Developing an Online Database of National and Sub-national Clean Energy Policies

**CLEAN ENERGY
SOLUTIONS CENTER**

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1 Introduction

Around the world, national and subnational (e.g., state, provincial, and municipal) governments are enacting policies and providing financial incentives related to clean energy. As the number of policies and incentives grows, it becomes more difficult for consumers, businesses, researchers, and policymakers to determine how they will impact clean energy projects.

The Database of State Incentives for Renewables and Efficiency (DSIRE) was established in the United States to provide summaries of energy efficiency and renewable energy policies offered by federal and state governments. Since the launch of DSIRE in 1995, the number of policies and incentives included in the database has grown from just a few hundred to more than 2,700. DSIRE, which is funded by the U.S. Department of Energy (DOE), is considered the premier public resource for information on clean energy policies and incentives in the United States. In 2012, DSIRE averaged more than 574,000 visits per month and more than 170,000 unique visitors.

Many other countries have expressed interest in creating a similar database to provide online, easy public access to national and subnational clean energy policy information. In 2011, the DOE partnered with India's Ministry of New and Renewable Energy (MNRE) to develop the Indian Renewable Energy and Energy Efficiency Policy Database (IREEED). Work began on IREEED in the fall of 2012 and the website was launched on September 20, 2013 (www.IREEED.org). The development of IREEED was funded under the U.S.–India Energy Dialogue and the Clean Energy Ministerial.

DOE support for IREEED was two-fold: the Clean Energy Solutions Center provided funding for the direct development of the database and DOE's Office of Energy Efficiency and Renewable Energy's International Team funded the technical assistance provided by the National Renewable Energy Laboratory (NREL) and the DSIRE staff to the IREEED staff, including the development of background materials and training. A background primer was provided to MNRE in 2011 to assist in the early planning and design process. The primer provided an overview of the major policy, research, and technical topics to be considered when creating a clean energy policy database and website. While the original background document was specific to India, it has been revised so that it can be useful to any entity interested in learning about how to develop a similar database and website for any other country.

When developing a clean energy national and sub-national policy database like DSIRE or IREEED, there are two main topics to consider: policy and technical (Figure 1). This factsheet provides an overview of many of the components under each of these topics that a project team developing a similar database may wish to consider. Though the expertise needed to address the policy and technical issues is vastly different, it is integral for the experts working on both areas

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to collaborate. For example, the policy team will determine what type of information the target audience will want to find on the website and the technical team will lead the design to ensure that the users can access the information provided in an efficient manner.

Policy Components

- Define objective
- Determine content scope
- Conduct initial research
- Define review and update plan

Technical Components

- Conduct technology audit
- Plan and design application
- Launch website
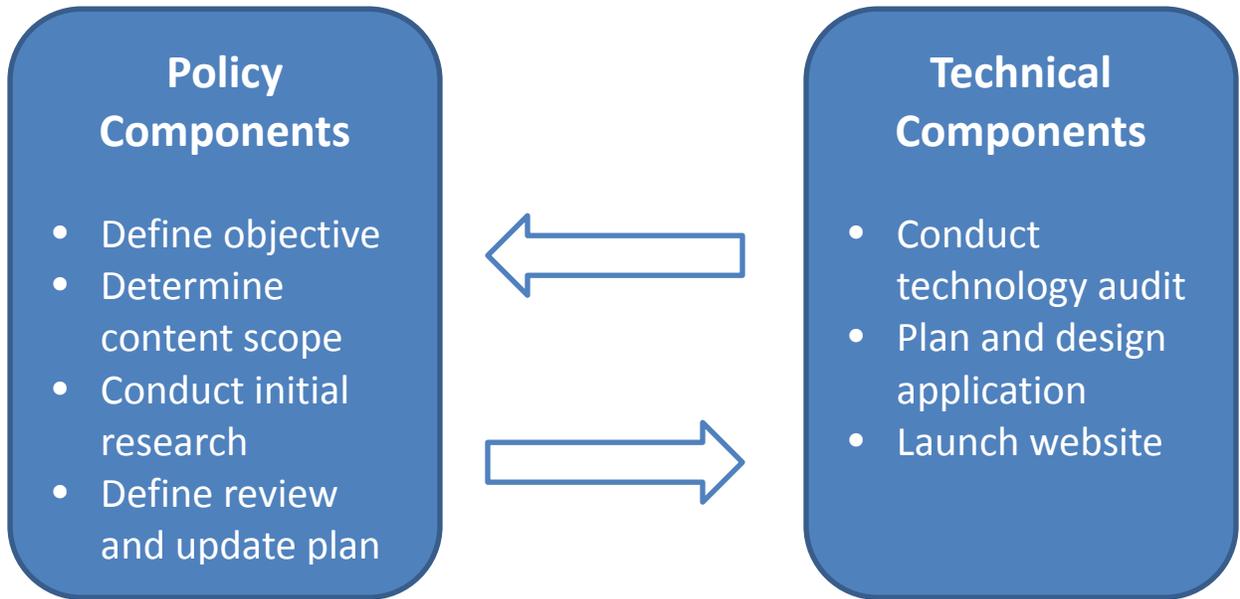
Figure 1. Overview of major policy and technical considerations

