GREENER SKILLS

How Credentials Create Value in the Clean Energy Economy

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COWS
center on wisconsin strategy

ACKNOWLEDGEMENTS

This paper, perhaps more than most, draws on a long history of collaboration and rumination on the concepts of "green" and "skills" among principals at COWS. Laura Dresser, Joel Rogers, and Sarah White developed the arguments in this paper through countless conversations, and the report plunders freely from Joel's extensive writing on these topics. Kari Dickinson, Adrienne Pagac, and Ayca Zayim provided research and production assistance. Others around the country improved early drafts with advice and information, including Rhandi Berth, Mindy Feldbaum, Evelyn Ganzglass, Alan Hardcastle, Jeremy Hays, Beth Holst, Kari Knudson, Jeannine La Prad, Andy Levin, Sally Prouty, Jeff Rickert, Whitney Smith, Jessa Valentine, Jason Walsh, and Jane Weissman. Thanks to them and many others for much useful discussion. Any errors are, of course, ours alone. Finally, we'd like to thank the Nathan Cummings Foundation and the Surdna Foundation for their generous support of this project.

ABOUT COWS

The Center on Wisconsin Strategy (COWS) is a national "think and do" tank based at the University of Wisconsin-Madison. COWS works to promote high-road economic development — a competitive market economy of shared prosperity, environmental sustainability, and capable democratic government.

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Even as this report delineates prominent national credentials in selected clean energy sectors, its purpose is larger: to suggest a more rational framework for human capital development in a greening economy.

EXECUTIVE SUMMARY

Everyone wants to coax green shoots from the economic badlands. And as the promise of green jobs has generated a flood of workforce initiatives, most everyone would like to put their hands on an atlas of green programs, skills, and credentials. But after two years of discussion and research, we've concluded that not only is developing a comprehensive, comprehensible map of "green" credentials impossible, it isn't worth doing if it doesn't get us closer to a coherent national system. And that is the central argument of this paper.

We believe current excitement about the new energy economy, and concern about national competitiveness, can be leveraged to finally achieve progress on reforming our fractured education and training system. Not only does this country need a far greater investment in workforce development, but skills – particularly at the lower end of the labor market – need to be delivered in very different ways. The priorities, as we see them, are more organization into navigable career pathways aligned with demand; curricular modularization and credentialing; and the integration of those social service supports necessary for advancement.

Critical to this reform agenda is the development of a national skill credentialing system. This paper makes the case for such a system. We outline an American skills agenda and call for a better, stronger, greener workforce system to support it. We describe what's out there, focusing on national certifications in renewable energy and energy efficiency. And we conclude with a series of policy recommendations for federal, state, and workforce system stakeholders.

WHAT WE FOUND

After sifting through hundreds of clean energy credentials, one thing became clear: ***All credentials are not created equal.*** To be worthwhile, credentials should be: (1) *meaningful in the labor market,* because they have value to employers; (2) *transparent,* so workers know how to earn them; and, where possible, (3) *embedded in a pathway,* clearly connected to either a job or the next level of training; (4) *standardized,* reflecting common measures of competence; and thus (5) *portable* – not limited to a particular region, employer, or institution.

Fragmentation in training systems within and across states undercuts the best efforts of workers, employers, and communities to participate in building a greener economy. Developing common standards and conferring commonly recognized credentials for verified occupational skills offers a firm path forward. For workers it provides mobility, bargaining power, and higher returns in the labor market. For employers it provides assurance that job applicants have the skills they need. And for consumers it provides critical information on the quality of work they can expect. National standards can help guarantee both quality jobs and quality work, in and outside of "green" sectors.

Greener Skills catalogs some prominent efforts toward standardization in renewable energy and energy efficiency training, including programs and credentials developed by:

North American Board for Certified Energy Practitioners • Association of Energy Engineers • Electronics Technicians Association • Building Performance Institute • Residential Energy Services Network • North American Technician Excellence • Northwest Energy Efficiency Council • Green Building Certification Institute • Wisconsin Regional Training Partnership • AFL-CIO Building and Construction Trades Department • Laborers International Union of North America • Centralia College Center of Excellence for Energy Technology

WHAT WE RECOMMEND

1. **Leverage green to the broader good, securing national agreement on skill standards and getting serious about building a system to create and support them.**

   Realizing the equity promise of the new energy economy requires broad national agreement — and action — on the needed reforms of our training system. One key reform is the development of national skill standards and a system for the impartial certification of their attainment.

2. **Federal Action: Support those high-quality national standards that already exist, and use public investments to encourage local connections to them.**

   Wherever functional, first-rate skill standards exist or are emerging, the Departments of Labor, Energy, and Education, among others, should support and advance them. These agencies need to pursue a clear and consistent approach to standards, coordinating with each other on investments or other support and ensuring that industry information works its way back through existing training and education systems.

3. **State Action: Drive rationalization through state or regional skill standards processes.**

   In the places where green training has already been built from the ground up, state workforce systems should seek to link local credentials to national standards, where they exist. But improving U.S. performance on skills upgrading need not wait for national systems reform. States can work with regional industry partnerships to develop skill standards, and they should extend such efforts to the broadest geography possible, establishing a common language of credentials in any given labor market.

4. **Systems Action: Focus on the coordinated and strategic greening of existing credentials, rather than rush to create myriad (and redundant) new green jobs programs.**

   Green jobs initiatives should be integrated into existing training systems. As we have consistently argued, much of the green future is already with us and seizing it requires us to transform the industries and jobs we already have. Education and training systems do not always have to develop new diploma and degree programs, just greener ones.

5. **Full Court Press: Build more on-ramps to training, credentials, and jobs for the workers who need opportunity most.**

   Beyond skills training, green jobs initiatives must address access and upward mobility. To help workers advance from unemployment, disconnection, or dead-end, poverty-wage work into better, greener jobs, publically supported training systems should only support clear, seamless, affordable career pathways to in-demand and materially rewarding occupations, with portable credentials for credibly tested competencies. The rationale is the promise most democratic governments make to their people: to at once maximize equal opportunity for individual advancement and minimize waste of common resources. The current green moment offers a chance to renew that compact.

INTRODUCTION:
SKILLS, GREEN SKILLS, AND THE NEED FOR STANDARDS

Green jobs and the skills necessary to do them continue to attract intense attention in this country and elsewhere, fueled by global climate change and job market collapse. The attention is important, but uncoordinated investment in greening the American workforce threatens to create more chaos in an already cluttered U.S. training system. This paper assesses the state of "green" training (a tumult of often inconsistent credentials and competencies across industries, employers, and providers); offers our normative argument for doing better; and provides specific policy suggestions on implementing a national credentialing system and ensuring equitable access to it.

This report is not an inventory. It does not attempt to catalogue the fast-emerging and rapidly evolving field(s) of "green." Even as it delineates prominent national credentials in selected clean energy sectors, its purpose is larger: to suggest a rational framework for human capital development in a greening economy, and to make the case for a national policy of portable, transparent, consistent, industry-specific credentials (and the state-supported pathways up to them).

While the focus here is primarily on training in renewable energy generation and energy efficiency, the questions of credentialing they raise have broader application. There are almost no "green" jobs, if by that is meant jobs devoted only to increasing the efficient and restorative use of our natural capital, with no destruction or waste of it of their own. But if we are to have any future, most jobs will need to be a good deal greener than they are at present; almost all that's said here applies to them. There are lessons even for those (very few) unconcerned about the environment, but dedicated to shared prosperity and capable, accountable government.

Building an equitable, low-carbon economy — one with opportunities for workers at all levels to prosper and advance — poses serious challenges of demand and access. On demand, there is no denying the current crisis in employment. But neither is there denying a longer-term increase in demand for skilled labor. This will be driven by aging of the current workforce; by belated national attention to our deficits in energy, transportation, and "social" infrastructure; and by new work required by transition to a "new" (cleaner and more efficient) energy economy. The larger questions of access (who gets training, skills advancement, and decent jobs) and competitiveness (how will U.S. high-road firms get the skilled labor force necessary to build a prosperous green future) can be answered most effectively and equitably by wholesale reform of training systems and the labor markets they supply. So while the question of green skills motivates this report, the most essential problem to be solved is the longstanding problem of skill and its distribution in the American labor market in general.

Green and Greener

Just as "green jobs" often turn out to be traditional occupations in traditional industries (like construction and manufacturing), and "green skills" are in many cases not that different from "gray" skills, there is no "green" workforce development system, just the same imperfect, fragmented education and training system we had in the "gray" economy. We need to make it better, stronger, greener.

Some things are new and green, to be sure, but the more important point, which we make repeatedly in this paper, is that the current romance of things "green" offers a chance to address the perennial challenges of the existing U.S. education and training system.

With all of this in mind, we will refer throughout the text to "green" economy, "green" training etc., without the distraction of quotation marks, and conceding the awkwardness and sometimes even disingenuousness of speaking of "green" things as if they were entirely discrete. We also freely substitute the narrower term "new" or "clean" energy economy throughout the paper, in line with our stated focus on renewable energy and energy efficiency skills training.[1]

WHY CREDENTIALS MATTER...

We will never be able to clean up the general mess of the American labor market or the specific confusion in green or greener jobs without a stronger and broader commitment to credentials and a system of common standards that support them. In fact, some general system of skill standards is essential not just as a product, but a prod to, systemic training reform. Done right, everyone benefits.

A competency-based credentials system, marking individual mastery of desired skills, immensely reduces employer search and other transaction costs in hiring and promotion; reliable data on the aggregate human capital pool also facilitates planning. The ability to demonstrate mastery of desired skills, in effect to carry a recognized credential, increases worker security on external labor markets and, given that, flexibility in internal labor markets. Students or trainees gain clear signposts to desired achievement, making that achievement more likely. The general public gains performance accountability over public and private training providers. All this leads to greater as well as more directed training efforts, improving the general human capital pool.

In the green context, the development and certification of standardized competencies can nudge energy efficiency and renewable energy industries onto the high road by guaranteeing both quality jobs and quality work.[2] The former is essential to realizing the equity promise of the new energy economy, the latter critical to demonstrating and capturing the benefits of green technologies. One way to get at job quality is to define, and where possible require, a certified workforce, which can command better wages in the labor market. The additional advantage – and critical value-added, really – of a certified labor force is that it offers some guarantee on quality of work. This is more than a question of individual return on investment. Every time a poorly trained worker bungles the installation of, say, solar panels or even attic insulation, the public loses confidence in "green" innovation, eroding the country's already tenuous political will to invest in low-carbon strategies.

...BUT WE STILL DON'T HAVE THE SKILL STANDARDS TO SUPPORT THEM

Most advanced economies have far more elaborate, nationally recognized skill standards and credentialing systems than the United States. In some countries (e.g., Germany) these have been longstanding; in others (e.g., Ireland) they are more recent. In all cases, the chief difference with the United States is that such credentials are elsewhere made available to the broad working classes. They are not limited, as here, to professionals (e.g., doctors, lawyers, accountants, and registered nurses), the provision of specialized business service providers (e.g., Microsoft Certified, Six Sigma Black Belt), or those with the good fortune of passing through a union apprenticeship program.

