy resources, social aspects of energy.**

I. Introduction

Energy infrastructures based on fossil fuels represent one of the key challenges to humanity in the 21st century. On one hand, most of the industrialized economies are highly dependent on the level of energy consistency and reliability that fossil fuels offer for electricity and transportation. Many of the so-called developing economies aspire to the levels of production and choices available in the fossil-fuel dependent societies. On the other hand strong environmental, community and policy efforts are being undertaken worldwide for a transition out of fossil fuel dependencies into renewable energy sources and technologies. It is important to realize that our current energy infrastructure favors a range of operating options (physically and structurally). This reality inevitably creates real and perceived challenges for any options that represent changes to the status quo.

The increased use of renewable energy sources is highly dependent on the social, economical and environmental context in which they are made. These variations occur not only among countries, but even among regions within the same country. For example, renewable resources in one part of a country might be different than in other parts, or those resources are in one region but energy is mostly needed in another region of the country. Who should pay, in the economic and social sense, for the costs related to the construction and operation in those scenarios? How is the common good achieved while not unfairly encumbering any one sector? Should a utilitarian perspective be followed? In a fossil-fuel dependent society some renewable energy advocates cannot understand objections to "green energy."

On the other hand, historically impacted communities might oppose such projects on social justice claims. Environmental groups could raise concerns for the impact to sensitive ecosystems nearby. There are questions and concerns on how to effectively approach and manage such a contested "green vs. green" scenario? There are further questions on how legacy infrastructure, processes and strategies should be dealt with. Who pays for the costs related to those legacy systems and how are such costs dealt with without them becoming stranded costs borne mostly by one sector?

All customers must be engaged in such discussions. It is critically important to look for a means of involving more sectors in the policy discussions that are taking place in facing the challenges of an increased use of renewable energy. Inter-generational aspects should be embedded in the decision-making regarding these issues. For renewable consumption to be sustainable by definition, it must integrate social justice concerns for our posterity. To that end, decisions should not only address more immediate issues, but should also take into account long term goals. With that mindset one avoids many (not all) potential unintended consequences, and even stranded costs that might arise from transition to renewable energy.

II. Puerto Rico, ITEAS and Stakeholder Engagement

Puerto Rico (PR) is an island with an area of about 3,500 square miles. It has been a territory of the U.S. since 1898. Its population is 3.8 million, it has 3,015,227 vehicles (among the largest in the world per capita), and Puerto Rican's Emissions per capita are 230% that of the average per capita of the Rest

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of the World, and 333% that of Latin America [1]. The Island is 99% dependent on fossil fuels for transportation and electricity, but there are no fossil fuel resources in PR. The social, environmental and economic costs of current energy sources and practices are too high. Health problems related to pollution are commonplace, especially in vulnerable communities. Figure 1 shows the fuel distribution for the electric power sector. The Puerto Rico Electric Power Authority (PREPA) is a self-regulated, public corporation that is the only utility in the Island. Puerto Rico has two co-generators under PURPA, EcoElectrica (uses Natural Gas), and AES (uses coal).

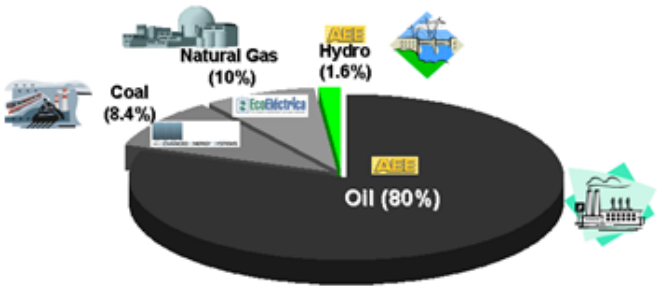

Fig. 1. Fuel Distribution in the Power Generation Industry

Laws that encourage the conservation of natural resources are ineffective since many do not connect energy policy and socio-economic development strategies. Solutions being sought and implemented are mostly economic, and in many times short term in nature. With Puerto Rico's abundant renewable energy resources, the question should be not how to best integrate renewable resources into existing energy infrastructures, but how existing energy infrastructures and practices should change or transition in order to allow maximum use of renewable energy potential [2-4].

