

Financing Clean Energy

Cost-Effective Tools for State Compliance with the Clean Power Plan

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U.S. efforts to mitigate global warming will require the allocation of significant sources of low-cost capital to leverage private-sector investments in renewable energy and energy efficiency technologies.

State “green banks,” institutions that provide financial products to assist customers with developing clean energy, are an effective tool states can use to scale up these investments to much higher levels. States have been innovating in this way because of challenges to implementing traditional financing programs. For example, direct incentives programs such as grants and rebates, while effective, can sometimes be difficult to scale up because of cost concerns and administrative complexities.

The six state governments (Connecticut, New York, Pennsylvania, Kentucky, Iowa, and Massachusetts) and, for instructional purposes, one national government (Germany) described in this report have mobilized public and private capital to strengthen clean energy investment.

In all of these cases, government administrators have:

- made use of in-house energy expertise to reduce the financial risks of private-sector loans for clean energy projects;
- educated, and were educated by, the financial sector;
- enabled a broad array of individuals, businesses, and institutions to achieve savings from clean energy investments.

State clean energy financing programs have been able to successfully engage diverse stakeholders to help mobilize capital. Collaborative efforts have included: making use of existing contractor networks to help roll out financing

programs; consulting with the financial community to build trust and identify sustainable funding sources; and drawing on local utilities’ experience in delivering programs to their customers to avoid duplication and maximize effectiveness.

The cases presented here show that clean energy financing programs offer a promising avenue to help states achieve their Clean Power Plan emissions-reduction targets for existing power plants (proposed by the U.S. Environmental Protection Agency [EPA]) while reducing American contributions to global warming emissions.

Financing Mechanisms That Help States Deploy Clean Energy

Investments in renewable energy and energy efficiency, both in the United States and around the world, have rapidly increased over the past decade. The global market for renewable energy technologies, according to the International Renewable Energy Association (IRENA), totaled \$214 billion in 2013; the following year, global sales of renewables grew by almost 18 percent, or \$38.3 billion, with 7 percent growth in the United States (FS-UNEP 2015). Meanwhile, the International Energy Agency (IEA) recently estimated that the energy efficiency market accounted for \$130 billion in 2014 (IRENA 2014a; IRENA 2014b). In many countries, the rapid expansion of these markets outpaced other sectors of the economy and served as a growth engine.

Despite these advances, substantial increases in renewable energy and energy efficiency will be further required, not only to meet the energy demands of the world’s growing economies but also to limit the worst consequences of climate change—key to any effective global warming mitigation plan will be the allocation of significant capital to invest in low-carbon energy technologies. Between now and 2030, some \$550 billion will need to be invested annually in renewable energy, IRENA estimates; and more than \$381 billion per year will be needed

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for energy efficiency, according to the International Energy Association (IEA). In the United States, the National Renewable Energy Laboratory (NREL) estimates that reaching national targets of 30 percent of U.S. electricity generated from renewable energy by 2025 and 80 percent by 2050 will require investment on the scale of \$50 to 70 billion annually over the next decade (NREL 2012).

One notable opportunity to hasten the transition to a low-carbon energy economy in the United States is the Clean Power Plan—a standard developed by the EPA to limit carbon dioxide (CO₂) emissions from existing power plants. The proposed plan, which sets emissions-rate reduction targets for the power sector of each state, would reduce national electricity sector emissions to 30 percent below 2005 levels by 2030, according to the EPA. Under this proposed standard, states would have significant authority, including the flexibility to implement their own tailored and cost-effective plans drawn from a suite of options for reaching their individual emissions-reduction targets. For example, the deployment of renewable energy resources is an eligible compliance option, as is energy efficiency increases in buildings and industry (Cleetus et al. 2014). Other options include process efficiency improvements at coal-fired power plants, the shifting of generation from coal to natural gas, and the deployment of nuclear power plants. States must develop their compliance plans no later than 2017, or by 2018 if they participate in a multistate plan.

To spur investments in renewable energy and energy efficiency as a means of complying with the Clean Power Plan, states can adopt a number of proven clean energy market-development mechanisms. The most popular to date have been renewable electricity standards, energy efficiency resource standards, public benefits funds, tax and incentive policies, utility rebates, building-energy codes, net metering, and carbon cap-and-trade. In addition, some of the states highlighted in this report are putting innovative clean energy financing initiatives into action that complement the already available set of policy options suggested above. These second-generation policies can also help make renewable energy and energy efficiency more competitive, especially as existing policy initiatives change, expire, or become less effective at driving deployment.

States have been innovating in this way because of challenges to implementing traditional financing programs. For example, direct incentives programs such as grants and rebates, while effective, can sometimes be difficult to scale up because of cost concerns and administrative complexities.

In addition, clean energy projects and their market development often face some significant inherent barriers, including:

Green banks offer a promising avenue to help states reduce emissions from existing power plants to achieve their EPA Clean Power Plan targets.

- financiers' limited understanding of the technology and their concerns about performance risk;
- the relatively small scale of individual clean energy projects, as compared with typical capital-provider investments; and
- the high transaction costs of due diligence and contract negotiations related to clean energy projects.

To address these concerns, several states have used “green banks” and other new financing initiatives to help secure the funding to scale up clean energy investments without the need for substantial direct incentives. In addition, these initiatives can incorporate a range of strategies—including lender outreach and education, contractor support and

BOX 1.

State Green Bonds: Another Vehicle for Clean Energy Investment

In addition to green banks, green bonds also have emerged as a viable tool for corporations, institutions, and municipalities to raise capital for projects, such as those based on renewable energy, that provide environmental benefits. The Climate Bond Initiative reports that more than \$40 billion in issuances occurred in 2014, and it estimates that \$100 billion in climate bonds will be issued in 2015. Issuance has been dominated by supranational institutions (e.g., the World Bank), but over the past few years states have been getting into the act. For example, in 2013 Massachusetts became the first U.S. state to issue green bonds. The New York State Environmental Facilities Corporation issued bonds in late 2014, and the District of Columbia Water and Sewer Authority is currently marketing a \$300-million 100-year bond.

training, installation-standards establishment, project aggregation, and credit-support mechanisms—to help facilitate market development.