Just why this comparative difference emerged and has persisted so long is itself a big question, but need not concern us here.[3] Suffice it to say that U.S. indifference on this is now being challenged, largely because of a generation-long stagnation in worker incomes and atrophy of traditional means of career advancement for workers without four-year college degrees.[4] To reintroduce regular upward mobility paths, connect disadvantaged workers to the labor market and get them reward within it, reduce *per capita* provider training costs, show effects of training (particularly among cash-strapped public training providers), or, most ambitiously, drive skills-based upgrading among firms, some standard way of measuring what workers know, that is accepted and used by employers, is now generally seen as a social good.

The chief barrier to promoting this social good has traditionally been employer resistance to using skills credentials in hiring and promotion. But this too is beginning to change, especially among more advanced firms. They are looking to reduce their search costs for new employees and increase their confidence that new hires possess at least a foundation of basic vocational skills (both analytic and social) on which they can build. This is evident, for example, in the persistent interest in WorkKeys and similar standardized basic skills credentials. Business is generally not prepared to do the mapping of workforce competencies that a more skills-based workforce development system would require, or to use competencies as latter day "rungs" in ladders of career advancement. In both, there is need for supportive public policy.

THE GREEN MOMENT: CLEAN ENERGY AND SYSTEMS REFORM

We have written elsewhere of the need to build greener career pathways in the new energy economy.[5] Our point here is larger: a call to critical broad-based systems reform. Beyond greening individual career pathways, the nation's education and training systems need to coordinate their products (credentials) and process (bridges and pathways), making them both accessible and useful to low-wage workers; worthwhile to unemployed adults shifting occupations and others at advanced stages of single careers; and, in the context of a cleaner and more efficient economy, meaningful to clusters of employers in key green industries.

We believe current excitement about the new energy economy, and concern about national competitiveness, can be leveraged to finally achieve progress on more generally needed reforms of our fractured education and training system. Not only does this country need a far greater political and material investment in workforce development, but skills – particularly at the lower end of the labor market – need to be delivered in very different ways. The priorities, as we see them, are more organization into navigable career pathways aligned with demand; curricular modularization and credentialing; and, for those who need them, integration of social service supports to make advancement possible.

Critical to this reform agenda is the development of a national skills credentialing system.

A coherent skills agenda would entail:[6]

1. Mapping regional labor markets by skills, jobs, and careers, and providing the public with a clear way of seeing the skills needed for different jobs and career pathways;
2. Modularizing training (breaking it into chunks), with each module delivering a certain competency or set of competencies, different jobs or careers described by different clusters of such modules, and movement from any particular module to any other possible through a series of incremental moves;
3. Making training demand-driven (that is, tied to real labor market demand), with its supply informed by high quality and continuously revised information on labor market conditions;
4. Offering training in any way needed to maximize access (e.g., online, at night, on weekends, at distance, in field settings as well as classrooms);
5. Certifying skills through testing, with such demonstration indifferent to the source or means of skill acquisition (i.e., if someone with no formal training can pass the test, more power to them);
6. Aligning certified skills with employer-recognized skill standards, at least implicitly tied to compensation;
7. Removing income as a barrier to training through need-based scholarships or individual loans;
8. Providing wrap-around social services to further maximize access.

Such a system – all the different parts of which have been demonstrated somewhere in the U.S., but nowhere all at once – would give workers knowledge of the skills they need to succeed, income-indifferent access to them, and some assurance of payoff. This would make labor market mobility much more clearly a function of ability and effort, not race or class or gender – hardly an equal opportunity paradise, but a lot closer to one than what we have at present.

THE STATE OF GREEN SKILLS: CREDENTIALING AND CHAOS

Lack of coordination in training systems within and across states undercuts the best efforts of workers, employers, and consumers to participate in building a greener economy. In green initiatives as in traditional workforce development, the disjointed, local nature of training systems pushes hard against the need for standardization and portability. If anything, the rush to "green" training in recent years has magnified the problem of fragmentation.

In the vast universe of potentially green endeavors, the clean energy sector alone involves an enormous range of technologies, industries, and occupations, some new, some traditional. A welter of programs offered by unions, technical and community colleges, trade organizations, community groups, and just about anyone hanging out a shingle offer a variety of "green" credentials, few of them aligned or standardized, even within a given system. Between a four-hour continuing education workshop and a four-year craft apprenticeship lies a wealth of often self-defined credentials. Developing common standards and conferring commonly recognized certificates for occupational skills offers a firm path forward.

This section reaches into a throng of competing skills benchmarks that differ by industry, employer, and training provider, and lifts up a few promising examples of standardization. These include national certifications for careers in renewable energy and energy efficiency – larger standards that can be employed by a wide variety of local stakeholders – and local certificate programs that could be used as a system model, particularly at the entry level.

Describing the core array of certifications and skill standards for workers in clean energy sectors is a key contribution of this report and the primary work of this chapter. First, however, we discuss terms and methods, and offer a few observations on what we found as we built our list.

TERMS

A credential is a formal acknowledgement of a particular level of training in a particular field – an applied associate degree, for example, or a continuing education certificate, or a journey card. "Certification" refers to a voluntary system of standards, usually set by key stakeholders and subject matter experts, that practitioners can choose to meet in order to demonstrate accomplishment or ability in their profession. A seemingly picayune but actually critical distinction – particularly in the context of standardizing credentials for clean energy occupations – lies between "certificate" and "certification." The American National Standards Institute (ANSI) observes that while the terms are often used synonymously,

> ***Certification*** *is more comprehensive and necessarily includes an assessment of an individual's knowledge, skills, and abilities based on a body of knowledge pertaining to a profession or occupation. In comparison,* ***certificate*** *programs emphasize learning events and coursework completion. Certification is valid for a specific time period and involves recertification at the expiry of the stated period. Certificates are generally issued for life.*[7]

Unlike "licensure," a form of regulation, the system of skill standards benchmarked by certification is not mandatory and does not vary on a state-by-state basis (a great benefit to workers, who then don't need to gain a new certification if they move to a new state). It is conferred to the individual and should not be confused with "accreditation," which is awarded to educational institutions for programs or courses of study that meet instructional standards.[8] The Institute for Sustainable Power Quality (ISPQ), for example, tries to ensure that renewable energy technicians are trained to a common standard by establishing metrics for related programs and certifying their instructors. In the United States, ISPQ standards are maintained and implemented by the Interstate Renewable Energy Council (IREC). To complete the circle of accountability, organizations that award certifications should themselves be accredited.

The American National Standards Institute accredits personnel certifying agencies – like the North American Board of Certified Energy Practitioners (NABCEP), the Green Building Certification Institute (GBCI), and North American Technician Excellence

(NATE), all discussed in the following pages – to an international standard, including issues of governance, disclosure, fairness to candidates, and non-discrimination.[9] ANSI and like-minded organizations, like IREC, call for a sturdy firewall between training and certification. A neutral third-party is necessary to identify current skill sets, design valid assessments, and verify competency – therein lies the value (and the time, expense, and perceived trouble and/or exclusivity) of national certifications.

METHODS

We make no claims to comprehensiveness: this report is not the result of a formal survey, nor does it offer a panoptic map of clean-energy certifications, much less clean or green credentials in general. Rather, to understand the nation's training system in the context of its green credentials, we compiled a sprawling almanac, populated with information gleaned from technical college course catalogues, apprenticeship directories, community program descriptions, certification guidelines, industry standards, and a slew of related reports and analysis. Then we talked to experts in and outside of the workforce system.

As a result, while we haven't gathered every green or greening credential out there, we do report on those that are most familiar to people working in renewable energy and energy efficiency.[10] And while we have not vetted the featured certifications to determine which is best on any number of measures, we do come to conclusions about which directions seem most promising.

One initial challenge in the research was simply to identify, understand, and categorize the many parties with a stake or interest in green-related training: educational institutions, workforce intermediaries, community-based organizations, industry and trade groups, independent certifying bodies, governmental and non-governmental initiatives, etc. Our next task was to narrow the scope of inquiry, focusing on national certifications for clean energy skills, as well as a handful of local or system-specific efforts at standardization. Our goal was not to report on the latest, sexiest green training program, but to elevate credentials or standards that could inform workforce system reform for the long haul.

Outlining the fundamental installation and operations credentials in the relatively recent (and circumscribed) renewable energy industry, limited here to solar, wind, and geothermal, was fairly straightforward; parsing the more established energy efficiency sector – where building design, function, construction, inspection, retrofit, and management offer a booming but crowded and confusing field of green credentials – proved more difficult.

It's worth noting that the challenge of presenting these in some meaningful order in this report mirrors the complexity of framing national skill standards. What is the organizing principle: Industry sector? Occupation? Educational attainment or technical proficiency? Technology?

In green initiatives, as in traditional workforce development, the disjointed, local nature of training systems pushes hard against the need for standardization and portability.

WHAT WE LEARNED

In the course of exploring this universe of existing and emerging certifications related to clean energy occupations, we were struck by a handful of significant if pedestrian points that may move us closer to a framework for how to think about our fractured training system. We run through them here, before diving into the weeds, because they are worth thinking about, and may help frame the national "green" credentialing discussion better than any compendium of programs.

1. All credentials are not created equal

To be worthwhile, credentials should be:

- *Meaningful in the labor market,* because they have value to employers;
- *Transparent,* so workers know how to earn them;
- Where possible, *embedded in a pathway,* clearly connected to either a job or the next level of training;
- *Standardized,* reflecting common measures of competence; and thus
- *Portable* – not limited to a particular region, employer, or institution.

2. Certifications typically serve advanced professionals

Most national certifications, with standardized skill sets and third-party verification, operate at the high end of the labor market. This has always been true, since this is where the money and attention lies in the United States. In existing industries, certification has typically accompanied advanced achievement in the professions (e.g., medicine, law, finance). Doing it right is time-consuming and expensive (the ANSI process, described elsewhere in this paper, can take up to two years). So, while promising efforts are now underway to rationalize pre-apprenticeship in the building trades, and a number of clearly articulated standards for technicians have emerged, many clean energy certifications, particularly on the renewable side, are for advanced professionals: architects, designers, and engineers – with either postgraduate training or a two- or four-year degree combined with many years of experience.[11]

3. Clean energy credentials defy organization

Even up this far slope of clean energy pathways, career-advancing credentials are not clearly delineated. The certifications we found, in fact, defy organization. Again, multiple organizations and industries run across a host of training systems and institutions. As the examples that follow illustrate, some target occupational level (e.g., engineers or technicians); some focus on technologies (in renewables, efficiency, or both). Some offer third-party verification, many have alliances with particular training providers, all claim recognition by key industry leaders.

4. National standards can transcend the tangle of local workforce systems

The most useful models allow workers across a variety of training systems to earn certification in a particular industry sector, based in most cases on a given technology. The clearest example is the North American Board of Certified Energy Practitioners (NABCEP), which certifies solar installers from a variety of training systems (joint apprenticeship training committees, community and technical colleges, community-based organizations, etc.) once they have demonstrated proficiency in the field and passed the requisite examination.