The guidance provided herein is based on nearly two decades of experience with DSIRE providing information on clean energy policies in the United States. Examples from IREEED are also included where applicable. However, because IREEED was released in September 2013, it is too early to share overall best practices based on IREEED's experience. Section 2 provides an overview of policy and research topics, focusing on identifying target audiences, defining project scope, planning initial research, and maintaining the database. Section 3 provides guidance and best practices on the technical needs for similar policy databases. Section 4 highlights some of the factors that impact budget and project timing, though specific estimates are not provided as they are highly dependent on multiple factors.

2 Major Policy and Research Considerations

There are many components to consider when planning and designing a clean energy database and website. This section provides an overview of the most important policy and research topics. Having a clear definition of the audience and policy scope will guide the research methods and design of the database and online user interface (e.g., website).

2.1 Define Objective and Target Audience

The first step in designing an online policy and incentives database is to clearly define the project objective and the target audience. This ensures that the project team is focused from the beginning on gathering and sharing the data that is relevant to the audience. Understanding how the audience will interact with the data (e.g., read online, download in excel) can guide the design of the online interface.

Possible target audiences may include:

- Consumers
- Businesses
- Policymakers and other government officials
- Researchers
- Media.

It may be the case that there are multiple target audiences. For example, the primary audiences for both DSIRE and IREEED are consumers, businesses, and policymakers. Users from each type of audience will seek different information and it may be important to consider developing unique portals for each type of audience with targeted information.

Sometimes a clean energy policy database will also attract users from other countries. The planning team could consider creating factsheets and other materials to help the international community understand how to use the database and how the country's energy sector is structured and operates.

2.2 Determine Policy Content Scope

It is critical to determine the initial scope of the policy content early in the process. Efficiencies can be gained by adhering to a consistent, transparent methodology for selecting relevant content. Sharing the scope and methodology can help users understand what is and what is not included. For example, DSIRE provides a summary of the scope of website at http://dsireusa.org/faq/ where it clearly states the methodology for determining which policies and incentives are included in the database.

IREEED similarly defines the scope of information included in the database on the Frequently Asked Questions page (http://ireeed.org/faq): "IREEED summarizes the policies of renewable energy and energy efficiency published by Ministry of New and Renewable Energy (MNRE), Bureau of Energy Efficiency (BEE) and other State Nodal Agency (SNA) and State Designated Agency (SDA)."

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When defining the scope, the project team may find it useful to start by determining what will and will not be included in four primary categories, described in greater detail below: 1) eligible technologies, 2) financial incentive type, 3) government policy or program type, and 4) additional energy data.

2.2.1 Eligible Technologies

Policies and incentives are typically designed to apply to specific types of technologies (e.g., photovoltaics and/or wind). Early in the process of developing the database, it is useful to clearly define the types of technologies that the database will cover. For example, is the database being created to provide information only on solar policies or will it include all renewable technologies? In broad terms, possible options include:

- Renewable energy
  - Electric applications
  - Thermal applications
  - Transportation (vehicles, fuels, and equipment)
- Energy efficiency
  - Buildings
  - Industry
  - Transportation
- Other technologies and systems
  - Energy storage
  - Smart grid equipment and infrastructure.