This report describes six state-level programs and one international program that have successfully leveraged limited funding to scale up clean energy investment. These programs range from all-encompassing green banks to more discrete efforts focused on a particular clean energy market sector. While some state programs have a lengthy history of success, others are in their early proof-of-concept stages.

We review Connecticut and New York's green banks, clean energy financing mechanisms in Pennsylvania and Kentucky, revolving-loan programs in Iowa, and the Mass Save HEAT Loan program of Massachusetts. Finally, we discuss Germany's Kreditanstalt für Wiederaufbau (KfW)—a federally chartered bank that provides a suite of diverse financing products—which over the past decade has helped make Germany a global leader in deploying clean energy.

Connecticut's Green Bank

Chartered by the state's legislature in 2011 in a bipartisan and nearly unanimous manner, the Connecticut Clean Energy Finance and Investment Authority (CEFIA) was renamed the Connecticut Green Bank in 2014. The nation's first comprehensive state-based clean energy financing entity—initially capitalized with \$48 million in utility surcharges and Regional Greenhouse Gas Initiative auction proceeds (CGC 2014)—the CEFIA was mandated to shift the state's clean energy market from government-based incentives to private-sector financing. Prior to the CEFIA's establishment, 80 percent of the clean energy incentives in Connecticut were from grants, rebates, or other subsidies. Presently, 80 percent of the state's clean energy resources are spent on financing instruments, such as loans and credit enhancements, which are successfully leveraging public funds to garner private investment.

The Green Bank sees this transition as having four market stages:

1. Government subsidies such as the performance-based incentive for residential customers, which reduces the upfront cost of solar photovoltaic (PV) systems

2. Green bank financing with reduced subsidies, which is the current state of the market in Connecticut
3. Green bank financing, such as leases and loan guarantee programs, with no subsidies
4. Private-sector financing, such as loans offered by local lending institutions

The Green Bank intends to complete the transition by developing programs to finance clean energy investment in residential, municipal, small business, and larger commercial projects; by supporting financing that promotes clean energy development and commercialization; and by stimulating demand for clean energy throughout the state to serve Connecticut residents (Connecticut Green Bank 2014).

PROGRAM FEATURES

SUPPORT FOR RESIDENTIAL RENEWABLE ENERGY AND ENERGY EFFICIENCY PROJECTS

The Connecticut Green Bank offers residential solar programs, with leases and loans provided by private-sector institutions AFC First Financial Corp. and Sungage Financial (Energize Connecticut 2015a; Energize Connecticut 2015b). The Green Bank gives credit support for the programs and maintains a list of eligible and vetted contractors for solar PV and thermal. The lease and loan products are advertised to customers engaged in the state's solar group purchase program, called Solarize Connecticut, and advertised as well through traditional marketing channels. The solar lease can have a term of up to 20 years, and it is packaged with insurance and maintenance provisions courtesy of Assurant (Energize Connecticut 2013). A solar loan offers a 15-year term with an interest rate of 6.49 percent.

The Green Bank also has a home-improvement loan called the Smart-E Loan; the bank provides a loan loss reserve fund (a credit-enhancement mechanism designed to provide payments in the event of a loan default) to create a more accessible private-sector loan program for energy efficiency improvements. Several local lenders have partnered with the Green Bank to offer Smart E-Loans, which have 5- to 12-year loan terms with interest rates ranging from 4.49 to 6.99 percent, to Connecticut property owners (Energize Connecticut 2015c). The loans can be used to support high-efficiency boilers and

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In 2012, Connecticut State Senator John Fonfara attended a ribbon cutting ceremony following the installation of a new 60-panel solar thermal system on an apartment in Hartford that received financing from the state's green bank. The system provides 70 percent of the 78-unit apartment building's hot water needs.

furnaces; insulation, air sealing, and duct sealing; ground- and air-source heat pumps; biomass boilers; and high-efficiency water heaters (Energize Connecticut 2015c and 2014b).

COMMERCIAL PROGRAMS

The Connecticut Green Bank offers the commercial sector several programs, including one called “commercial property assessed clean energy (C-PACE) financing” that embraces solar leasing and energy efficiency lending. C-PACE allows property owners to finance energy improvements or alternative energy projects on their buildings and repay the loan through a tax assessment tied to the property. This financing mechanism allows the loan to transfer if the property changes hands, and it increases the likelihood that debt will be recovered in the event of a default. The program, which is coordinated with municipalities that have adopted PACE-enabling legislation, is considered one of the most robust in the United States.

The Green Bank warehouses the PACE loans and sells them once the program reaches a sufficient volume of closed loans. The Green Bank also serves as the technical administrator and reviews proposed project portfolios for buildings based on their merit. Depending on the size of the project, applicants can access a streamlined review process. High-efficiency lighting, HVAC upgrades, building-envelope improvements, building-automation systems, and renewable energy projects are all eligible for financing through the program. Loans can range from 10 to 20 years and interest

rates vary from 5 to 6 percent with a closing fee (Energize Connecticut 2014a).

PROGRAM EFFECTIVENESS

The Connecticut Green Bank has been successful in making clean energy financing more accessible and affordable for homeowners, businesses, and institutions. Over the past three years, the program has completed 8,800 projects and installed solar panels in more than 10,000 Connecticut homes, thereby creating almost 6,200 jobs and reducing carbon emissions by one million tons (Connecticut Green Bank 2015a).