5. Skill development needs to be rationalized at all levels

One criticism of such certifications – as often levied against MSSC as NABCEP – is that they set too high a bar. But many professional certifications are intended to be a career capstone. The answer is not to lower the bar, but to establish common intermediate benchmarks, and to build better on-ramps, particularly at the bottom. The challenge is to get more people – particularly the poor and the working class – up and over. Doing so requires, among other things, organizing and aligning a transparent, accessible sequence of career-building credentials. This is critical if we are to realize both the equity and the material promises of the new energy economy. Of course it is not realistic to have all green programs seek ANSI accreditation. But the process – and the standardization that provides its value – can be mimicked at the state or regional level.[12]

6. Standardization can start locally

Indeed, improving the comparatively dismal U.S. performance on skills development and upgrading need not wait for the development of national skill standards and aligned certifications in clean energy occupations. Local institutions can think beyond local labor markets even as they establish locally relevant programs. Because registered apprenticeship programs are a fulcrum for workforce development in the clean energy economy, labor unions should continue to (a) align training with national industry standards in emerging technologies; and (b) figure out how to rationalize on-ramps through legitimate pre-apprenticeship programs designed to expand and diversify recruitment. For their part, community and technical colleges need to avoid the pitfalls of excessive customization, with its counterproductive short-term orientation, and to protect the mobility of workers that comes from broad and certifiable occupational qualifications.

7. Assessment matters

A system of standards isn't much use without a system of assessment. And as credentialing becomes more sophisticated, it makes sense in many cases to segregate the verification of worker competencies from the training of related skills. Developing a certification is a long, slow process. It requires a significant budget, legal support, subject matter expertise, and industry cooperation. But without taking the time and trouble of establishing (and using) a fully vetted, neutral, third-party evaluation, certification programs cannot necessarily guarantee impartial assessment, and the associated credential can lack reliable meaning for both consumers – individuals, business, government – and employers.

Our list, divided roughly into renewables and efficiency, starts with the classic North American Board for Certified Energy Practitioners (solar and, under development, small wind); continues with another well-established group, the Association of Energy Engineers (geothermal, though also, and primarily, building science/energy efficiency); and moves on to preview some new offerings from the Electronics Technicians Association (combined solar, wind, geothermal). Because there is no national certification for utility-scale wind (though the new Washington State skill standards for wind technicians are discussed later in this document) we proceed to what are largely energy efficiency certifications.

On building efficiency, we trolled a roiling sea of credentials and pulled out a number of key national certifications. These include, in no particular order, the sometimes inter-related residential efficiency credentials from the Building Performance Institute, Residential Energy Services Network, and North American Technician Excellence; the commercial Building Operators Certification, developed by the Northwest Energy Efficiency Council; and the LEED-based Green Building Certification Institute.[13]

NATIONAL CERTIFICATION

Individual professional certification for workers may be offered by an international or national governing body, like the North American Board of Certified Energy Practitioners. It can also begin with a local initiative, as in the early attempt of Iowa's community colleges to establish a nationally recognized certification for biofuels training.[14] In other cases, a de facto gold standard exists, typically defined by a local institution working in concert with industry. Energy programs at the Bismarck State College National Energy Center of Excellence, for example, are recognized by operators, utilities, and unions around the country, and attract students from 50 states.[15]

What follows is a brief survey of some prominent national certifications for workers in emerging clean energy industries; the subsequent section provides examples of local institutions making change that could work at a national level.

North American Board of Certified Energy Practitioners (NABCEP)

The solar sector currently offers the most advanced certification model for renewable energy occupations. The North American Board of Certified Energy Practitioners (NABCEP) has completed task analyses for two key occupations in this sector: solar electric (photo-voltaic) system installers and solar thermal system installers. (NABCEP has also completed task analysis for small wind, but does not yet certify practitioners).[16] A formal task analysis, which identifies an occupation's critical tasks, knowledge, and skills, functions as a foundational document for credentialing assessment and provides the learning objectives for curriculum development. NABCEP used its task analyses to build and launch a certification program that provides professional certification to a broad range of journeymen, contractors, and foremen.[17] In addition, NABCEP developed an entry-level exam program for PV systems, aimed at workers interested in getting into the field.

The advantage of NABCEP is that the Board recognizes a variety of pathways into a solar career, and offers a wide variety of experience and training combinations to qualify to sit for its twice-yearly exams. The professional installer credentials set a very high bar, and are intended to recognize advanced skill and knowledge in the field, serving as an indicator of excellence (and ongoing skill development) for experienced installers. The entry-level PV exam sits at the other end of the training spectrum,

Table 1

NORTH AMERICAN BOARD OF CERTIFIED ENERGY PRACTITIONERS (NABCEP) CERTIFICATION REQUIREMENTS

NABCEP Certification	*Requirements*
PV Entry Level Exam Program	Taking a course from a registered provider. For the list of providers: www.nabcep.org/wp-content/uploads/2009/01/RegisteredProviders09162009.pdf
PV Installer Certification	Experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Be an existing licensed contractor in good standing in solar or electrical construction-related areas with experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Four years of electrical construction-related experience working for a licensed contractor, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Three years experience in a U.S. Dept. of Labor-approved electrical construction trade apprentice program, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR A two-year electrical construction-related, or electrical engineering technology, or renewable energy technology/technician degree from an educational institution or four-year construction-related or engineering degree from an educational institution, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam.

marking completion of a standardized instructional program in basic concepts and skill sets for PV installation. This is a benchmark of sorts, rather than a professional certification. NABCEP offers no intermediate credentials, although many of these are actually "traditional" credentials that can be earned within a particular training system – an applied associate degree, for example, or an electrician's journey card.

Organizations training for some or all of NABCEP certifications include regional leaders like Solar Energy International (CO), the Midwest Renewable Energy Association (WI), and the Florida Solar Electric Center. Other accepted instructional paths include college and university programs, formal apprenticeships (JATCs are frequent partners here), and manufacturer training.

Table 1 continued

NABCEP Certification	*Requirements*
Solar Thermal Installer Certification	Four years of experience installing Solar Hot Water Systems; OR Two years of experience installing Solar Pool Heating Systems in addition to completion of a Board-recognized training program; OR Two years of experience installing Solar Thermal Systems in addition to completion of a Board-recognized training program; OR Be an existing licensed contractor in good standing in solar or construction-related areas with one year of experience installing Solar Thermal Systems; OR Four years of HVAC, mechanical, pipe-fitting, or plumbing-related experience working for a licensed contractor, including one year of experience installing Solar Thermal systems; OR Three years experience in a government/trade union-approved construction trade apprentice program, including one year of experience installing Solar Thermal Systems; OR A two-year construction-related, or engineering technology, or renewable energy technology/technician degree from an accredited educational institution plus one year of experience installing Solar Thermal Systems; OR A four-year engineering degree from an accredited educational institution, including one year of experience installing Solar Thermal Systems; OR NABCEP© Solar PV Installer Certification; AND Sixteen hours of Board-recognized training; AND Installation of at least two solar hot water systems. These two systems require permitting and inspection process by a permitting authority, but in the absence of such, an appropriate underwriter is authorized to provide an inspection certificate. In regions where neither of these inspection options exist, the Application Review Committee will judge experience based on supplied documentation.

Association of Energy Engineers (AEE)

The Association of Energy Engineers (AEE), an international society whose certifications are recognized by USDOE and USAID, among others, has by far the most clearly articulated and elaborate set of technical certifications for clean energy occupations. To an even greater degree than NABCEP solar installation credentials, AEE certifications in energy and building management are aimed at highly educated, deeply experienced practitioners. Candidates must take AEE preparatory seminars and sit for a rigorous examination, followed by demonstration of continuing education and skill development. While these are excellent standards that promote expertise in the field, this Olympian view offers little perspective on establishing and coordinating benchmarks for individual training programs.

Table 2

ASSOCIATION OF ENERGY ENGINEERS (AEE) CERTIFICATION REQUIREMENTS

AEE Certification	*Requirements*
Certified Energy Manager	A four-year engineering or architectural degree, or a registered Professional Engineer (P.E.) or Registered Architect (R.A.), with at least three years experience in energy engineering or energy management; OR A four-year business or related degree, with at least five years experience in energy engineering or energy management; OR A two-year technical degree, with eight years experience in energy engineering or energy management; OR Ten years or more of verified experience in energy engineering or energy management.
Certified Sustainable Development Professional	A four-year engineering or architectural degree from an accredited university or college and/or the current status of P.E. or R.A. or Certified Energy Manager (CEM®), with at least three years verified experience in energy efficiency and pollution prevention, or sustainable development; OR A four-year degree in business or related degree from an accredited university or college, with at least five years verified experience in energy efficiency and pollution prevention, or sustainable development; OR A two-year technical degree from an accredited college, with at least eight years verified experience in energy efficiency and pollution prevention, or sustainable development; OR Ten years or more of verified experience in energy efficiency and pollution prevention, or sustainable development.
Certified Carbon Reduction Manager	A four-year engineering or architectural degree, and/or the current status of Certified Energy Manager (CEM®) in good standing; OR A four-year business or related degree, with at least three years experience in energy/carbon management; OR A two-year technical degree, with at least five years experience in energy/carbon management; OR Eight years or more of verified experience in energy/carbon management.

Table 2 continued

AEE Certification	*Requirements*
Certified Energy Auditor	A four-year degree from an accredited university or college in engineering or architecture, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR A four-year non-engineering degree, with at least four years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR A two-year technical degree, with at least five years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR Ten years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR The current status of Certified Energy Manager (CEM®).
Certified Building Commissioning Professional	A four-year degree from an accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in HVAC or process engineering design, architecture, construction project management, facilities management, testing, adjusting and balancing, or building commissioning; OR A two-year technical degree, or four-year non-technical degree from an accredited university or college in a field not specified above, with five years experience in HVAC or process engineering design, architecture, construction project management, facilities management, or testing, adjusting and balancing, or building commissioning; OR Ten years or more of verified experience in HVAC or process engineering design, architecture, construction project management, facilities management, or testing, adjusting and balancing, or building commissioning; OR The current status of Certified Energy Manager (CEM®).
Certified Business Energy Professional	A four-year degree from an accredited university or college in business/marketing, engineering or architecture, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least two years of experience in business/marketing/management/sales in the energy field; OR A four-year non-technical degree from an accredited university or college, with at least three years experience in business/marketing/management/sales in the energy field; OR A two-year technical degree from an accredited college, with at least five years experience in business/marketing/management/sales in the energy field; OR Eight years of experience in business/marketing/management/sales in the energy field; OR The current status of Certified Energy Manager (CEM®).