The Institute for Tropical Energy, Environment and Society (ITEAS by its acronym in Spanish) was created at UPRM to lead the intellectual and cultural leap necessary to develop public policy, and sustainable energy practices for Puerto Rico. One of the problems in the public policy cycle is that scientists and technical personnel usually participate in a limited way, usually in the form of reports to policymakers. The flaws of this approach are many, requiring a more active participation of energy experts in the decision-making process. ITEAS is committed to retake the unfinished business in terms of research and application in sustainable energy, but with a strong understanding that energy researchers should not simply inform the process, but rather, have to be active participants in all stages of the public policy cycle such as the agenda setting and issue identification stages. One of the main activities in this line is the establishment of participatory structures that allow all stakeholders to be involved in the development of the energy policy needed for the transition to a more sustainable future.

ITEAS has a holistic perspective of energy issues through the development of sustainability-based public policy. Sustainability presents a holistic approach to integrate not only the technological dimension, usually tied up with economic considerations, but also the environmental as well as the social dimensions of development. Our definition of sustainable development is from *Our Common Future* and deals with how we use resources today in a way that does not compromise the ability of future generations to meet their needs [5]. Regardless of particular positions on what defines sustainability, a sustainable future will require sustainable energy sources and practices. A reference point that will be used in this paper is that sustainable energy integrates the economic, social and environmental dimensions of energy issues in decision making (see Figure 3).

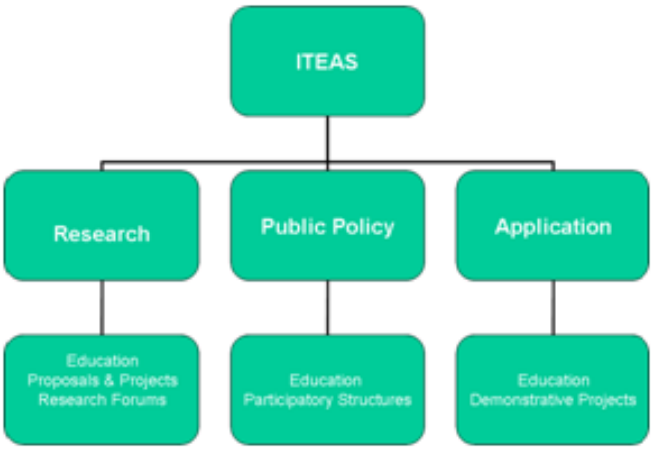

Fig. 2. ITEAS Organization

Fig. 3. ITEAS Organization

In ITEAS energy is approached as a societal, complex issue that cannot be addressed from a single discipline, but rather from multiple perspectives. In order to have long-lasting commitment and involvement, the search for sustainable energy must be framed as a moral obligation with an integrative and global perspective. This new energy ethics creates the kind of personal or institutional commitment necessary to withstand the hardships of consensus-building needed in participatory processes [6].

In order to move to a sustainable future, all energy stakeholders need to participate in the generation, evaluation and implementation of long-term strategies: Every sector must assume its responsibilities in enabling a sustainable energy future. Collaborations among government, industry, commerce and citizens need to be established to shift the current adversarial positions to collaborative relationships, from mutual distrust to a serious and lasting commitment for the public good, and the establishment of policies that

integrate the social, environmental and economic dimensions of energy.

Energy stakeholders must have trustworthy mechanisms to constructively discuss concerns and viewpoints in dealing with the challenges of an increased use of renewable energy resources. For example, a forum to allow groups to reach common ground from which to devise concrete actions for increased use of renewable energy resources. The forum would have to deal with the uncertainty issues and regional variations mentioned earlier. The forum would also have to manage trust problems that might exist among groups that have traditionally had contentious relationships.

Any stakeholder engagement mechanism requires some form of common, transparent way of providing timely information to all sectors before policy decisions are final. This is especially true considering that many energy decisions are usually made based on hierarchal, top-down approaches. This paper argues that one of the causes for polarization in public debate is the long-standing, limited and usually late participation of the public in the policy making process. It is time to level the playing field by changing that paradigm in a way so that no singular group or sector is favored, but all parties benefit. A transparent communications system can be used as a tool for all stakeholders to voice their concerns or suggestions regarding energy. Transparency should not be feared but rather embraced for its accountability. The next three sections present some of the stakeholder engagement efforts that ITEAS has led in its quest to establish inclusive, transparent and participatory spaces for discussions on renewable energy transition in Puerto Rico.