The bank has also been effective at leveraging private-sector capital with limited public-sector funds. For example, the Smart E-Loan program has used \$2.8 million in state resources to deploy more than \$30 million in private-sector loans for energy—a ratio of more than 10:1. The C-PACE program has had a similar track record. During its first two years of operation the program has:

- sponsored more than \$65 million in financing for over 90 renewable energy and energy efficiency projects, which provide more than six megawatts of clean electricity generation;
- delivered consumer energy-bill savings of 20 to 40 percent for energy efficiency projects and 50 to 90 percent for solar projects;
- signed up more than 105 municipalities—accounting for nearly 90 percent of the state’s commercial and industrial building stock—to participate in the program; and
- trained over 100 contractors to implement C-PACE-financed clean energy projects (Connecticut Green Bank 2015b).

The Green Bank also recently completed its first auction of loans and has achieved a 4:1 leverage ratio, which it expects to

C-PACE allows property owners to finance energy improvements or alternative energy projects on their buildings and repay the loan through a tax assessment tied to the property.

nearly double in future years as funds are recycled. In short, the bank is meeting its goal of transitioning the Connecticut market from incentives to sustainable finance.

LESSONS FOR OTHER STATES

The investor-owned utilities in Connecticut—Connecticut Light and Power and United Illuminating—also offer efficiency programs. In order to maximize effectiveness, Connecticut Green Bank programs have been carefully coordinated with these utility offerings. To avoid customer confusion and also produce high-quality results, states intending to deploy green banks should develop a strategy for cooperating with utility programs (Garcia 2014).

In 2013, some Green Bank funds were reallocated elsewhere to help meet Connecticut’s budget deficit (Garcia 2014), with consequent reductions in the number of projects it could help finance. This problem is not unique to Connecticut, as other states have also sought to cut budgets for renewable energy and energy efficiency during austere times. Thus it is important for states establishing green banks to (a) make clean energy development a high priority and (b) explore methods to separate and guarantee funds so as to create investor and customer confidence in the reliability of green bank programs.

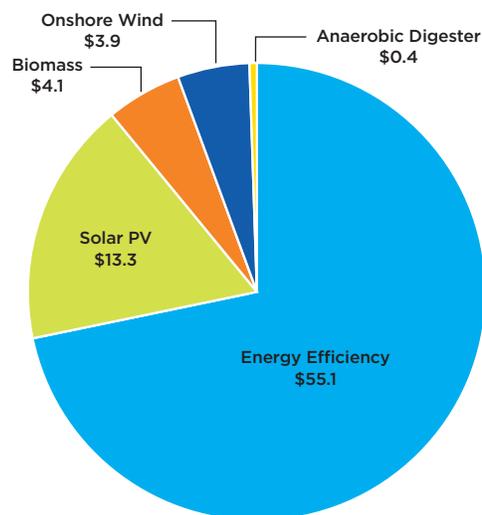
New York’s Green Bank

In January 2013, Governor Andrew Cuomo announced the creation of the New York Green Bank, a major financing initiative to increase the flow of capital to clean energy projects in the state. The initiative’s cited rationale was to reduce the \$1.4 billion that New York spent each year on direct clean energy incentives and to transition to a more sustainable market-support model (New York Green Bank 2014).

Over the year that followed, state agencies developed a comprehensive Green Bank business plan, which among other things aimed to overcome a number of persistent market barriers:

- An undeveloped secondary market for clean energy finance
- High upfront costs for renewable energy and energy efficiency technologies
- Insufficient understanding by capital markets of clean energy technologies and of the opportunities and risks of clean energy investments
- A limited ability to scale clean energy loan-underwriting processes (New York Green Bank 2014)

FIGURE 1. New York Green Bank 10-Year Investment Potential (Billions of Dollars)



The estimated 10-year investment potential for the Green Bank reveals a substantial market opportunity for clean energy projects throughout New York. The majority of these investments are projected to be leveraged to support energy efficiency technology deployment.

An initial Green Bank study found that the investment potential for clean energy in New York State during the first 10 years of bank operations was more than \$75 billion. This analysis reviewed a range of potential clean energy technology categories, including energy efficiency, photovoltaics, combined heat and power, biomass, onshore wind, and anaerobic digestion (Booz & Company 2013). Figure 1 shows the estimated breakdown of investment opportunities.

In December 2013, Governor Cuomo announced an initial capitalization of \$210 million for the Green Bank, sourced from the sale of carbon credits related to the Regional Greenhouse Gas Initiative and from system benefit charges levied on energy consumers.

The investment potential for clean energy in New York State during the first 10 years of bank operations is more than \$75 billion.

PROGRAM FEATURES

Because the Green Bank intends its financing products to be responsive to market demand, it has continually posted online an open request for proposal so that market actors may propose projects and programs for Green Bank investment (New York Green Bank 2015). Key investment categories include:

- credit enhancements, such as credit guarantees and loan loss reserves, that reduce project risk for private financiers;
- short-term loan warehousing and aggregation that facilitate secondary-market participation in clean energy finance;
- subordinated debt (i.e., losses due to nonpayment are first borne by other financing providers); and

- composite financing products that span a range of mechanisms, including equity investments and the development of tax equity funds.

In October 2014, New York announced its first round of Green Bank investments, totaling \$800 million, across a diverse portfolio of investment types and clean energy market segments. Examples of funded projects included:

- support of an investment fund for energy service agreements in the commercial real estate sector;
- creation of an investment vehicle for distributed combined heat and power systems;
- lender guarantees for a mid-size commercial solar project expected to serve as a template that would allow local banks to more easily invest in similar projects; and
- co-investment in a portfolio of commercial clean energy projects through provision of long-term debt that would otherwise be unavailable in the marketplace.

The New York Green Bank's varied portfolio and flexible lending approach allows it to quickly adapt to market needs.