It will likely be helpful for the project team to be as specific as possible regarding included technologies (e.g., will policies targeting photovoltaics and concentrating solar be included?). As an example, the list of specific technologies included in DSIRE can be found by scrolling through the "Select a Technology" dropdown list on the DSIRE search page at http://dsireusa.org/searchby/index.cfm?ee=1&re=1.

2.2.2 Financial Incentive Type

There are many different types of financial incentives, some of which will be unique to particular countries. Potential incentive categories include:

- Tax incentives
- Rebates
- Performance-based incentives
- Long-term purchasing contracts and offers
- Grants
- Loans and loan guarantees.

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In addition to considering the type of incentives to include, it can also be beneficial to consider the longevity of program funding. For example, DSIRE generally only includes financial incentives that are available on an ongoing basis and does not typically include one-time funding opportunities.

Each financial incentive will be administered by a specific entity, such as a state or provincial government, a utility, or a non-profit. Depending on the target audience(s), it could make sense to limit the scope to include incentives provided only by specific entities, such as:

- Federal government agencies

- State government agencies

- Local government agencies

- Quasi-government agencies

- Electric utilities

- Gas utilities

- Businesses (including banks and other lenders)

- Non-governmental organizations (domestic and/or international).

The project team may choose to devote special consideration to whether incentives offered by the private sector (e.g., businesses) will be included. As an example, the DSIRE project staff has found that it is difficult to assess the perceived merits of financial incentives that are offered by businesses (including banks but excluding utilities) and therefore does not include such financial incentives in the database.

2.2.3 Government Policies or Program Type

In addition to offering financial incentives, government agencies may establish other policies to encourage or require the use of renewable energy and/or energy efficiency technologies. As an example, these are non-financial policies that are currently implemented by federal, state, or local governments throughout the United States:

- Appliance/equipment efficiency standards

- Building energy codes

- Contractor licensing requirements

- Energy efficiency resource standards

- Energy standards for government buildings

- Government green power purchasing commitments

- Interconnection standards

- Net metering

- Public benefits funds

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- Renewables portfolio standards

- Renewable energy permitting policies

- Solar and/or wind access policies.

It is likely that other relevant government policy types exist in specific countries that the project team may find important to include. Depending on the target audience, the project team may wish to consider including summaries of approved government energy plans, initiatives, roadmaps, or other similar documents. While DSIRE does not include such content, these documents can provide useful information about the policy environment at the specific level of government.

2.2.4 Additional Energy Data

Depending on the objective of the database, it may make sense to include additional energy data and information beyond the incentive and policy summaries. Users might find it helpful to have various energy statistics available, such as:

- Energy usage data (historic and current)

- Energy pricing data (historic and current)

- Maps and/or charts of renewable energy resource availability

- Maps of transmission lines

- Current electricity tariffs and schedules

- Current natural gas tariffs and schedules.

Including this type of data, however, can significantly expand the scope of the database, which could make the database more difficult to navigate and maintain.

2.3 Design and Conduct Initial Research

The target audience and the content scope will guide how the initial research is designed and conducted. The project team will likely need to employ multiple methods of soliciting and collecting information to populate the new resource. Possible methods include:

- Conducting research at the national, state, and local levels using relevant legal tools, databases, and other available resources

- Surveying similar Web-based resources and related reports

- Designing and sending a survey to government officials, utilities representatives, non-governmental organizations, and businesses that operate in the energy arena to collect information about relevant financial incentives and government policies; follow-up phone calls can ensure a more robust response

- Conducting media research for news articles addressing relevant financial incentives or government policies using appropriate media archives, databases, and other available tools.