Table 2 continued

AEE Certification	*Requirements*
Certified Measurement and Verification Professional	A four-year degree from an accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in energy or building or facility management, or measurement and verification; OR A two-year technical degree or a four-year non-technical degree from an accredited university or college in a field not specified above, with five years experience in energy or building or facility management, or measurement and verification; OR Ten years or more of verified experience in energy or building or facility management, or measurement and verification; OR The current status of Certified Energy Manager (CEM®).
Certified Energy Procurement Professional	A four-year degree from accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in energy or building or facility management, or real estate, or procurement, or brokering; OR A two-year technical degree or a four-year degree in a field not specified above, with five years experience in energy or building or facility management, or real estate, or procurement, or brokering; OR Ten years or more of verified experience in energy or building or facility management, or real estate, or procurement, or brokering; OR The current status of Certified Energy Manager (CEM®).
Certified Lighting Efficiency Professional	A four-year engineering or architectural degree from an accredited university or college, and/or be a registered Professional Engineer (P.E.), and/or a Registered Architect (R.A.), and/or a Certified Energy Manager (CEM®), with at least three years experience in lighting efficiency; OR A four-year business or related degree from an accredited university or college, with at least five years experience in lighting efficiency; OR A two-year technical degree from an accredited college, with eight years verified experience in lighting efficiency; OR Ten years or more of verified experience in lighting efficiency.
Distributed Generation Certified Professional	A four-year degree in science, engineering, architecture, business, law, finance, or related field and/or be a registered Professional Engineer (P.E.), with at least three years experience in cogeneration or distributed generation; OR A two-year technical degree or a four-year non-technical degree, with at least five years experience in cogeneration or distributed generation; OR Ten years or more of verified experience in cogeneration or distributed generation; OR The current status of Certified Energy Manager (CEM®).

Table 2 continued

AEE Certification	*Requirements*
Certified Green Building Engineer	A Professional Engineering (P.E.) License (*U.S. only) AND a Certified Energy Manager (CEM®) registration.
Certified GeoExchange Designer	A four-year engineering degree and/or be a registered Professional Engineer (P.E.), and/or a Registered Architect (R.A.), with at least three years of combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field; OR A four-year non-technical degree, with at least five years of combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field; OR A two-year technical degree, with at least eight years of combined experience in the geothermal heat pump design and heating, ventilating, and air conditioning field; OR Ten years or more of verified combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field.
Certified Power Quality Professional	A four-year engineering degree and/or be a registered Professional Engineer (P.E.), with at least three years experience in power quality, energy or building or facility management, or electrical design, engineering or contracting; OR A four-year non-engineering degree, with at least five years experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR A two-year technical degree, with five years experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR Ten years or more of verified experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR The current status of Certified Energy Manager (CEM®).

Electronics Technicians Association (ETA)

The Electronics Technicians Association (ETA), which is a professional association that certifies workers in a variety of electronics fields, with particular strengths in fiber optics and telecommunications, recently developed two certification tracks for alternative energy workers — installation and integration. Integrators use "pre-engineered systems and components to design packages for retrofitting" and are cross-trained in solar, wind, micro-hydro, and fuel cells. The installer track is much less well defined. It would seem that these programs are just getting off the ground, with a recently released series of "Hybrid Alternative Energy Job Training Guides." It remains to be seen whether race to green serves ETA's constituents well, and if the organization, which does provide third-party assessment of electronics competencies aligned with ISO 17024 standards, can leap effectively from electronics to electricity, adding value to a renewable energy field in serious need of rationalized, coordinated skill assessments.

Table 3
ELECTRONICS TECHNICIANS ASSOCIATION (ETA) CERTIFICATION REQUIREMENTS

ETA Certification	*Requirements*
Alternative Energy Integrator Level I	Electronics Exam 1 — Direct Current Theory; AND Electronics Exam 2 — Alternating Current Theory; AND Comprehensive Exam 1 — Photo-Voltaic, Wind, Micro-Hydro, and Fuel Cells; AND Comprehensive Exam 2 — Covers Physics, Chemistry, Meteorology, and Mathematics.
Alternative Energy Integrator Level II	Electronics Exam 4 — Digital Theory; AND Comprehensive Exam 1 — Covers Passive Solar and Geothermal; AND Comprehensive Exam 2 — Covers Project Development, Finance, Standards and Codes, Incentives, Feasibility Analysis, and Site Development.
Alternative Energy Integrator Level III	A battery of tests over the entire alternative energy area with a heavy emphasis on project and product development, finance, standards, laws, covenants, and return on investment (ROI) analysis; AND Candidate must either be a graduate of an ETA-approved four-year degree; OR Have held a Level II certification for 36 months; AND Have worked in the field during the 36-month period of certification.
Alternative Energy Installer Level I	A test including written and hands-on components.
Alternative Energy Installer Level II	An advanced test with written and hands-on components; AND Twelve months experience working in the field.
Alternative Energy Installer Level III	Six specialty tests and a comprehensive exam including technical competencies, management, and standards; AND Five years of experience.
Installer Level III — Electrical Energy Generation	At least two Level II certifications; AND Twelve months work experience; AND Pass four of the five Level II written exams (Photo-Voltaic, Wind, Micro-Hydro, Fuel Cells, and Stirling technology).
Installer Level III — Alternative Thermal Energy	A comprehensive exam including technical competencies, management, and standards; AND A Level II certification in each of two specialty areas (passive solar, geothermal); AND Five years experience working in the field.

Building Performance Institute (BPI)

Founded 25 years ago as an independent third party aiming to verify worker skills in weatherization and the building trades, the Building Performance Institute (BPI) now offers an "integrated certification, accreditation, and quality assurance program" that works with local training affiliates around the country to certify building performance technicians.

While there are no formal prerequisites for BPI certification, the Institute strongly recommends that candidates have some training and experience in the building performance industry before attempting the exams. BPI certifies a worker's competence to optimize building performance in a particular area, and the credentials are not designed to substitute for trade training and certification in service and installation skills.

Table 4
BUILDING PERFORMANCE INSTITUTE (BPI) CERTIFICATION REQUIREMENTS

BPI Certification	*Requirements*
Building Analyst Professional	100-question written examination and field examination. Candidates need to master BPI's Knowledge Essential Task List (KETL) – a comprehensive list of related knowledge, skills, and tasks, from building science to professional ethics; OR HERS Certification (see RESNET); AND BPI Building Analyst Professional 50-question written examination; AND BPI Building Analyst Professional field examination.
Envelope Professional	100-question written examination and field examination; OR Any other BPI Certification; AND BPI Envelope Professional 50-question written examination; AND BPI Envelope Professional field examination.
Manufactured Housing Professional	100-question written examination and field examination; OR Any other BPI Certification: AND BPI Manufactured Housing Professional 50-question written examination; AND BPI Manufactured Housing Professional field examination.
Heating Professional	100-question written examination and field examination; OR Any other BPI Certification; AND BPI Heating Professional 50-question written examination; AND BPI Heating Professional field examination; OR NATE Heating Service Certification (See NATE); AND BPI Heating Professional 50-question written examination; AND BPI Heating Professional field examination.
A/C or Heat Pump Professional	40 CFR Section 608 Type II or Universal; AND BPI A/C or Heat Pump Professional 50-question written examination; AND NATE AC Service or NATE Heat Pump Service (See NATE) 100-question written examination; AND BPI A/C or Heat Pump Professional field examination.
Multi-Family Building Analyst Professional	Certification model for multi-family buildings (typically 5+ residential units) is not fully articulated online at this time.
Energy Efficient Multi-Family Building Operations Specialist	Certification model for multi-family buildings (typically 5+ residential units) is not fully articulated online at this time.
Multi-Family Hydronic Heating System Design Professional	Certification model for multi-family buildings (typically 5+ residential units) is not fully articulated online at this time.
Multi-Family Advanced Heating Plant Technician	Certification model for multi-family buildings (typically 5+ residential units) is not fully articulated online at this time.

Residential Energy Services Network (RESNET)

Residential Energy Services Network (RESNET) is a national standards-making body for building energy efficiency rating systems, verifying energy performance for, e.g., energy efficient mortgages, EPA ENERGY STAR Homes, and residential performance in energy efficiency programs funded by state utility benefits programs. In addition to certifying Home Energy Raters, RESNET over the past five years developed two additional certifications in order to establish a more structured career path. Individuals train with an accredited Home Energy Rating Provider and can enter the field at either the more basic Rater Field Inspector or the standard Certified Rater level, then advance to senior levels through documented experience and Rater Specialty Certifications (e.g., HVAC, LEED for Homes, etc.).

Table 5

RESIDENTIAL ENERGY SERVICES NETWORK (RESNET) CERTIFICATION REQUIREMENTS

RESNET Certification	*Requirements*
Home Energy Rater Services (HERS) Certified Rater	To have a passing score on the RESNET National Rater Test (80%); AND To complete two mandatory Supervised Ratings under the guidance of a RESNET accredited Rater Training Provider; AND To contract with a RESNET accredited Rating Provider; AND To perform mandatory Probationary Ratings.
Rater Field Inspector	Completion of Rating Field Inspector training by a RESNET accredited Rater Training Provider; AND Passing the RESNET National Field Inspector Test; AND Completion of three additional probation tests under the direct supervision of a certified rater.
Senior Certified Rater	Experience as a certified energy rater for a period of at least one year; AND Documentation of having accurately completed ratings and performance tests of a minimum of 25 homes; AND Certification in a minimum of two Rater Specialty Certifications; AND Demonstrate the ability to complete a rating and all required performance testing, without the use of any reference material, in the presence of a rater trainer or quality assurance designee; AND Passing the National Senior Rater Test administered by RESNET; AND A National Senior Rater must also publicly demonstrate before a jury of five, approved by the Technical Committee and composed of at least three of his/her peers and at least one Certified Trainer and at least one Quality Assurance Designee, that he or she is competent in all areas by passing an oral exam, designed to determine if the National Senior Rater candidate can successfully diagnose and discuss in detail the building science phenomena that underlie a complex home energy rating case study, approved by the Training and Certification Committee.
Rater Specialty Certification	RESNET will formally recognize raters' optional specialty certification(s) by independent programs in closely related fields of building performance, above and beyond RESNET's rater certification.

North American Technician Excellence (NATE)

North American Technician Excellence (NATE) is an industry organization that certifies heating, ventilation, air conditioning, and refrigeration technicians.[18] Parsing skills into 21 Knowledge Areas of Technician Expertise (KATEs), NATE offers certification exams for installation, service, and senior technicians. Specialties are: Air Conditioning, Air Distribution, Air-to-Air Heat Pumps, Gas Furnaces, Oil Furnaces, Hydronics Gas, Hydronics Oil, Light Commercial Refrigeration, and Commercial Refrigeration. Senior technicians are certified HVAC efficiency analysts.

Table 6

NORTH AMERICAN TECHNICIAN EXCELLENCE (NATE) CERTIFICATION REQUIREMENTS

NATE Certification	*Requirements*
Installation Technician	Core installation exam; AND One specialty exam; AND No formal pre-requisites, though NATE suggests some technical training and one year of experience to pass tests, which are based on applied knowledge.
Service Technician	Core service exam; AND One specialty exam; AND No formal pre-requisites, though NATE suggests some technical training and two years of experience to pass tests, which are based on applied knowledge.
Senior Technician: HVAC Efficiency Analyst	Pass a 100-question test for HVAC Efficiency Analyst Senior; AND Candidate shall hold two certifications by NATE in Service Sector Specialties; AND Five years experience (suggested).