ITEAS research in stakeholder engagement follows a constructivist approach, emphasizing the integration of the perspectives from different societal groups [7]. A constructivist approach to policy seeks to bring different values, definitions, attitudes, and knowledge to the policy-making process. These approaches can positively affect policy design and outcomes [8] particularly when dealing with complex problems such as sustainability.

III. Expert Consultation Efforts in Energy

In November 2005 an Energy Experts Summit took place in San Juan. Although ITEAS did not exist then, some of its members participated as organizers or panelists in the activity. That activity focused on electric energy, and brought together energy leaders from various organizations. Although this activity centered on technical issues, it planted the seed for future, broader stakeholder engagement efforts.

In May 2007 ITEAS hosted a 2-day conference at UPRM entitled "OK with Renewable Energy, but now what?" with presenters from Hawaii, Spain, local government officials, community and environmental groups and industry representatives. Diverse viewpoints were presented on how Puerto Rico should take steps towards renewable and sustainable energy practices and technologies. The conference was recorded and is available in the web [9]. One of the main outcomes of the conference was the need to establish a dialogue space or forum for energy where stakeholders can present their concerns and opinions about the Island's energy future. ITEAS took as a project to study various structures for that stakeholder engagement structure, motivated by the example from the Energy Forum of the Policy School of the University of Hawaii (one of the presenters in the conference).

In May 2008 open access was approved so that private power producers can use PREPA's transmission and distribution lines to deliver electric power to their particular clients. This mode of operation, also known as "wheeling" of power, created concerns and public protests in various sectors of Puerto Rican society, e.g., important energy stakeholders were left out of the discussions about wheeling. To address these public concerns, and using the results from the research on stakeholder engagement performed in the year after the 2007 conference, ITEAS organized a public discussion on "Wheeling and the Puerto Rican Electric System: Visions of a Future Social, Economical and Environmental Welfare for All." Many energy stakeholders were invited as audience, and six key stakeholders accepted invitations as part of a discussion panel. The panel had representatives from the utility, government, labor union, environmental/community groups, industrial sector and UPRM (ITEAS).

The half-day discussion started with a brief technical description of the Puerto Rican electric system and relevant areas of concern related to wheeling by a power expert from ITEAS. A roundtable format was then used as a structure for the discussion among invited panelists. Each of the six represented sectors had a 5-minute initial opening statement and each was asked to base their remarks on the vision of their organization regarding the Puerto Rican electric system. There were three rounds of questions, were the panelists were asked: What is the impact of wheeling in the economic development of Puerto Rico? Is our electric system ready to support Wheeling? What mechanisms or processes are needed so that Wheeling reduces the cost of electric energy for all sectors?

Each panelist had two minutes to answer the same questions, and the other panelists had 1 minute to react to answers from other panelists. The final question was: is your organization willing to collaborate with other sectors to identify strategies and directions to improve our electric system? How? Each panelist had 5 minutes to answer. There was a 20 minute Q&A session. This activity was also recorded. All panelists expressed their willingness to collaborate with other sectors to improve the Island's electric system. ITEAS invited all panelists to a more informal discussion over lunch, which resulted in a commitment to continue the energy dialogue.

After 18 months of meetings, the multi-sector energy dialogue group presented in December 2009 its strategic plan for the future of the electric system in Puerto Rico.