New York City's iconic Empire State Building recently completed a comprehensive energy efficiency retrofit project that is expected to reduce energy use by 38 percent and cut carbon emissions by 105,000 metric tons over a 15-year period. By lowering the building's energy bills by \$4.4 million annually, the project is expected to recover the \$13.2 billion in upfront capital costs in three years. The New York State Research and Development Authority, who was one of five partners in this project and operates the state's Green Bank, is financing similar projects in other buildings in the city and throughout the state (Jones Lang LaSalle et al. 2009).

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PROGRAM EFFECTIVENESS

Because the initial New York Green Bank investments were so recently announced, there are no reported results as yet. But early-stage analysis suggested that financing from the bank could leverage private-sector capital at a ratio of 8:1. The same analysis found that Green Bank investments could yield a return on investment of 1.5 to 4.1 percent (Booz & Company 2013). If these metrics hold true, the Green Bank could quickly become a self-sustaining finance entity, thereby significantly reducing the need for state programs focused on direct clean energy market subsidies.

LESSONS FOR OTHER STATES

Developing the New York Green Bank market model was a multiyear effort that involved multiple stakeholders and significant input by the state Public Service Commission. The substantial body of work that resulted, which is now a public

record, could be useful to other states interested in developing their own Green Bank initiatives.

The New York Green Bank enjoyed significant initial capitalization from several funding streams, including revenue from the Regional Greenhouse Gas Initiative. But despite the attractiveness of the model, some states may not have ready access to appropriate capital for launching such a comprehensive effort. Moreover, the development and operation of a green bank takes knowledgeable and experienced professionals with strong backgrounds in finance. States should be prepared to recruit such individuals with these qualifications in order to ensure that its green bank effectively serves market investors and program beneficiaries.

Pennsylvania's Keystone Home Energy Loan Program and Warehouse for Energy Efficiency Loans

Since 2006 Pennsylvania has been operating the Keystone Home Energy Loan Program (Keystone HELP), one of the most successful residential energy efficiency financing programs in the United States. A collaborative effort between state agencies and private-sector financing entities, Keystone HELP recently underwent a significant transition. In order to create long-term sustainable financing streams featuring lower-cost debt for energy efficiency projects, Keystone HELP is participating in the multistate Warehouse for Energy Efficiency Loans (WHEEL)—a model that accesses the secondary capital markets, which substantially increases a participating program's impact.

PROGRAM FEATURES

KEYSTONE HELP

Keystone HELP is administered by AFC First Financial on behalf of the Pennsylvania Treasury and the state's Department of Environmental Protection (DEP) (Keystone HELP 2015). The program originally featured origination of loans by AFC First, followed by the Pennsylvania Treasury's purchase of the debt; funding from the DEP supported a loan loss reserve (McGuckin et al. 2011). But under this model, the Treasury had limited ability to hold loans on its balance sheet, so a transition to selling loans in secondary markets occurred (see the description of the WHEEL's structure below).

Loans disbursed to homeowners through the Keystone HELP typically have a term of 1 to 10 years, with a loan maximum of \$10,000. Financing through the program is unsecured, with typical interest rates of between 3 and 9 percent. Originally, the state provided a loan loss reserve equal to

Keystone HELP is supported and sold through a network of contractors that have received training.

5 percent of the total loan amount. Given concerns about long-term viability of this strategy, however, the program shifted to providing subordinated debt—i.e., losses due to nonpayment are first borne by other financing providers. Keystone HELP is supported and sold through a network of contractors that have received training from AFC First. This approach allows the program to build a network of advocates while helping to ensure high-quality retrofit installations.

WAREHOUSE FOR ENERGY EFFICIENCY LOANS

Working with a coalition that included the National Association of State Energy Officials, the Pennsylvania Treasury, Renewable Funding, and Citigroup Global Markets, the Energy Programs Consortium developed WHEEL, which provides low-interest financing for a wide variety of energy efficiency initiatives. Not intended to be state-specific, WHEEL can be utilized by any state looking to support clean energy lending.

WHEEL works by aggregating unsecured loans through utility and government programs. Under the current model, WHEEL holds (i.e., warehouses) loans developed under

BOX 2.

Program-Eligible Measures for Pennsylvania's Keystone HELP

- Air sealing and insulation
- Air-source heat pumps
- Boilers (all fuels)
- Furnaces (all fuels)
- Central air conditioning systems
- Programmable thermostats
- Water heaters
- Ceiling fans
- Ventilating fans



Consulting with the financial community is important for designing and implementing effective state clean energy financing programs. This engagement is also important for building trust and identifying sustainable funding sources.

a state program until there is a sufficient quantity of loans to permit their packaging and sale to bond investors. The proceeds from selling these aggregated bonds are then used to recapitalize the original state fund, allowing further clean energy loans to be generated. Program sponsors, such as state agencies, receive a return on their initial investments through loan repayments, which they can invest in their communities.

PROGRAM EFFECTIVENESS

Since its inception, Keystone HELP has supported more than 12,000 residential loans totaling nearly \$90 million (McGuckin et al. 2011). The default rate for loans issued under this program is currently at 1.28 percent. The transition to the WHEEL model is expected to significantly expand the total volume of loans provided by Keystone HELP, which intends to sell its first asset-backed notes once that volume reaches roughly \$50 million (Clouse 2014).

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LESSONS FOR OTHER STATES

Keystone HELP has benefited from a strong contractor network that can educate consumers about the energy efficiency financing options available to them. This model may be of interest to state governments and utilities with limited experience in supporting home energy retrofit programs.

WHEEL provides an open platform, available to any state or local government's energy efficiency financing program,

for aggregating loans and selling them in the secondary market. For Pennsylvania, this option has greatly increased the potential scope of Keystone HELP. Meanwhile, New York and Kentucky are working to integrate their own energy efficiency programs with WHEEL.