Building Operators Certification (BOC)

Designed for commercial building operators, Building Operators Certification (BOC) is a professional continuing education program created by the Northwest Energy Efficiency Council. BOC certification follows competency-based training and assessment at sites across the country, including technical colleges, utility-funded programs, and regional training institutes.[19] The programs – which upgrade participants' skills in, e.g., electrical, HVAC and lighting systems; indoor air quality; environmental health and safety; and energy conservation – target a variety of career levels, from engineers to energy managers, technicians to architects.

Table 7
BUILDING OPERATORS CERTIFICATION (BOC) REQUIREMENTS

BOC Certification	*Requirements*
Building Operator Certification Level I	Completion of eight one-day classes and an accompanying series of facility-based projects, AND passing the BOC exams; *Candidates must also have:* A high school diploma or GED; AND Two or more years of experience working in operations and maintenance of a commercial or institutional facility; OR A high school diploma or GED; AND A minimum of one year of experience working in operations and maintenance of a commercial or institutional facility; AND One year of technical college level education in facilities engineering related program; OR A high school diploma or GED; AND Two or more years of experience in energy management of facilities with a focus on operations and maintenance.
Building Operator Certification Level II	Completion of seven one-day classes and an accompanying series of facility-based projects, AND passing the BOC exams; *Candidates must also have:* A high school diploma or GED; AND A technical degree and three years of experience working in operations and maintenance of a commercial or institutional facility; OR A high school diploma or GED; AND A union membership at journey level and three years of experience; OR A high school diploma or GED; AND BOC Level I certification and four years of experience.

Green Building Certification Institute (GBCI)

While the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) manages the storied Green Building Rating Systems, the Green Building Certification Institute (GBCI) independently administers the LEED professional credentialing program, including exam development, application, registration, and delivery. The separation of these two functions reflects GBCI's commitment to objectively measuring standardized skill sets, and brings their certifications in line with the ANSI accreditation they are seeking. GBCI certification reflects a high level of professional achievement, but requires no formal associated training – all references are free and downloadable. As a stand-alone credential, the LEED Green Associate reflects GBCI's interest in developing a broad green building sector which includes, e.g., leasing agents, product salespeople, and real estate brokers. This ground-floor credential, which signifies basic knowledge of green design, construction, and operations, is also designed as the first step to a LEED AP. AP certification is a technical credential that requires advanced knowledge of green building practices and specialization in a particular LEED Rating System: Operations & Maintenance; Homes; Building Design & Construction; Interior Design & Construction; and, starting in 2010, Neighborhood Development (recommissioning).

Table 8

GREEN BUILDING CERTIFICATION INSTITUTE (GBCI) CERTIFICATION REQUIREMENTS

GBCI Certification	*Requirements*
LEED Green Associate	Passing the Green Associate exam; AND Documented involvement on a LEED-registered project; OR Passing the Green Associate exam; AND Employment (or previous employment) in a sustainable field of work; OR Passing the Green Associate exam; AND Engagement in (or completion of) an education program that addresses green building principles.
LEED AP	Passing the two-part LEED AP exam (part one is the Green Associate exam; part two is a specialty exam based on one of the LEED Rating Systems: Operations & Maintenance; Homes; Building Design & Construction; Interior Design & Construction; and, starting in 2010, Neighborhood Development (recommissioning)); AND Documented professional experience on a LEED project within the last three years.
LEED Fellow	Under development. GBCI imagines LEED Fellows as the *eminences gris* of the green building field, leading professionals distinguished by deep and mighty contributions to common standards of practice.

LOCAL MODELS, NATIONAL PROSPECTS

There are lots of models around the country – or, rather, there are lots of folks trying to develop renewable energy or energy efficiency curricula and train workers per industry demand. A few are doing so in model ways (i.e., conducting labor market studies, building career pathways, talking to labor and community and industry, etc.), including Centralia College (WA), Lakeshore Technical College (WI), Lane Community College (OR), and Los Angeles Trade and Technical College (CA).[20] Regional efforts, too, are nudging workforce systems in the right direction, like the Midwestern Governors Association's New Energy Jobs Platform which calls on states to align credentials across training systems and promote region-wide career pathways.[21] These efforts might seem wholly inadequate, given national employment and climate crises. But just greening local curricula to an agreed upon industry standard, and then articulating local certificates into regionally recognized associate degrees would be a huge improvement, as would integrating the public workforce system and support services into clearly delineated career pathways.[22]

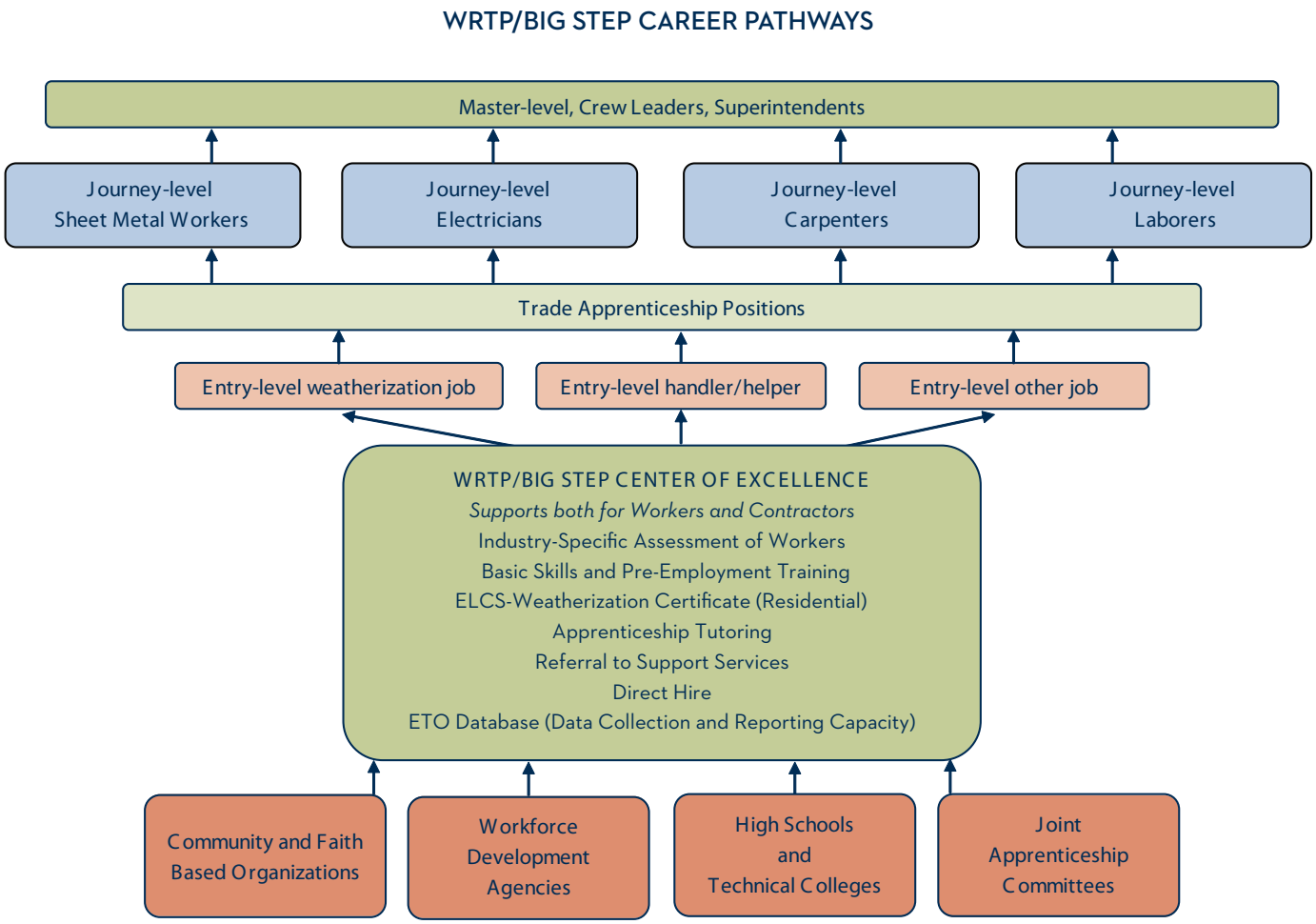
Newer technologies, like wind and solar, are more likely to drive "new" programs and credentials. But in many cases related installation and operations jobs, like the majority of jobs in green building and efficiency retrofitting, are more obviously linked to traditional trades training. In these cases, skills critical to renewable energy and energy efficiency occupations (many traditional, a few greener) are best delivered through the original and, perhaps, strongest career-pathway – apprenticeship. It isn't the newness of any emerging green industry (or skill set) that's hard, but aligning the on-ramps for workers, which is difficult because the system is complex, access opaque, and requirements are, for many, a high bar (requiring, e.g., onsite experience, math, reading, and communications skills). Add to this the poorly defined and often disconnected range of programs called "pre-apprenticeship."[23]

Two of the most interesting efforts in this regard – one local, one national but system-specific – attempt to standardize entry-level training for the skilled trades: The Wisconsin Regional Training Partnership (WRTP) Entry Level Construction Certificate, and the AFL-CIO Multi-Craft Core Curriculum. Taking a more occupationally specific approach, two other initiatives are drawing national attention for their work to standardize "green" skills training and assessment. Laborers' International Union of North America (LIUNA) has developed a national model for residential weatherization training; and Washington State has been steadily developing sound, up-to-date skill standards for energy industry jobs, including renewables. We outline these various approaches below.

Wisconsin Regional Training Partnership: Entry Level Construction Certificate in Weatherization

The Wisconsin Regional Training Partnership (WRTP)/Building Industry Group Skilled Trades Employment Partnership (BIG STEP) is one of the nation's preeminent labor-led sector partnerships. Working with unions, businesses, community groups and the public workforce system, WRTP/BIG STEP has helped thousands of Milwaukee-area workers – often low-income or unemployed women and people of color – connect to good jobs and build their skills while also helping dozens of local employers connect to the skilled workers they need.

WRTP/BIG STEP's Center of Excellence offers workers a wide range of support during their preparation for construction and manufacturing careers, including academic assessments and individualized tutoring for apprenticeship exams; pre-employment skills training and certification; and connections to community organizations that can assist with daycare, transportation, GED prep, job readiness, and other services.[24]


WRTP/BIG STEP CAREER PATHWAYS
Master-level, Crew Leaders, Superintendents
Journey-level Sheet Metal Workers
Journey-level Electricians
Journey-level Carpenters
Journey-level Laborers
Trade Apprenticeship Positions
Entry-level weatherization job
Entry-level handler/helper
Entry-level other job
WRTP/BIG STEP CENTER OF EXCELLENCE
Supports both for Workers and Contractors
Industry-Specific Assessment of Workers
Basic Skills and Pre-Employment Training
ELCS-Weatherization Certificate (Residential)
Apprenticeship Tutoring
Referral to Support Services
Direct Hire
ETO Database (Data Collection and Reporting Capacity)
Community and Faith Based Organizations
Workforce Development Agencies
High Schools and Technical Colleges
Joint Apprenticeship Committees

In addition to helping candidates up the pipeline into its apprenticeship-prep program, WRTP/BIG STEP helps participants find jobs – and succeed in them. The Center of Excellence maintains a database of apprenticeship-ready workers, and can certify them for construction projects with residential hiring requirements. Once WRTP/BIG STEP participants are placed, the Center of Excellence continues to provide individualized support and evaluation to help apprentices advance in their careers.