IV. Community Attitudes Towards Renewable Energy

Recent changes in Puerto Rico's energy policy environment have opened a window of opportunity for the development of renewable energy projects. Support for renewable technologies both on environmental (green energy) and economic (ending oil dependency) grounds is generally perceived as substantial in Puerto Rico. However, as

exemplified by the literature on social acceptance of renewable energy technologies, implementation of renewable energy projects, wind energy projects in particular, has encountered strong community opposition around the world.
In recognition of the financial, technological, environmental and political complexities involved in the siting of renewable energy projects, and the substantial financial commitment such ventures entail, it becomes imperative for project developers to possess all relevant information necessary for their successful implementation. What are the most significant factors influencing the social acceptance of renewable energy projects? How do communities perceive such projects in their backyards? What strategies, processes and initiatives can assist in bringing communities and developers together to collaborate in the development of a renewable energy project? Applied social research, mainly on the social acceptance of renewable energy technologies can assist in answering these questions before the planning and design phases of a renewable energy project.

A. Wind Energy in a Small Island Town

The main purpose of this study was to provide Aspenall Energies, LLC, with empirical data on community perception and attitudes regarding the location of a pilot wind project in Vieques, P.R. [10] This report describes the community's knowledge and attitudes regarding renewable technologies, including but not exclusive to eolic energy. In addition, it identifies key topics and issues for the development of an environmental education project. General suggestions are given on an effective community participation strategy in the island. The study included of a survey to 157 adults that live in the area surrounding the proposed site and 10 in depth interviews with community leaders.

There was a low recognition of the term "renewable energy" among members of the community surrounding the proposed site. However, general recognition of solar and wind technologies were high. Overall there was a positive attitude towards wind energy, in many ways comparable to solar energy. Both solar and wind technologies are perceived as the safest, environmentally friendliest and most viable for implementation of all alternative energy technologies.

Regarding the variables associated to social acceptance, what the Viequenses enjoyed the most about their community was the visual landscape and the peacefulness of the area. This is a significant finding, as visual landscape issues have been found to be highly correlated to wind energy facility siting. The community wants to be involved throughout the whole decision-making process of the project, and they would like to be informed of the plans as early as possible.

The developer and the Mayor of Vieques were perceived as equally responsible for informing the community. That communication was preferred to be in person or through the mail. Public hearings and community meetings in community centers during week day *evenings* seemed to be the preferred channel for participation. The meeting agenda should be received in advance and people should have access to relevant documents and independents experts to enhance public participation.

Most community leaders see the development of renewable energy technology in a relatively positive light. At the same time, they conceive a successful renewable/wind project in Vieques as one that integrates the input and needs of the community along with commercial interests. Some of the main concerns/questions expressed by community leaders regarding the proposed wind project were: What is in it for Vieques? Why this particular equipment? Why was the proposed location chosen? Who is the developer? What would be the project's environmental impact?

Future mobilization around issues such as renewable energy in Vieques, will most likely rest on existing organizational structures such as small cooperatives that focus on a single policy issue such as the need for cultural preservation activities, the betterment of health services, increase of economic opportunities for the locals, etc. Although their leadership appears to be highly fragmented and involved in interpersonal struggle, it is essential that all local cooperatives, citizen groups, non-governmental organizations are included.

The success of the project depends on how it addresses salient issues among the Viequense community. The perceptions of people outside Vieques concentrate on environmental contamination and other issues related to the Navy's departure, while Viequenses are more concerned with issues related to their daily quality of life. Therefore, the issues that the project should address need to emanate from the community perspective instead of an outsider's perception of Viequenses needs.

The study showed an overwhelming concern over the social and economic repercussions of the project rather than its more technical aspects such as the size and design of the wind turbines or the kilowatts per hour that are going to be produced. This study suggests that public participation and education strategies that focus on early involvement of community members in the design and planning stages of the proposed wind energy project, have the potential of enhancing the prospects of its successful implementation. Such involvement could be structured through collaborative planning activities which integrate a strong educational component as participants learn from each other's experience, and ensure effective participation in all stages of the project. The sense of ownership fostered by these activities will go a long way towards Aspenall's pilot wind project becoming a reality in Vieques.

B. Social Acceptance of an Industrial Wind Farm

The purpose of this project was to collect data on known important variables associated with a community's tolerance to the installation of two wind turbines in the Bacardi facilities [11]. As requested by Aspenall Energies, LLC, UPRM-ITEAS developed and administered a survey among a random sample of community members to measure social acceptance to a wind energy project among the community surrounding the Bacardi Distillery in Cataño, PR. The data was collected between the months of June and July of 2009. The target population was composed of all adults permanently residing in three residential areas neighboring the Bacardi facilities in Cataño; 81 face to face structured interviews were carried out of a stratified systematic sample of 150 (response rate 54%).