Kentucky's Home Performance Program

Established in 2010 under the federal American Recovery and Reinvestment Act (ARRA), the Kentucky Home Performance program is administered through a partnership of the Kentucky Housing Corporation (a quasi-governmental agency) and the Kentucky Department for Energy Development and Independence. The program has been credited with developing a sustainable model for the home performance industry in Kentucky (KHC 2013).

PROGRAM FEATURES

Modeling its home performance program on an EPA initiative—Home Performance with Energy Star—Kentucky created a workforce development program for contractors that provides training on energy efficiency improvements, financial incentives, and energy auditing. Kentucky Home Performance offers 60- to 180-month loans, with interest rates ranging from 3.99 to 9.99 percent, and homeowners can access both secured and unsecured loans. The program is administered through AFC First Financial, a leader in energy efficiency lending and program implementation. The ARRA funds enabled a credit enhancement for Phase I of the program; Phase II, launched in 2013, has adopted the WHEEL model to create a sustainable structure that does not rely on government grants. Eligible improvements include heating and cooling systems, geothermal heat pumps, insulation and air sealing, high-efficiency windows, and high-efficiency water heaters (KHP 2012).

PROGRAM EFFECTIVENESS

Phase I of the Home Energy Performance program supported 1,000 retrofits of single-family homes and trained some 150 contractors to perform energy efficiency retrofits in the state. So far, the program has produced \$11 million in energy efficiency



A technician seals ductwork in a home in Lexington, KY, following an energy efficiency audit done in partnership with the KY Home Performance program. In addition to providing rebates for energy audits, the program offers financing to pay for identified energy efficiency retrofits that are achieving average energy bill savings of 26 percent (Sloan 2012).

investments, and participating homeowners have averaged energy savings of 26 percent from their retrofits. As a result, Kentucky received national recognition from the EPA and the National Council of State Housing Agencies for its innovative use of ARRA funds.

LESSONS FOR OTHER STATES

After the ARRA funds were exhausted, Kentucky successfully transitioned the program from grant-funding dependence to the more sustainable WHEEL model. Home Energy Performance, originally focused on energy efficiency, could

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be adapted to also promote on-site renewable energy technologies such as solar PV, solar water heating, and biomass heating.

Iowa's Clean Energy Revolving Loans

Iowa has two revolving-loan programs for individuals and public organizations: the Iowa Green Bank and the Alternative Energy Revolving Loan Program.

IOWA GREEN BANK

The Iowa Economic Development Authority administers a revolving loan program for public facilities pursuing renewable energy and energy efficiency investments. Private-sector loans are issued in partnership with the Iowa Area Development Group. This loan program, the Iowa Green Bank, was initially capitalized in 2009 with American Reinvestment and Recovery Act funding (IADG 2015). The program offers \$50,000 to \$500,000 in the form of 1-percent interest loans for up to 10 years.

ALTERNATIVE ENERGY REVOLVING LOAN PROGRAM

In 1995 the Iowa legislature established the Alternative Energy Revolving Loan Program (AERLP), which the Iowa Energy Center at the University of Iowa was tasked with administering. Under this program, no-interest loans of up to \$1 million for alternative energy projects are available to individuals, organizations, electric co-ops, and municipal utilities. These loans, with terms as long as 20 years, cover up to 50 percent of project costs (DSIRE 2014). Because matching funds must be provided by a participating private-sector lender, many lenders from around the state have been engaged with the AERLP since its inception. The fund received \$5.9 million initially from Iowa's investor-owned utilities, and an additional \$5 million in both 2009 and 2010 from the Iowa I-JOBS bill (Iowa Energy Center 2015a).

PROGRAM FEATURES

IOWA GREEN BANK

The Iowa Area Development Group provides technical assistance to businesses and industrial applicants in order to identify potential energy efficiency projects, and it connects them with available utilities and service providers for energy audits and assessments prior to submission of the application (IADG 2015). Projects eligible for funding, such as those listed in Box 3, must demonstrate a 10-year payback on the initial investment.

The Iowa Green Bank offers \$50,000 to \$500,000 in the form of 1-percent interest loans for up to 10 years.

ALTERNATIVE ENERGY REVOLVING LOAN PROGRAM

Under the AERLP, the Iowa Energy Center provides loans of up to \$1,000,000 to individuals or organizations, and up to \$500,000 every two years to electric co-ops or municipal utilities, for implementing alternative energy projects. Partnering lenders manage the entire loan for the duration of the project and are responsible for repayment of the Iowa Energy Center's share. These co-lenders also assess the applicant's credit-worthiness, while the center's expertise is tapped to evaluate the energy project itself. The AERLP maintains a website list of lenders that have participated in this way (Iowa Energy Center 2015b).

Applications for \$25,000 or less are evaluated continuously, while larger applications are reviewed on a quarterly basis. Eligible projects include solar energy (PV or thermal), wind, biomass (waste management, resource recovery, refuse-derived fuel, agricultural crop residue, and wood-burning), and small hydro (Iowa Energy Center 2014).

BOX 3.

Iowa Green Bank Eligible Measures

- Combined heat and power
- Demand-reduction equipment
- Ground-source heat pumps
- HVAC upgrades or replacements
- Insulation
- Lighting replacements
- On-site solar PV up to 60 kW
- Small biomass or thermal
- Wind up to 20 kW
- Window and door replacements
- Solar hot water
- Solar thermal up to 20 kW



In 1993, the Spirit Lake School District in Iowa installed one of the nation's first school wind turbines to generate electricity for their nearby elementary school. Success with this project led them to install a second, larger turbine in 2001 to power additional district facilities, including their high school, middle school, vocational-tech building, district offices, maintenance building, and athletic fields. Iowa's AERLP provided \$250,000 in no-interest financing of the total \$780,000 cost, which was instrumental in moving forward with the project. During the first five years, the project generated a positive cash flow, with annual average savings of \$120,000 exceeding their \$97,000 loan payment and operations and maintenance cost (Iowa Energy Center 2007).