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2.4 Maintain and Operate Database

Database projects can be more successful if initial planning efforts address how the content of the database will be reviewed and updated for accuracy and timeliness. If the content is updated regularly, the database could prove more useful as a decision making tool. Ideally, database content will be reviewed and updated at least once a year, and new incentives and policies will be added immediately after going into effect. Methods used by DSIRE staff for staying abreast of clean energy policy and incentives developments include:

- Subscribing to relevant news feeds, newsletters, and other media resources

- Periodically conducting legal research, particularly on pending and proposed policy changes even if they may not be added to the project website until they are enacted

- Periodically reviewing utility and government websites

- Periodically communicating directly with stakeholders

- Attending webinars, workshops, conferences, and other events

- Inviting the general public to suggest, modify, or provide content through an online form or an open source platform.[1]

If feasible, it can be helpful to periodically contact the program administrator directly to verify that an incentive or policy is still in effect and verify the accuracy of the database record.

In gathering policy data, the IREEED team has relied more heavily on direct interactions with policy and program administrators because details of the specific state policies are not as readily available online as they are in the United States. As this process can be more time consuming, it is important for the project team to understand the type of methods that will be used to collect and update data when determining the resources needed to complete this task.

When initially planning a clean energy policy database and website, there may be very few incentives and policies to include. However, it may be useful to incorporate expectations for growth into the initial plan and maintenance and operations protocols to ensure future flexibility.

Database users may want to know how often and how recently the information is updated. DSIRE accomplishes this by providing a description on the Frequently Asked Questions (FAQ) page explaining that all information is updated at least once annually. Both DSIRE and IREEED provide a date on the top of each summary page that indicates when it was last reviewed (Figure 2 has an example from DSIRE). Providing the users with a specific date of the last review allows them to quickly determine if the information is recent or if they should contact the program administrator to see if any updates have occurred.

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[1] DSIRE coordinates with OpenEI. All DSIRE data is available for public download on OpenEI, and users can add or revise policies and incentives directly in OpenEI. DSIRE staff members are alerted to any user additions or changes and review them within one week. If approved, all changes are incorporated into both the OpenEI and DSIRE websites.

Figure 2. "Last review" dates help indicate freshness of content

2.5 Additional Considerations

During the budgeting and development stage it may be helpful to consider several additional issues that could impact the direction of the database, and therefore the staff and funds needed to operate it. These issues may include:

- **Additional Project Resources**
  In addition to summaries of financial incentives and government policies, the DSIRE website provides a multi-criteria search tool, summary maps (see Figure 3 as an example), summary tables, a library of project publications and presentations, a glossary, an FAQ page, a list of related external links, an online contact form, archives of the data for download, and a solar-specific sub-site. While IREEED was just released in September 2013 and has not included many additional resources, the site does provide archives of the data for download and policy news updates. The project team may consider providing similar resources based on the project scope and objective.
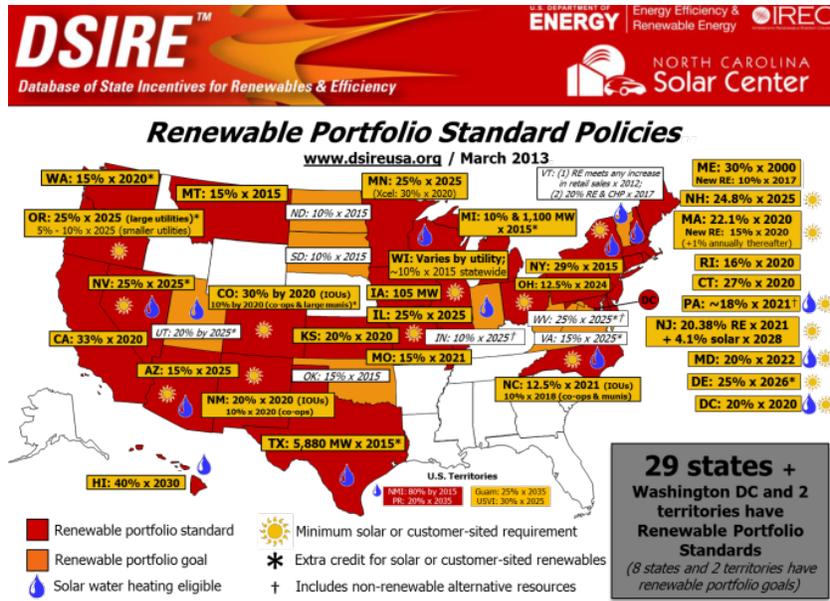
Figure 3. Example map that DSIRE provides in addition to the policy summaries in the database

- **Outreach and Communications**
  Designing and implementing a proactive and coordinated outreach plan early in the process could help to maximize awareness and use of the database. It may be beneficial to allocate resources to allow staff to travel to conferences, workshops, meetings, and other events to generate awareness of the website among government officials, businesses, and the general public.