This model industry partnership offers a perfect paradigm for green-collar job training. It is no surprise, then, that WRTP/BIG STEP has an answer to the weatherization challenge posed by the recent and dramatic increase in federal dollars: how to move towards ensuring both the quality of jobs and the quality of work in the traditionally low-end labor market for residential construction.

Working with Community Action Programs and the Laborers Union, WRTP/BIG STEP plans to bring their experience and skill to the growing market for energy efficiency retrofitting in southeastern Wisconsin, and, hopefully, statewide. Key components include:

INITIAL ASSESSMENT AND COMMUNITY PARTNERS

One key to success, according to Associate Director Rhandi Berth, is savvy skills assessment and strong partnerships: "We are able to quickly assess the needs of the people that come through our door – whether they require essential, basic, or technical industry skills. We work with hundreds of local community organizations that refer those that are work-ready to us and provide support for workers we identify as needing help becoming job-ready."

EMPLOYER-DRIVEN TRAINING

WRTP/BIG STEP partners with employers and training providers to offer appropriate curriculum for their students. Their experience in the residential construction sector includes preparing workers for lead abatement and asbestos removal and WHEDA building projects. By building on that history and coordinating with appropriate agencies and organizations, WRTP will expand its industry-recognized Entry Level Construction Skills (ELCS) credential to include a weatherization component. The ELCS-Weatherization Certificate will assure contractors that graduates have the skills they need to satisfy the high standards of the program.

LEVERAGED RESOURCES

WRTP/BIG STEP navigates a thicket of public and private funding systems to leverage training dollars from state, federal, and industry sources. WRTP, for example, is an eligible provider for Workforce Investment Act programs; workers can use their Individual Training Account (ITA) vouchers for ELCS training.

WORKER SUPPORT: TUTORING & MENTORING

WRTP/BIG STEP has developed a model mentorship program to support workers entering the construction industry. It is well known that new workers do better on the job when they have the support of an experienced worker to guide and advise them, but few organizations run successful mentoring programs. WRTP/BIG STEP matches every new worker with a mentor. These mentors are senior workers whose primary relationship with their mentee is supportive – they are not a supervisor or a trainer who may have conflicted relationships with their mentee. Mentors can spot early signs of trouble and WRTP can then work with all parties to find the appropriate resources to help the mentee succeed – relying on community partners, union allies, or others, as appropriate.

The WRTP/BIG STEP commitment to helping workers enter into lasting careers led to the development of a successful tutoring program for passing apprenticeship tests. The Center of Excellence helps workers gain the math, science, and other skills they need to enter the building and construction trades. Hundreds of graduates have been placed in apprenticeship programs thanks to flexible tutoring schedules and individually tailored curricula.

LABOR PARTNERS

WRTP/BIG STEP has a longstanding relationship with the Laborers Union, Local 113. That union has a residential construction package rate of about $20 per hour, which includes pension and health care benefits. By working with contractors affiliated with the Laborers in residential weatherization, WRTP can offer access to excellent training and support for workers.[25]

Earning an ELCS-Weatherization Certificate can be a gateway to a decent job in residential energy efficiency, if weatherization programs are implemented with reasonable labor standards, or the first step on a pathway from residential-sector construction to good jobs on the commercial side, particularly in green building and retrofitting.

AFL-CIO: MULTI-CRAFT CORE CURRICULUM

The AFL-CIO Building Trades Multi-Craft Core Curriculum proposes to institute at a national level an apprenticeship prep program similar to WRTP's Entry Level Construction Skills program. Sean McGarvey, Secretary Treasurer of the national Building and Construction Trades Department, AFL-CIO, describes the Core Curriculum as "an innovative training program that provides a gateway from high school or community college to joint labor-management registered apprenticeships throughout the United States. The Core Curriculum is also designed to provide an on-ramp to careers in the construction trades for adults exploring a career transition. The Building Trades 'Core' was developed as a national industry credential by the national apprenticeship and training directors in the construction industry to establish, for the first time, a standardized pre-apprenticeship for entry into any of the crafts in the building trades." Given the current slump in the construction industry, the program is only running pilots in two Washington State skills center sites. When economic recovery and green infrastructure development take off, and the apprenticeship pipelines re-open, this promises to be a welcoming, rationalized on-ramp to solid skills training for an urban, underserved workforce that traditionally viewed the trades as inaccessible.[26]

Laborers Interational Union of North America (LIUNA): Weatherization Training Pathways

The Laborers are tackling the challenge of residential weatherization at a national level – i.e., bringing small traditional programs, typically run by Community Action Programs, to scale; focusing on high-road contractors to assure both quality of jobs and quality of work; and ensuring that a dramatically expanded weatherization workforce has opportunities for career advancement in the construction sector.

Based on a successful pilot in Newark, New Jersey, run under a Minority Outreach Program grant in partnership with the Garden State Alliance for a New Economy, LIUNA developed a Weatherization Training Program (WTP) that they are working to implement nationwide. The LIUNA program beefs up DOE's core competencies for weatherization with greener and more sophisticated construction skills, including environmental remediation. The comprehensive curriculum moves from general construction skills through environmental hazard identification and abatement to weatherization installation, testing, and auditing. Using their sophisticated education infrastructure (70 facilities around the country as well as mobile training units), the Laborers plan to train through their locals in partnership with community-based organizations. Prospects are good not only for moving towards critical scale and quality of energy efficiency work, but for weatherization workers to earn family-supporting wages or transition to other construction careers, including those in the better-paid commercial sector. In a relatively short time frame, LIUNA/WTP can produce legions of credentialed Technician/Installers, Weatherization Supervisors, and Energy Auditors. What is not clear at this point is how this weatherization training will link to a national certification, or if the Laborers can otherwise position their credentials as the common currency of residential retrofitting in general.

Washington State: Energy Skill Standards

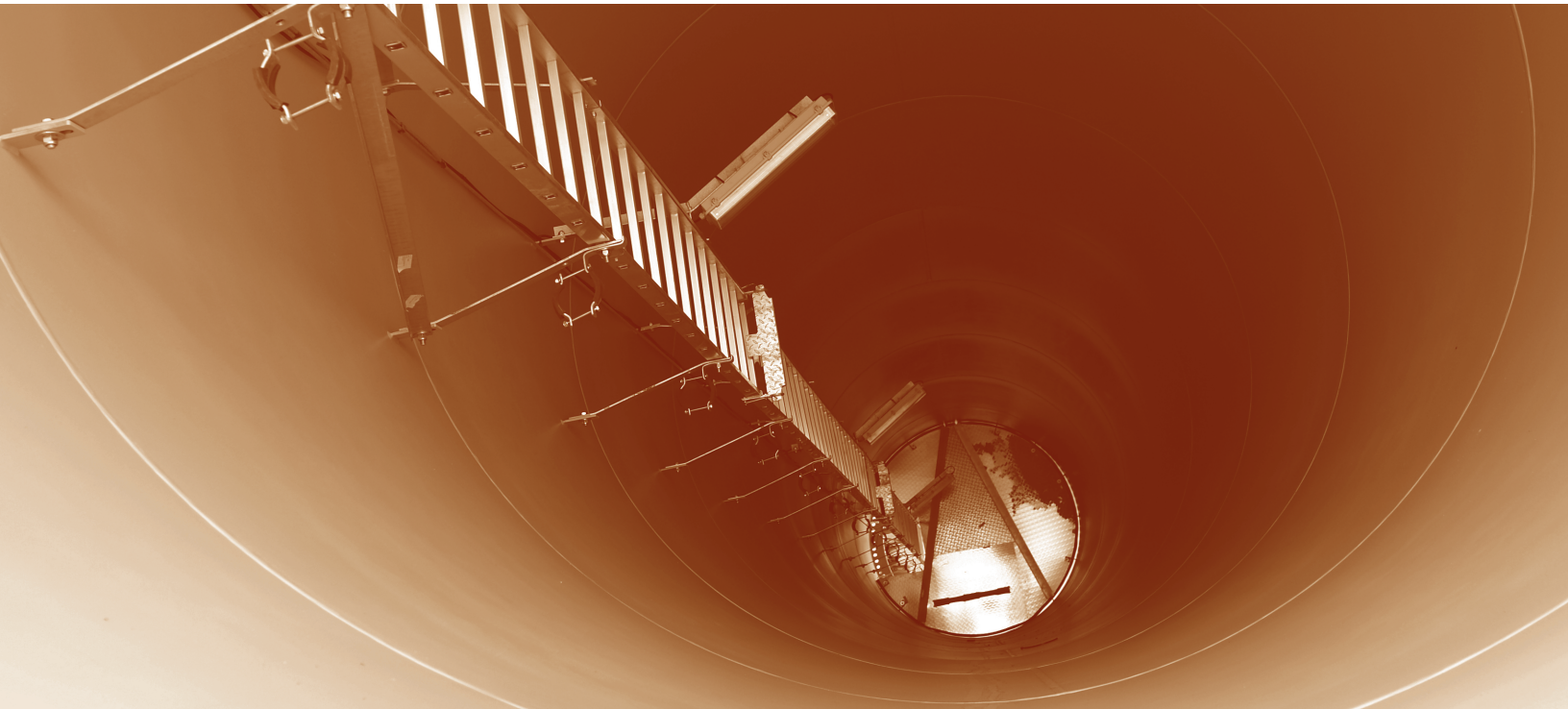
Other local examples could serve not as a national model so much as an actual national standard. The Northwest Energy Efficiency Council's Building Operators Certification program, for example, has gained some national recognition as a benchmark for quality continuing education and skills upgrading. On the renewable side, another Northwest innovator, and one with a traditionally systematic approach to workforce education and training, is Washington State.

An established leader in skill standards development, a solid analyst of green jobs and related labor markets, and an innovator in community college bridge programming, Washington has in recent years turned its attention to the energy industry.[27] The state's Center of Excellence for Energy Technology at Centralia College – founded in 2003 to address a shortage of skilled workers in power generation fields – has made great strides in rationalizing community and technical college programs leading to energy industry careers.

The Energy Industry Skill Standards Project convenes the state's public workforce system, labor unions, community and technical colleges, and employers to develop standards that can serve as technical benchmarks for entrance to and success in related careers. As part of this initiative ("to specify the critical work functions, key activities, performance indicators and knowledge, skills, and abilities an individual needs to succeed in certain energy-related occupations"), Centralia's Center of Excellence just released a comprehensive analysis of Skill Standards for Wind Technicians.