PROGRAM EFFECTIVENESS

IOWA GREEN BANK

There is limited publicly available information on the Green Bank's performance. Three municipal energy efficiency projects and one renewable energy project are under way through this public-sector loan program (IEDA 2014).

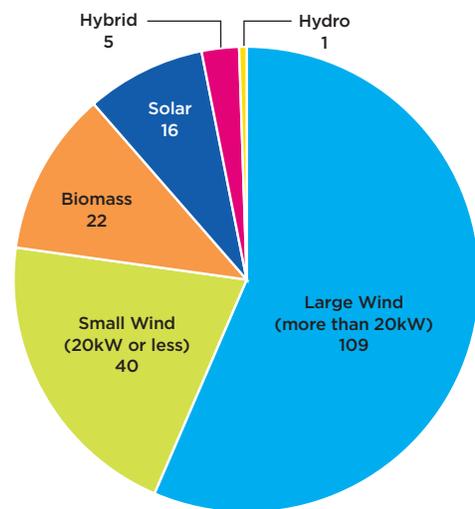
ALTERNATIVE ENERGY REVOLVING LOAN PROGRAM

Since 1996, the AERLP has provided \$28.4 million in funding to 195 alternative energy projects with total construction costs of \$295 million. (Iowa Energy Center 2014). As shown in Figure 2, the program has supported a diverse array of projects.

LESSONS FOR OTHER STATES

Since it began operating 12 years ago, the AERLP has developed a large array of partner lenders that have now become quite knowledgeable about lending for alternative energy projects. The Iowa Green Bank model provides applicants with pre-application assistance, which makes it more likely that numerous high-quality projects will be available for private-sector lenders' consideration.

FIGURE 2. Iowa AERLP Project Types



While much of the funds have been devoted to wind projects given the state's abundant wind energy resources, a diverse array of other clean energy technologies have been deployed with the financial support provided by the AERLP.

Massachusetts' Mass Save HEAT Loan

Not surprising in a state consistently rated by the American Council for an Energy Efficiency Economy (ACEEE) as number one in the nation for state-level energy efficiency policy, Massachusetts's utility-sponsored programs in this domain offer a wide range of technologies and incentive types. Prominent among them is a longstanding residential-efficiency financing program known as the Mass Save HEAT Loan, which since its launch in 2006 has significantly leveraged new private-sector capital and recruited dozens of local financing institutions to participate.

PROGRAM FEATURES

The Mass Save HEAT Loan is structured as an interest-rate buydown program that provides homeowners, landlords, and multifamily households with zero-interest financing to install a range of renewable energy and energy efficiency technologies. Current HEAT Loan traits include a maximum loan amount of \$25,000 with a term of up to seven years. Box 4 shows the renewable energy and energy efficiency technologies eligible for a HEAT Loan.

To access the HEAT Loan program, homeowners and landlords must complete an energy audit, which is provided free of charge through utility energy-efficiency programs. Loans are underwritten and provided by participating local lenders, which have significant flexibility—e.g., they can opt for secured or unsecured debt. The program currently includes a range of financial institution types, from small credit unions to major international banks (Mass Save 2015).

Energy efficiency experts consider the HEAT Loan program one of the most successful U.S. financing programs for residential energy-efficiency.

Lenders evaluate prospective borrowers in accordance with their usual underwriting criteria, and financing prices are based on current market rates. Instead of charging homeowners interest on a loan, lenders receive the net present value of its expected interest from HEAT Loan program administrators; homeowners pay only principal for the life of loan. A lump-sum interest payment from the program

BOX 4.

HEAT Loan Program-Eligible Measures

- Attic, wall, and basement insulation
- Central air conditioning/Air-source heat pumps
- Digital and Wi-Fi thermostats
- Ductless mini-split heat pumps
- Energy Star-qualified replacement windows
- High-efficiency domestic hot water systems
- High-efficiency heating systems
- High-efficiency wood pellet boilers
- Solar hot water systems

administrator reduces lender risk, thereby encouraging investments in energy efficiency technology.

PROGRAM EFFECTIVENESS

The ACEEE and other energy efficiency experts consider the HEAT Loan program one of the most successful U.S. financing programs for residential energy-efficiency. Through 2012, it had financed \$180 million in residential energy efficiency projects in more than 21,000 homes (HB&C 2012). Average default rates for the program have been very low, estimated at less than one percent (EEAC 2013). The program has also developed innovative ways to connect with traditionally underserved groups such as multifamily and low-income households.

LESSONS FOR OTHER STATES

An important reason for the HEAT Loan program's effectiveness is that it leverages the expertise of veteran actors—such as home improvement contractors who sell the energy efficiency upgrades and local lenders who underwrite and distribute the loan—already in the market. State and utility intervention in the transaction is minimal beyond establishing HEAT Loan program criteria, qualifying lenders, and making payments to lenders. The program is fully integrated with the statewide residential energy-audit initiative, which allows energy auditors to educate homeowners, face to face, about the program.

The HEAT Loan's offerings were recently expanded beyond residential to commercial properties. But to date, this initiative has had limited success, reportedly because the



DOE

The Mass Save Heat Loan program provides homeowners, landlords, and multifamily households with no-interest loans of up to \$25,000 for seven years for a wide range of energy efficiency and renewable energy technologies. Between 2006 and 2012, the program financed \$180 million in residential energy efficiency projects in more than 21,000 homes (HB&C 2012). Energy-saving improvements such as adding insulation, replacing windows, and installing efficient lighting and appliances are all cost-effective ways to lower energy bills and reduce carbon emissions.

interest rate buy-down model does not make many energy efficiency retrofit projects sufficiently attractive to commercial and industrial property owners.