- **Language**
  The language of the website will likely be determined by the language of the targeted audience(s). If target audiences speak multiple languages, it may be necessary to provide the information in more than one language. IREEED is currently available only in English, though adding a Hindi version may be considered in the future.

- **Requests for Technical Assistance and Information**
  Users may need or want technical assistance and information beyond what is provided on the website. For example, DSIRE staff provides technical assistance to policymakers, businesses, and the general public upon request. This assistance can take the form of a phone call to discuss the specifics of an incentive, conducting further research on a certain policy, or presenting information at a conference of regulators. To minimize the amount of staff time absorbed by individual requests, DSIRE has predefined responses for frequently asked questions.

- **Coordinate Activities with Similar Resources**
  Early in the planning stage, the project team may find it useful to contact program administrators for similar resources (e.g., DSIRE, IREEED) to discuss lessons learned. It may also be worthwhile to establish a partnership with other similar projects to share lessons learned and exchange information that could improve the effectiveness of such resources. This type of coordinate and partnership can allow program administrators to leverage existing resources.

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3 Major Technical Considerations

The second major component of creating a clean energy policy database is developing the database structure and the online user interface (website). Collaboration between the information technology (IT) and policy teams can help ensure that the database meets the needs of the staff inputting and reviewing policies and the user interface meets the needs of the users. This section provides an overview of the various technical components involved in developing an online policy database.

3.1 Technology Audit

It is beneficial to conduct a technology audit early in the planning process to identify server and application environment variables, assets, and needs, to set the foundation development and ongoing maintenance requirements. Through the audit process, the project team will document specifications for the server environment, database platform, application server, and hosting environment, as described below.

3.1.1 Server Environment

Two servers – a dedicated web server and database server – will likely be necessary to house the application framework. A hardware virtualization array may also be considered. Minimum hardware specifications are dependent on the project scope but could include:

- CPU Xeon Quad Core or better
- 8 GB of RAM
- 80 GB SCSI HDD space RAID 1.

In addition, if the database application will reside on existing servers, the project team will likely wish to review database requirements against:

- The specifications of the server (e.g., processor, RAM, or SCSI RAID)
- The version of the server utilized (e.g., Linux, Windows, or Mac OSX)
- The version of the operating system that the server is running.

3.1.2 Database Platform

The database platform will need to provide a stable environment for application requests, concurrent connections, and scalability. The choice of database platform is often based on the designated server OS environment. As an example, the DSIRE database is constructed using Microsoft's SQL Server 2008. Additional cloud-based frameworks, such as Microsoft's SQL Azure, are other potential options.

3.1.3 Application Server

The application server is typically chosen based on server environment and the database platform. In addition, existing application environment costs and development preferences may influence this decision. The project team may want to also consider what features may be added, such as mobile viewing capability.

3.1.4 Hosting Environment

There are three main topics to consider when selecting a hosting environment for the application:

- **Reliability**
  Reliability is a top priority in considering a data center to host the database application. Maximizing and maintaining up-time is critical to establish and maintain a long-term user base. As users become dependent on access to data, the application must be ready and available on demand.

- **Routine Back-Up Service**
  Hosting candidates often provide various database and file back-up services to support disaster recovery plans. Hardware failures and human errors occur; ensuring that redundancies are in place can help improve project success.

- **Bandwidth**
  The DSIRE application uses an average of 120 GB in bandwidth per month. Bandwidth is measured by the amount of data that can be transferred from the server to the user. A large user base requires more bandwidth. Web hosts often base monthly hosting fees on bandwidth allocation. Planning for bandwidth usage can help prevent costly overages if an external host is selected. In addition, cloud-based resources may be an option for file management in order to reduce the amount of bandwidth used as file data is served by the cloud host. However, heavy dependence on external cloud-based services can affect application load times, which could negatively impact users.