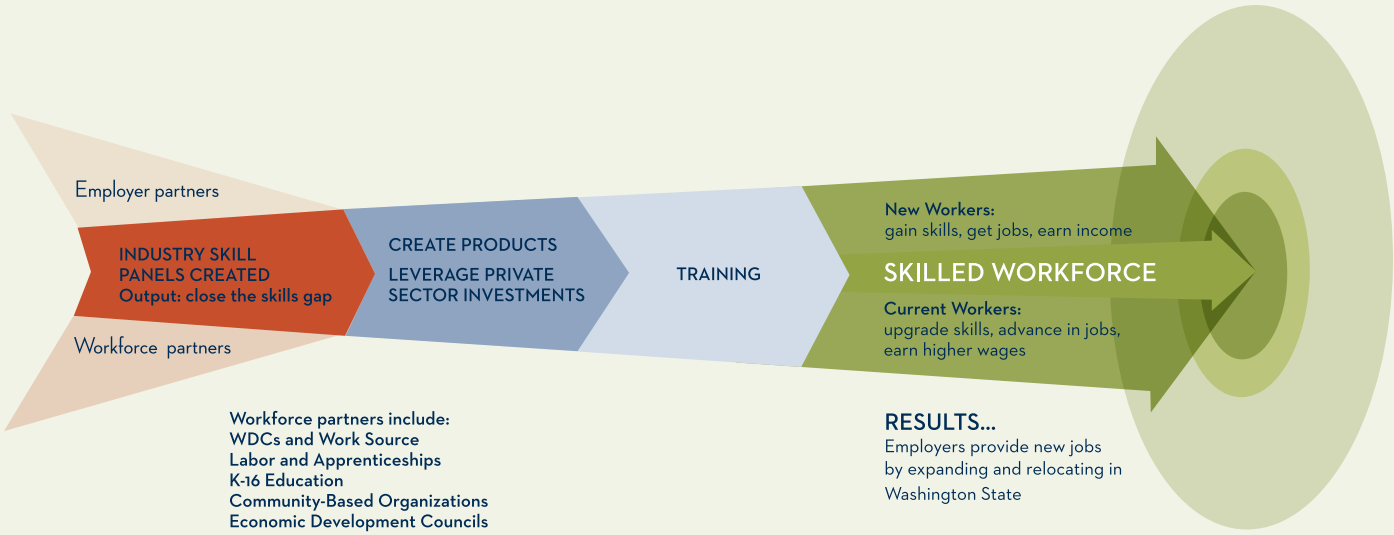
Not only can these standards serve as national metrics, but the process itself is a textbook case of collaborative skill standards development. Funded by the Pacific Mountain Workforce Development Council's Workforce Innovation in Regional Economic Development (WIRED) Initiative, the Wind Technician project was led by the Center of Excellence in collaboration with the WSU Extension Energy Program, and included a broad swath of labor, industry, and education partners.

To map and validate the skill standards, the Wind Technician team followed a process mandated by the State Board for Community and Technical Colleges, including extensive research, focus groups, surveys, expert analysis, and industry-wide review. Because of this, and because of the commitment and full participation of all partners, the project resulted in a widely accepted, industry-driven set of (voluntary) standards that colleges and unions agree to train to (and develop curriculum for), and that will be a baseline for ongoing discussion and continuous improvement.



WASHINGTON'S INDUSTRY SKILL PANELS

Washington's Industry Skill Panels bring business, labor, and education together in public-private partnerships to build a skilled workforce in key industry sectors. The principles shaping the state's energy skill standards are no different, including the basic premise that "experienced workers are the experts in their career field and are best able to identify the work performed and the skills, knowledge, and abilities required to be successful."[28]



Adapted from Washington Work Force Training and Education Coordinating Board for *Greener Pathways* (COWS, 2008).

The standards report starts with a basic job description and moves through required credentials to task and function analyses of routine, crisis, and long-term scenarios. It also includes the project's SCANS (Secretary's Commission on Achieving Necessary Skills) surveys that delineate pertinent foundational abilities from basic academic skills to problem solving, working in teams, and the use of technology. Final skill standards include performance indicators (how do we know when the task is performed well?); technical knowledge (skills, abilities, tools); and employability skills.

Skill standards establish metrics for competent performance in a particular job or activity; they do not measure or certify an individual worker's level of competence. To be meaningful in the labor market, industry or occupational skill standards need to be linked to voluntary, standardized assessments and certifications.[29] If this can be done on a national level, creating an assessment and certification process based on the Washington Wind Technician standard and accessible through a variety of training systems, the pay-off, for workers and employers, would be twofold: (1) mobility, as "national recognition of skill standards in career fields provides a common basis for certifying achievement against those standards, thereby allowing for the portability of skills across geographic areas, companies and careers;" and (2) rationality, as "skill standards provide benchmarks for making education and training decisions, shaping curricula and directing funds toward highest value education and training investments."[30]

POLICY RECOMMENDATIONS:
GREENER SKILLS AND GREENER STANDARDS

A real system of national skill standards is our key recommendation for building a quality energy workforce and an equitable green future.

The preceding description of key existing credentials for green jobs makes the diversity and confusion of the system evident. American labor market "systems" work against establishing the sorts of clear credentials and training paths that would serve both the interests of employers and America's working class. The current hot "green" moment makes it clear that the general problem is exacerbated in the context of new jobs, or hopes for them, and increasing investment and anticipation of a new energy future.

Already, we see the general and longstanding problems being recreated in whole – new programs being set up one community college at a time, new "standards" being trained to with no jobs for the workers who complete the training, new initiatives and investments that aren't even aware of existing workforce training infrastructure, "apprenticeships" being established without sufficient understanding of the scale of demand for new workers in the industry.

But it may be that some of these existing initiatives and standards could help rationalize and align the training system for new green jobs. And that's what we need to seize on if we're going to get from here to the green training future that we want to build.

What would we actually do in the area of green training, if we could just do it now? First, and always, we'd start with actual jobs and a national system of skill standards to train workers where they're needed. Federal leadership would organize the discussion between industry, labor, and education leaders to establish broadly endorsed skill standards. The federal departments would have to pursue consistent and coordinated investment in the development of the actual standards, and their dissemination, and the development of multiple ways of training to them. Industry leadership, convened and supported by the federal government, is the first and most essential step in getting to portable credentials whether they are green or not.

This is more straightforward when the job is new – wind turbine maintenance for example. Our review of existing credentials shows that these new areas already exhibit some industry leadership and ability to disseminate standards broadly. The task of establishing standards becomes much harder when the green component is an add-on to an existing job – a situation we've already argued is dominant numerically and morally. Harder because existing jobs are already located in the diverse and often irrational "systems" for training and access to those jobs.

Here the federal government needs to work to identify the strongest systems for training and job quality (apprenticeship into union trades being an obvious starting point) and work with industry to identify the green skill enhancements required for specific work.

But all this assumes we have a broad national investment in skills, and that is our first recommendation.

1. LEVERAGE GREEN TO THE BROADER GOOD, SECURING NATIONAL AGREEMENT ON SKILL STANDARDS AND GETTING SERIOUS ABOUT BUILDING A SYSTEM TO CREATE AND SUPPORT THEM

Realizing the equity promise of the new energy economy requires broad national agreement – and action – on the needed reforms of our training system. One key reform is the development of national skill standards and common certification of their attainment.

Any standard-setting process, however, faces political and design difficulties. The basic political problem is this: unless business is assigned a leadership role in the process, the standards will almost surely not be used. But if business alone is assigned a leadership role, the standards (if taken to be binding) are likely to be set lower and broader than is desirable, or (if purely voluntary) narrower and higher than desirable. Addressing this problem requires, in one way or another, bringing in other social interests, preeminently those of labor. Given the gross power imbalance between business and labor in the United States, however, this is a difficult marriage to make. Complicating things, business and labor both lack encompassing organizations with the technical and political capacity needed both to strike a deal and make it stick.

A further critical sticking point in developing skill standards in the United States is whether/how to make the standards mandatory.

The voluntary/mandatory problem is intuitively obvious, even if its solution in the U.S. is far from so. On the one hand, the utility of standards depends directly on the *universality* of their use, and unless there is a degree of obligation in that use, it will be far from universal. On the other hand, the utility of standards depends directly on the universality of their *use*, and, at least under present circumstances in the U.S., use will again not be forthcoming at all or in any interesting way (i.e., in a way that meaningfully shapes hiring and compensation practices) if business is ordered to do it.

That this is as easily stated today as it was two decades ago should not depress us (even though it does). But it should, perhaps, remind us that the solution is not new nor is it easy. Fortunately, after years of federal neglect and disarray (and defunding), there is an emerging workforce dialogue in Washington on national skill standards, industry-recognized credentials, and evolving labor markets in key green sectors.

We are encouraged, for example, by the current Administration's efforts to establish national workforce certifications and training standards in the energy efficiency retrofit sector. Working with DOE, DOL, HUD, EPA, and others, the Vice President's Middle Class Task Force and the White House Council on Environmental Quality have called for a collaborative effort to "assess existing standards and training programs and develop consistent models, guides, and best practices for training and certification," to be deployed by Education, Commerce, and the Small Business Administration.[31] But as we've found after years of work in building state-level career pathways (and local bridges onto them), models, pilots, and best practices aren't enough. Bringing change to scale requires broad-based systems reform and that will require attention, investment, and real political will.

A real system of national skill standards is our key recommendation for building a quality energy workforce and an equitable green future.

But we understand, as is clear above, that such a system will not easily or instantly be created. The more modest suggestions that follow can in the meantime steer the country toward a stronger, greener, and more aligned training system.

2. FEDERAL ACTION: SUPPORT THOSE HIGH-QUALITY NATIONAL STANDARDS THAT ALREADY EXIST, AND USE PUBLIC INVESTMENTS TO ENCOURAGE LOCAL CONNECTIONS TO THEM

Whenever and wherever functional national standards exist or are emerging, the Departments of Labor, Energy, and Education, among others, should support and advance them. These agencies need to pursue a clear and consistent approach to standards, coordinating with each other on investments or other support and ensuring that industry information works its way back through existing training and education systems. Executive and legislative green jobs initiatives should then guarantee reliable assessment of related competencies (can workers actually do what their credentials say they can?) by clearly supporting impartial and, where possible, independent skills verification.

The federal government – through both its legislative and executive agendas – can also help by investing in local efforts to develop training to identified national standards where skills shortages are clear. These investments should tie systems together rather than encourage the constant creation of new pilot programs to prove that training is possible. They should also require local partners to connect to industry. In fact, wherever the federal government is underwriting "green" programs or projects, policy-makers should include a workforce development component that requires participating education and training systems to prepare participants for established third-party certifications.

Further, in the absence of national system reform, federal programs and federal legislation should support exemplary state and local programs: those that are not bounded or "staccato" (with big gaps between steps) in the career paths marked by their training; use widely recognized training curricula and third-party verification of claimed competencies; provide work opportunity and income support to students during training; have high employer involvement in the design of program content; and articulate with two- and four-year higher education institutions for academic credit assignment.