Meanwhile, Massachusetts is working to broaden the HEAT Loan program to include other technologies, such as residential solar PV. The Department of Energy Resources announced an initial program design for this solar financing program in late 2014. Developed in collaboration with local lenders, the program would provide state funds to buy down the costs of solar loans for Massachusetts residents. This initiative is expected to increase the availability of long-term loans while reducing interest rates for homeowners.

Germany's Kreditanstalt für Wiederaufbau Green Bank

Several countries, including Germany, the United Kingdom, Australia, and Japan, have created national mechanisms to facilitate the financing of renewable energy and energy

efficiency projects. While German policies such as its “feed-in tariff” for renewable energy (a fee or payment by electricity suppliers to consumers who produce renewable energy) have attracted significant international attention, green financing programs have also played a major role in making Germany a global leader in clean energy deployment. Toward that end, the German Kreditanstalt für Wiederaufbau (KfW)—a federally chartered bank established under the Marshall Plan to rebuild the country after the Second World War—has been offering a suite of diverse financing products.

PROGRAM FEATURES

The KfW's financing products include:

- home energy-related retrofit loans of up to €50,000;
- renewable energy loans for individuals, farms, and other businesses of up to €25 million;
- debt financing for offshore wind projects of up to €700 million;

- resource risk insurance for geothermal energy projects; and
- financing for stationary battery-storage projects paired with PV systems (KfW 2015).

Like other green financing institutions discussed in this report, the KfW partners with retail banks to support and market its financing products. Such arrangements allow it to leverage existing customer relationships, make use of commercial banks' underwriting expertise, and, often, reduce its risk by requiring these outside lenders to provide some of the

TABLE 1. KfW Renewable Energy Program Metrics

	2011	2012	2013
Investments financed (€billion)	8.3	10.0	6.6
Jobs created (for one year)	56,800	73,500	47,000
Annual CO ₂ metric tons avoided	5,079	6,600	4,600
Fossil fuel imports avoided (€million)	430	460	n/a

Over a three year period, Germany's green bank has financed nearly €25 billion in renewable energy investments, creating tens of thousands of jobs and significantly reducing fossil fuel imports and carbon emissions. These investments have allowed homeowners and businesses to gain access to low-interest financing that has helped make Germany a global leader in wind and solar energy development.

SOURCE: KfW 2014

TABLE 2. KfW Energy Efficiency Metrics

	2011	2012	2013
Investments financed (€billion)	18.6	27.3	34.6
Jobs created (for one year)	253,500	352,000	424,000
Annual CO ₂ metric tons avoided	576.8	743.9	805.0
Homes financed for energy retrofit	282,000	358,000	409,000

Germany's green bank financed €80 billion in energy efficiency retrofits in more than one million homes between 2011 and 2013. These investments have created hundreds of thousands of clean energy jobs manufacturing, installing, and maintaining energy efficiency measures, while making an important contribution toward Germany's targets to achieve deep cuts in carbon emissions.

SOURCE: KfW 2014



Armin Kibelbeck/Creative Commons (Wikimedia Commons)

Germany's federally chartered green bank—established under the Marshall Plan to rebuild the country after the Second World War—has played a major role in making the country a global leader in renewable energy development.

projects' financing. Additionally, the German federal government guarantees all loans issued by the KfW, thereby enabling the bank to offer low-cost financing at highly competitive rates (Schröder et al. 2011). One reason for the government's help in financing is that it uses the KfW's programs as a conduit for implementing new energy programs and policies—including, for instance, energy retrofit standards and PV/battery backup incentives.

PROGRAM EFFECTIVENESS

The KfW's suite of financing options has been highly effective in supporting Germany's clean energy market growth. Table 4 shows results of the KfW's renewable-energy programs, and Table 5 shows key metrics for the KfW's energy efficiency programs, for the 2011–2013 period (KfW 2014). As these tables suggest, KfW programs have enabled clean energy technology deployment, substantial job creation, and reductions in global warming emissions.

LESSONS FOR U.S. STATES

KfW loans have enabled the rapid expansion of the German clean energy industry, and critical to this success has been the bank's flexible approach: it adapts programs to meet evolving market needs. Another reason for the KfW's success is its substantial lender-education programs. These initiatives have increased local lender's familiarity and comfort with clean energy projects, which has facilitated market development and lowered financing barriers.

The KfW has also been a leader in creating market standards for clean energy projects. For instance, the bank has developed a unique retrofit-financing program that boasts a sliding level of incentive/financing cost based on the expected degree of home retrofit. This feature, together with the substantial volume of financing that the KfW produces, has helped transform the German home energy-efficiency retrofit market.

While the guarantee provided by the German federal government is of significant value to the KfW, in that it enables the bank to offer low-cost financing, such an arrangement could be challenging for a U.S. state because of the significant scale and potential financial risk involved.

What Other States Should Keep in Mind

States with an interest in pursuing clean energy financing programs should note that in the cases cited here the government programs strategically involved stakeholders, such as in:

- **Leveraging existing contractor networks.** In many of the cases, contractors were involved in the rollout of specific financing programs and sometimes assisted in underwriting the loans. An experienced contractor base also served as a source of trusted partners for assessing program feasibility and made successful implementation much more likely.
- **Consulting the financial community.** The New York Green Bank garnered public- and private-sector support by engaging stakeholders prior to launching its projects. New state initiatives can adopt a similar approach to build trust and momentum. By working with the financial sector well before state programs open their doors,

By working with the financial sector well before state programs open their doors, state staff can establish themselves as trusted partners in the enterprises.

state staff can establish themselves as trusted partners in the enterprises.