3.2 Application Planning

The application planning process involves objectives, resource usability, maintenance, scalability, and extensibility.

3.2.1 Determine the Application Objective

One of the first decisions to be made is to determine the application's main objective. The objective of DSIRE and IREEED is to disseminate up-to-date policy information effectively and on a mass scale. To achieve this objective, the application allows the project staff to update data and provides a medium to ensure effective communication.

3.2.2 Establish Short- and Long-Term Goals

Application goals are often set and achieved by reaching quantitative benchmarks, such as number of unique users, number of page views, or usage relative to a benchmark site. In 2011, the DSIRE application was used by an average of 560,000 visitors per month.[2] Each visitor averages four page views. This data indicate that the DSIRE application is reaching a large audience. Long-term goals can be established to address application evolution and penetration into new markets.

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[2] It is too early to determine the annual average users for IREEED as the website was released at the end of September 2013.

3.2.3 Maximize Usability

A strong understanding of the target audience and how users will prefer to access and use the data can inform database design and help ensure positive user experiences. Accordingly, the project team may wish to consider the following issues:

- **Browsers**
  First, it is important to determine which browsers the target audience most commonly uses. Often, websites and applications are designed to work on the past three or four versions of each target browser.

- **Screen Resolution**
  Websites and applications should be designed to function at the screen resolution settings most commonly used by the target audience(s).

- **Compliance**
  If applicable, the web application interface may need to meet specific accessibility standards. As an example, sites funded by the U.S. government must comply with U.S. "Section 508" usability standards.

- **Functionality**
  Taking into account how and why users will visit the website will allow the project team to design the website to direct users to relevant results. One metric for determining if users are able to accomplish their goals efficiently is to minimize the amount of clicks necessary to accomplish tasks. As an example, DSIRE uses a three-click standard.

- **Phased Launch**
  It is important to recognize that the database's website does not necessarily need to be launched in whole, at one time. The project team may find it useful to launch the website in multiple phases as individual components of the initial research effort are completed.

3.2.4 Maintain the Database

Over the life of the database, project staff will need to modify, add, and delete content on a regular basis. Setting up a password-protected administrative component will ensure only project staff are able to make changes, protecting the content of the website. As an example, the DSIRE application is updated by project staff via a web-based interface ("update console") to the database.[3] When designing and programming an "update console," it will be important to consider the number and credentials of people who will modify the content, and the method and speed by which modified content is promoted to the public website. Alternatively, the project team may prefer to set up the database to encourage substantial public input. The type of model chosen will impact how the project team will define the review and approval process. For example, if substantial user input is expected, the project team may choose to establish an approval process where team members must complete a review of the public input within a set timeframe (e.g., 7 days). Providing a clear definition of the public input review process on the website will set realistic expectations for users who contribute information.

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[3] DSIRE staff also receives limited revisions through user input into OpenEI.