This report provides the information necessary to develop the community education and participation strategy that could contribute to the project's success.

Our sample compares Catano's and Puerto Rico's population in their demographic characteristics. The three main differences are that our sample is older, with higher education levels but lower incomes. Some of the main results are:

1) Enjoyment of the local landscape and aversion to disturbances of tranquility and passive recreation.
2) High perceived knowledge
3) Positive bias towards solar energy technology
4) Preference towards direct communication between the developer and the community, supported by the local government, through community meetings in their neighborhood during the work week evenings.
5) Preference towards early and constant community involvement in the decision-making process with the support of independent experts to represent the community's interest.
6) Agreement with compensation and/or profit sharing schemes in conflictive projects.
7) Low trust in government and lack of affiliation to civil society.

Based on these findings, it was recommended that direct communication as well as early and constant community involvement exist in the decision-making process. Issues related to disturbances to the community's enjoyment of the local landscape and tranquility could arise during the installation process. These must be dealt with but not with a patronizing approach, but recognizing high levels of knowledge about energy among community members. Appropriate compensation and/or profit sharing schemes could include aid in the development of micro and domestic solar energy projects among community members.

V. Benefit Assessment and Stakeholder Involvement

In order for different stakeholders to make decisions about the value or desirability of a product or service, they must concurrently understand the benefits and the consequences of the product or service. In theory, the optimal decision would maximize the benefits while minimizing the consequences. The optimization of benefits to consequences can be quite complex in situations such as electrical power generation where the benefits and the consequences can be very different for each stakeholder group. What may be considered a benefit for the utility in charge of generating electrical power may be viewed as a serious consequence to the community living next to the power plant. Another challenge is that the overall benefit depends on a group of factors of different natures such as technical factors, economic factors, social factors and environmental factors. A proper benefit assessment should provide the framework to identify these factors for a given stakeholder group and be able to assess the preferences and attitudes of the stakeholder group. This evaluation is the basis for generating a benefit assessment for the stakeholder group.

One of the most challenging areas in benefit assessment is the identification and evaluation of social factors such as acceptance, desirability and fear of certain technologies. This is the case of a community that faces the situation of having a power plant being place next door. This situation is even further complicated by the fact that the proposed power plant may be based on a new and unfamiliar generation technology which may be the case of the site selection process for a wind farm. This is the case of the community of Barrio Indio in the city of Guayanilla – a town on the south coast of the island of Puerto Rico. This community is nearby two existing power generation facilities, one that uses bunker C and another that used natural gas. Presently a private developer is pursing the construction of a wind farm of 25 1 MW generators on a nearby site along the coast; this land is not developed and has a high ecological value. This is a situation where there is a diversity of stakeholders such as the Puerto Rico Electrical Power Authority, the private developer, the community and the customers of the power authority – each with their own set of benefits and consequences.

The social acceptance instrument used in the projects mentioned in the previous section was the basis for conducting a benefit assessment of the Barrio Indio community regarding the proposed wind farm. This was quite a challenge since the community has been active and organized against the construction of the proposed wind farm. Nevertheless, it was decided that this was an important effort and that could provide insight on how to combine social factors with technical and economic considerations. It was also decided that it would be a valuable education experience for engineering students to administer the evaluation instrument in community so that they could understand the importance and challenge of evaluating social factors in conducting a stakeholder assessment.

The project was conducted in three phases. During the 1st phase, the team had separate meetings with the private developer, ecological experts of the nearby Guánica Dry Forest Reserve (which believe that the project is a threat to this UNESCO as Biosphere Reserve) and with the local community. This was to get a sense of what where the concerns of different stakeholders. During the 2nd phase the team visited the community and completed the evaluation instrument with different members of the community. This provided quantitative information related to the concerns of the community regarding the proposed wind farm. Some of the concerns listed where the disruption of the visual landscape by the wind generators, the disruption of the construction phase and the destruction of what is perceived as ecologically valuable and sensitive land. The 3rd phase consisted of measuring the priorities of the community regarding their concerns and fears. This was done by using a weighting methodology during a meeting at the local community center. Ironically, during this meeting many community leaders acted suspicious since they believed that the evaluation team (which consisted of engineering students) was working for the private developer. It took over 60 minutes to convince the community that the team was a third party that had no relation to the developer. The result of this exercise produced some interesting results such as that a high value was placed on their privacy and how this would be disrupted by the construction phase; on the other hand a very low value was placed on the cost of energy to the community – the promise of lower energy costs was not a important