- **Identifying sustainable funding sources.** Pennsylvania's Keystone HELP and the Kentucky Home Performance program had to change their financing approaches after federal government funding was exhausted (usually because of high demand). To prevent disruptions in financing, new state programs should investigate program structures that have long-term viability. Ultimately, Pennsylvania and Kentucky both moved toward the WHEEL program, which provides a sustainable funding stream and lower-cost financing for program participants.
- **Engaging utility partners.** Utilities have been actively working with ratepayers to improve energy efficiency in their service territories. Therefore states considering their own initiatives in clean energy financing should coordinate them with any existing utility programs; this process serves to prevent duplication, establish a handy outreach tool, and stimulate innovation. The Connecticut Green Bank, for example, has collaborated with the state's two investor-owned utilities to offer energy efficiency rebates and on-bill financing mechanisms.

Another important property of these financing programs is that they can jump-start renewable energy and energy efficiency markets while allocating fewer taxpayer or ratepayer dollars—aspects that have traditionally galvanized bipartisan support (McGowan 2011).

Other State Clean Energy Policies

This report focuses on financing programs, but if mechanisms for renewable energy and energy efficiency investment are to be successful, they need a supportive policy environment. As of April 2015, key complementary clean energy policies employed by the states included:

- **Renewable electricity and energy efficiency resource standards.** Twenty-nine states and Washington, D.C., have enforceable standards that require electricity suppliers to provide a growing percentage from renewable sources. In addition, 24 states have binding targets that utilities or third-party administrators must meet in reducing consumer energy use over time.
- **Public benefits fund.** Twenty-one states and Washington, D.C., have public benefits funds (created through a small surcharge on electricity bills) that are used to support projects in renewable energy, energy efficiency, low-income assistance, and research and development for new technologies that directly benefit the public.
- **Tax and incentive policies.** To help support renewable energy and energy efficiency investments, most states have created their own tax incentives—including sales tax and property tax exemptions, tax credits, grants, and rebate programs—to complement existing federal tax incentives.
- **Utility rebate programs.** Many utilities offer rebates to homes and businesses so as to encourage the installation of renewable technologies, energy-efficient appliances, and other energy-related equipment.
- **Building codes.** Most states have building codes that require new residential and commercial buildings to meet minimum energy-efficiency criteria. The aim is to ensure deployment of cost-effective technologies and practices in all new construction.
- **Net metering.** Most states have policies allowing consumers who generate their own electricity from renewable technologies to get credit for any excess power they generate and to be charged only for the net amount of electricity they consume over a billing period.
- **Carbon cap-and-trade programs.** California and nine northeastern states have set a declining cap on overall emissions and permit the issuance of allowances (the right to emit a certain number of tons of carbon dioxide) to match the cap.

Table A.1 indicates which of these policies are in place in the states profiled in this report. Further details can be found in the Database of State Incentives for Renewables and Efficiency (DSIRE) webpage at dsireusa.org.

TABLE A. Summary of Key Clean Energy Policies in the Profiled States

State	CT	PA	NY	MA	KY	IA
Renewable electricity standard	●	●	●	●		●
Energy efficiency resource standard	●	●	●	●		●
Public benefits fund	●	●	●	●		
Tax and incentive policies	●	●	●	●	●	●
Utility rebates	●	●	●	●	●	●
Building codes	●	●	●	●	●	●
Net metering	●	●	●	●	●	●
Carbon cap-and-trade programs	●		●	●		

The states highlighted in this report are putting innovative clean energy financing initiatives into action that complement the already available set of policy options included in this table. These second-generation policies can also help make renewable energy and energy efficiency more competitive, especially as existing policy initiatives change, expire, or become less effective at driving deployment.

Additional Resources

CONNECTICUT

- The Connecticut Green Bank showcases its initiatives on www.ctcleanenergy.com/Default.aspx.
- Energize Connecticut houses information about all of the state's energy initiatives—from the Green Bank, utilities, and others—on www.energizect.com.

NEW YORK

- Details on the structure of the New York Green Bank, as well as on the program's progress and initiatives, are available in its public filings shown on <http://greenbank.ny.gov/About/Public-Filings.aspx>.

PENNSYLVANIA

- The National Association of State Energy Officials describes the structure of the Warehouse for Energy Efficiency Loans program on www.naseo.org/wheel.
- The Warehouse for Energy Efficiency Loans provides a step-by-step process for interested loan applicants on https://wheel.renewfund.com/how_it_works.

MASSACHUSETTS

- MassSave provides a clearinghouse for information on the HEAT Loan program, and on other clean energy programs available to state residents, on www.masssave.com.
- Information about the state's residential solar loan program design is showcased by the Massachusetts Department of Energy Resources on www.mass.gov/eea/docs/doer/renewables/solar/mass-solar-loan-program-final-design.pdf.

KENTUCKY

- The Kentucky Housing Corporation houses information about all of the energy efficiency programs available to KY homeowners on <http://kyhousing.org/Pages/default.aspx>.

IOWA

- The Iowa Area Development Group hosts eligibility criteria and guidance information pertinent to the Iowa Green Bank on www.iadg.com/services/financial-assistance/iadg-energy-bank.aspx.
- The Database of State Incentives for Renewables and Efficiency provides information about the Iowa Green Bank and the Alternative Energy Revolving Loan Program on <http://programs.dsireusa.org/system/program/detail/5410> for the Iowa Green Bank and on <http://programs.dsireusa.org/system/program/detail/209> for the Alternative Energy Revolving Loan Program.

GERMANY

- The KfW has a clearinghouse website—which describes the bank's financing programs for renewable energy and energy efficiency projects, along with associated eligibility and application requirements—on <https://www.kfw.de/inlandsfoerderung/Unternehmen/Energie-Umwelt/index-2.html>.

All of the above websites were accessed on May 30, 2015.

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