3.2.5 Plan for Scalability

Because policy information and technical resources sometimes evolve rapidly, it is essential to plan for changes to the database and application architecture. Scalability planning is particularly important for the core database. The database architecture influences the scope of the application interface. Figure 3 and Figure 4 provide examples of how much the user interface for DSIRE has evolved over the years to reflect usability enhancements and IT improvements.
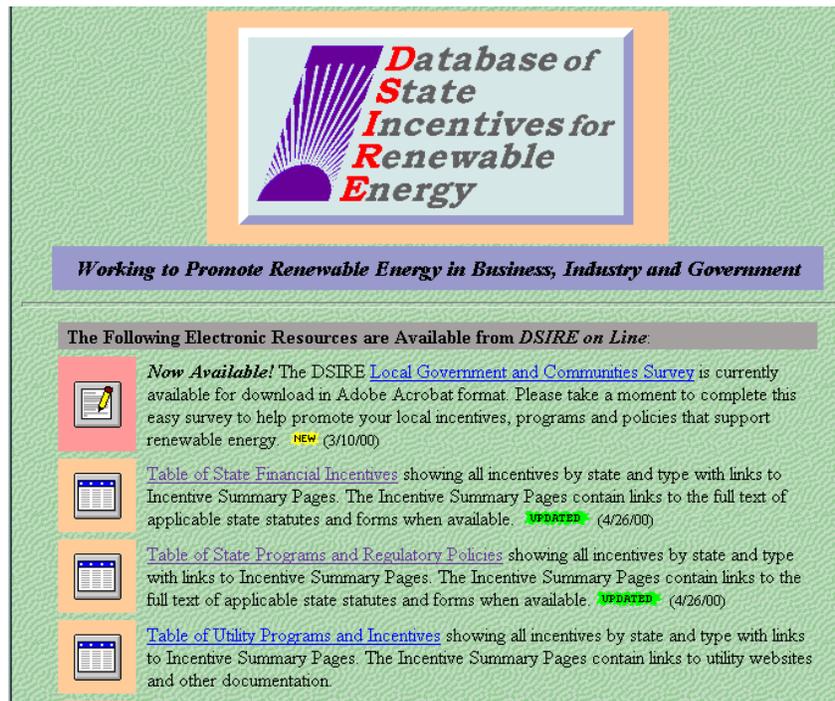

Figure 4. DSIRE user interface, 1997–2001

Figure 5. 2013 DSIRE user interface reflects IT advances and usability enhancements

While each policy and incentive category will have unique details, there are likely to be a number of similar details that will be included for all types. Performing a strategic analysis of the potential data to be contained in the database can allow the project team to determine how the data can be normalized across the data types. For example, DSIRE provides a "program overview" on each policy and incentive page that covers eligible technologies, applicable sectors, and date of enactment. Additional details are described in a separate summary. The "normalized" data captured in the program overview helps users to quickly understand the policy or incentive in general and they can then read the summary if they would like a deeper understanding. While this type of normalization is important, it is likely that there will always be unique data for each policy and incentive type that will need to be captured in a format specific to the type of policy or incentive.

The interconnectivity of the Internet has increased the demand for data extensibility. The application planning phase is a good time to consider opportunities to extend project data and other information beyond the scope of the local application. This could be accomplished by planning and building an infrastructure that can support data consumption by web-based services. Specifications and access can be documented using an Application Programming Interface (API) to enable accessibility. The API will indicate how to access a database query object to produce the desired results from the web service.

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4 Budget and Timing

It is difficult to generalize about the costs and timing for developing a policy database. Labor costs vary greatly from country to country and the labor requirements are highly dependent on project scope. For example, when DSIRE began in 1995, only a few hundred policies were included in the database. Over time, as the number of state energy efficiency and renewable energy policies has increased, DSIRE has grown to cover approximately 2,700 policies. The staff time needed to review and update policies has therefore increased greatly. The accessibility of policy information can also greatly impact the staff time and costs. If most subnational governments make their policies available to the public, it will be easier to gather the necessary information to include in the database.

Similarly, the amount of time needed to develop and launch such a database depends on the project scope. IREEED was released in two phases: the beta release in April 2013 and the final launch in September 2013. The beta release included policies from three states and functionality was limited. This early release allowed the project team to get feedback on the database and to make improvements prior to the final launch. It took approximately six months to develop the database such that it was ready for the beta release and approximately another six months for the final launch. Like DSIRE, it is expected that IREEED will continue to evolve as the needs of the target audience change.

5 Conclusion

Creating a clean energy policy database is a complex undertaking requiring close coordination between policy and IT experts. A good first step in developing such a database is to clearly define the project objective and target audience as these will guide the planning, design, and implementation. Careful planning early in the process can help ensure that the database meets the needs of the users.

In addition to considering the initial scope and audience, it can be useful to begin brainstorming about how the database and website might grow or change over time. Planning for possible future needs could help the team design the database with the necessary flexibility to adapt as needed.

As national and subnational governments enact new policies and incentives to promote renewable energy and energy efficiency, it could become more difficult for consumers, businesses, or policymakers to determine which policies and incentives will apply to a clean energy projects. Online databases like DSIRE and IREEED, which provide a single location for the public to access this information, can provide insight on a country's clean energy policy.

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