consideration to the community. The next step is to start the work on the integrating these social factors with technical, economic and environmental factors to develop a comprehensive benefit assessment methodology.

VI. The DOE's Perspective

A. Energy Information and Public Outreach

As was mentioned before, transitioning to a renewable energy portfolio is a tremendous challenge. It is not simply the work of scientists and engineers. Research and development cannot exist in a vacuum and never make it out of the laboratory. For it to make a difference it must be deployed into society, and for that to occur many sectors need to be appeased. Investors and innovators need to be assured they are able to earn an honest profit and will have to comply with reasonable, streamlined regulations. The public needs to be assured of minimal adverse environmental impacts (sometimes what is considered adverse may be different; as an example, windmills are seen as beautiful in some communities while are considered eyesores in others), and economic benefits such as jobs, taxes, and just compensation. Otherwise renewable energy will simply not have the necessary support required for implementation.

The Department of Energy (DOE) recognizes the value education plays in the process of public acceptance of renewable energy. As the United States and the world community continue to transition from a fossil-centric society and economy to a green-oriented standard, education is vital to properly introduce the citizenry to new green concepts. Education serves to dispel misinformation and rumors that so often circulate as truth.

For the public to be properly informed the information must be seen as coming from a reputable and impartial source. As a government entity, the DOE is often viewed with suspicion while at the same time being acknowledged as an authority. So while the public may clamor for the DOE's opinion and input as an authority on the subject of energy they also dismiss that very information as biased. As such, the DOE (or for that matter any government entity) is sometimes not an effective agent for promoting energy education. An informed, neutral third-party is required to act as an "honest broker" to facilitate respectful, constructive dialogue, and to follow-up on that conversation to make certain that the opinions and concerns expressed are all fairly represented. This is where "buy-in" occurs and when renewable energy is not simply commercialized but is embraced.

B. Experiences on Stakeholder Engagement in DOE

While federal government partnering in stakeholder engagement is challenging, it is essential to fulfilling responsibilities and understanding the issues from a perspective that is "outside of the beltway". The federal government can become so isolated that other perspectives on issues are not considered. When other voices are not heard it brews resentment and distrust.

For instance, the DOE is actively engaged in addressing the legacy of its history with nuclear material production. Many of the DOE nuclear sites have a history of being operated in secret and are now contaminated. As the DOE has begun the process of restoring the environmental soundness of these sites it has set up community organizations to assure a new era of transparency and accountability in an effort to overcome the suspicion the communities around these sites have of DOE's sincerity and interest. These community engagement activities have resulted in rebuilding trust between DOE and the impacted communities as well as productive, healthy visions for restored sites. The best example is the conversion of the Rocky Flats nuclear site from being one of the most contaminated DOE sites to it being a wildlife refuge. This would not have been possible without community input and government acceptance.

VII. Finals Remarks and Lessons Learned

Some of the lessons learned in Puerto Rico that could be applied elsewhere include the need for participatory structures that enable local and regional dialogues to reach the decisions needed to move forward with sustainable policies. Another important lesson learned is the need to go beyond the traditional cost-benefit analysis and include social and intergenerational factors in energy policy. We also need to stop thinking within the bounds of our disciplinary or sector limits, start considering the bigger picture and identify the connections and implications of our decisions into other areas or sectors. This approach challenges the traditional "specialization" or disciplinary approaches; a constructivist approach is suggested to bring different values, definitions, attitudes, and knowledge to the policy-making process. Finally, the development of local expertise and workforce is necessary to deal with specific issues of a region. Education and outreach to the general public, and the training of the energy workforce must take place in a holistic, integrative and participatory way.

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