3. STATE ACTION: DRIVE RATIONALIZATION THROUGH STATE OR REGIONAL SKILL STANDARDS PROCESSES

State policy should promote the development, expansion, and institutionalization of such programs. And like the state of Washington, whose leadership in this area we described in the last section, states should approach green jobs systematically and strategically. They can start by focusing on the jobs themselves, identifying those industries critical to sustainable regional prosperity that lack or will soon run short of adequately skilled workers. They can move forward to define the skills necessary to execute those jobs and develop a related package of standards. A set of credentials can then mark the achievement of those skill standards, preferably chunked into manageable, achievable, articulated sequences allowing entry and advancement at all levels – from basic skills training to post-graduate education. Finally, public and private training systems can adopt these universally recognized credentials, integrating them into traditional curricula or pathways.[32]

In the places where green training has already been built from the ground up, state workforce systems should seek to link local credentials to national standards, where they exist. At a minimum, they should extend efforts towards standardization to the broadest geography possible, establishing a common language of credentials in any given labor market.

Even aside from the current obsession with cultivating a skilled green labor force, workforce development systems have a lot of good reasons to want to be able to measure the acquisition and mastery of critical labor market skills. Among them: (a) to evaluate the education and training programs that purport to provide them; (b) to increase the efficiency of additional or remedial training by giving both trainers and trainees a more precise sense of deficiencies; and above all (c) to provide a convenient way for workers to demonstrate to potential employers what skills they have, and reward their further acquisition.

4. SYSTEMS ACTION: FOCUS ON THE COORDINATED AND STRATEGIC GREENING OF EXISTING CREDENTIALS, RATHER THAN RUSH TO CREATE MYRIAD (AND REDUNDANT) NEW GREEN JOBS PROGRAMS

Green jobs initiatives should be integrated into existing training systems. As we have consistently argued, much of the green future is already with us and seizing it requires us to transform the industries and jobs we already have. From a workforce development perspective this means that training providers should focus less on creating courses of study and curricula from scratch and more on embedding green curricula for greener skills into existing and broader courses of study. Private and public education training systems do not always have to develop new diploma and degree programs, just greener ones.

Community colleges, for example, shouldn't simply rush to start their own "green jobs" programs (though many already have, with offerings that range from important and critical to redundant and ridiculous). While opening a new program may offer a press opportunity and prove your campus is on the green edge, in fact the ways that all schools manage to integrate the green content into existing programs, and the resources they save by doing so in consistent and industry-defined ways are likely to prove both more important and sustainable.

And other local institutions can take a broader view. Because registered apprenticeship programs are a fulcrum for workforce development in the clean energy economy, labor unions and JATCs should continue to (a) align training with national industry standards in emerging technologies; and (b) figure out how to rationalize on-ramps through legitimate pre-apprenticeship programs designed to expand and diversify recruitment.

5. FULL COURT PRESS: BUILD MORE ON-RAMPS TO TRAINING, CREDENTIALS AND JOBS FOR THE WORKERS WHO NEED OPPORTUNITY MOST

Beyond skills training, green jobs initiatives must address access and upward mobility. To help workers advance from unemployment, disconnection, or dead-end, poverty-wage work into better, greener jobs, policy-makers at every level should work with local partners to develop career pathways – and bridges onto them. This may be the greatest challenge and the one most easily neglected. This is our moment, however, to make systems work for those who need the support the most.

For low-skilled, low-wage, unemployed, or disconnected workers to access the skills training necessary to land decent jobs, they need clear, consistent on-ramps into the system, and where they exist, its career pathways. At community and technical colleges, this means building bridges between basic skills or English language learning and occupational programs, and improving transitions between developmental and for-credit coursework. It also means providing the services and support – career and academic advising , child care, transportation, etc. – necessary for many working adults and disconnected youth to achieve post-secondary credentials and clean energy careers.[33] Finally, improving the nation's dismal post-secondary persistence rates for low-skill adults, most of whom never complete a certificate, diploma, or degree, requires the strategic overhaul of (a) financial aid systems and (b) program delivery to sustain workers who attend college part time. All of which can and should be supported by federal, state, and local institutional policy.

Better access to apprenticeship requires legitimate, standardized, well-connected pre-apprenticeship programs that have strong direct ties to both union apprenticeship programs and community organizations. Apprenticeship requirements set a high bar for basic academic and worksite skills, and programs have, in many cases, troubling persistence rates for women and people of color. Making the entrance process more transparent (particularly in the byzantine construction industry), investing in on-site mentoring, and consistently enforcing apprenticeship standards can all improve access and persistence. Additionally, the apprenticeship system, which is in many ways the archetypical career pathway, should seek better alignment with the public workforce system, and, where possible or pertinent, community and technical colleges.[34]

CONCLUSION

We believe that publicly supported career-tech training systems should only support clear, seamless, affordable career pathways to in-demand and materially rewarding occupations, with portable credentials for credibly tested competencies, ideally including credit for their academic content from colleges and universities. The rationale for each element in this recommendation is the same, the promise most democratic governments make to their people: to maximize equal opportunity for individual advancement without wasting public money doing so. That promise is violated by a training system that has initial barriers or steps to advancement that are not understandable, navigable, and affordable to ordinary people; prepares participants for unrewarded work; claims graduate competencies not credible to employers; does not increase those graduates' labor market mobility; or fails to recognize the academic content of vocational skills, creating unnecessary drag on future learning and advancement.

The current green moment offers a chance to broker a new compact. The country's renewed enthusiasm for workforce development, inspired by a compelling vision of the clean energy economy and its greener jobs, should be channeled into realizing the actual promise of equal opportunity and family-supporting employment, and reforming the training systems that undergird it.

NOTES

1. We have argued elsewhere that a "clean energy economy" is broader than just the renewable energy and building energy efficiency sectors, that a "green" economy would be broader still, and that any such boundaries are necessarily arbitrary, given that it is almost impossible to parse the "green" elements of a given job, and that most jobs can and should be greener. See, e.g., Sarah White and Jason Walsh, *Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy* (Center on Wisconsin Strategy, 2008). While this is by now a fairly widely accepted concept, and is not inconsistent with, e.g., the useful ONET taxonomy of increased demand, enhanced skill, and new/emerging occupations, the persistent drumbeat of new, novel, silver-bullet, job claims continues to plague many discussions of "green" economic and workforce development.

2. By "high-road" we mean, for firms, a value-based competitive strategy that seeks to increase net by (a) increasing product market value by increasing product performance, distinctiveness, or customization and (b) minimizing waste (of natural and human capital) in product production and distribution while (c) sharing that net with those who helped produce it.

3. Without answering it, we can say it owes proximately to the historic weakness and peculiarly apolitical character of U.S. labor, the "laggard" and incomplete U.S. welfare state, the lack of explicit attention to class in our politics, the persistence of popular illusions about the class-negating effects of our "comprehensive" high schools, etc. – all of which were long tolerated given exceptionally high general living standards in the U.S.

4. There are a lot of reasons for the latter: deregulation, contracting out of lower-runged job ladders, reduction in the number of remaining rungs, declining plant size, declining unionization and civil service coverage, general increases in labor market instability and informality, especially among younger workers. A long story.

5. See, e.g., White and Walsh, *Greener Pathways*.

6. This list is adapted from a memo circulated last year by Gerry Hudson, Joel Rogers, and Phil Thompson, *Eyes on the Prize: Program Architecture of Emerald Cities* (1/10/09).

7. www.ansica.org/wwwversion2/outside/PERfaq.asp?menuID=2. ANSI is the official U.S. representative to the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) via the U.S. National Committee (USNC).

8. Wendy L. Parker, et al., "Costs and Benefits of Practitioner Certification or Licensure for the Solar Industry" (IEEE Photovoltaic Specialists Conference, 2002). For the finer points of these distinctions, and the best all-around summary of related issues in developing and assessing green workforce programs, see Jane Weissman, et al., *Renewable Energy Training: Best Practices and Recommended Guidelines* (IREC, 2008).

9. ANSI/ISO/IEC 17024. NABCEP is already certified; GBCI is in the rigorous 12-24 month application process, as is NATE and the Manufacturing Skill Standards Council (MSSC).

10. Various organizations, including the Advanced Technology Environmental and Energy Center, the Interstate Renewable Energy Council, and the U.S. Department of Energy, are tracking training programs. See, e.g., www.ateec.org/learning/credit/index.htm; www.irecusa.org/trainingCatalog/providerMap.php; www1.eere.energy.gov/education/educational_professional.html.

11. Even the more modest technician certifications require both academic and applied skills. The BPI certification tests, for example, are written at an 11th-grade reading level, which may exclude many of the disadvantaged and disconnected youth who have gained the required technical competence in Job Corps or other training programs.

12. A number of intermediaries are attempting to broker skills conversations between certifying bodies, industries, educators, and other stakeholders, or at least hold up pieces of them. Notable examples include the Energy Providers Coalition for Education (EPCE), the Partnership for Environmental Technology Education (PETE), and the Advanced Technology Environmental and Energy Center (ATEEC). A National Science Foundation Advanced Technology Education Center of Excellence, ATEEC works with community colleges and secondary schools on curriculum development and program improvement, and has done a lot of work defining occupations for energy technicians. To access ATEEC's clearing house of related task analyses and other resources, go to www.ateec.org. While it is beyond the scope of this paper to discuss these projects and organizations, they could play a significant role in skill standardization – if, of course, they align their work with related regional, national, and industry initiatives.

13. These are larger, more comprehensive skill certifications serving entire occupations in particular industries, rather than some of the narrower technical task certifications (e.g., lead or asbestos abatement) that may be available within the national credentials reviewed in this paper. Participants in the Laborer's Weatherization Training Program, for example, may earn lead abatement certification as part of their achievement of a LIUNA auditor credential. But there is no national third-party exam for lead abatement workers. State regulations typically deem that an inspector, contractor, or worker is "lead-certified" if they successfully complete a training program accredited by the state's public health agency.

14. *Greener Pathways,* p.39.

15. These include, e.g., Power Plant Technology, Electric Power Technology, and Electrical Transmission Systems Technology. In 2007, the U.S. Department of Energy designated Bismarck State College (BSC) as the National Power Plant Operations Technology and Education Center. And while there are no formal national skill standards in place, industry stakeholders continue to work towards common credentials with BSC and others through the Energy Providers Coalition for Education, described in note 12.

16. NABCEP has completed a task analysis for small wind (100kw or less) and is in the process of developing the related certification. No national certification in utility-scale wind turbine operation and maintenance exists, and installation of large wind systems obviously includes a variety of skilled tradespeople in traditional construction occupations. As we describe later in this paper, Washington State has developed comprehensive skill standards for wind technicians. Geothermal technologies are currently addressed by the Association of Energy Engineers, also described below, which certifies advanced professionals trained by the International Ground Source Heat Pump Association (IGSHPA) at Oklahoma State University, in partnership with the Geothermal Heat Pump Consortium.

17. Jane M. Weissman, "Defining the Workforce Development Framework & Labor Market Needs for the Renewable Energy Industries" (Interstate Renewable Energy Council, 2004). Task Analyses are used here in place of DACUM, an alternative method used by, e.g., ATEEC. See Weissman et al., *Best Practices.*

18. NATE certifications are not intended for the design and engineering communities; the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) offers a professional certification for high performance Heating, Ventilation, Air Conditioning and Refrigeration (HVAC/R) system designers.

19. Accredited by the International Association for Continuing Education and Training (IACET), BOC complies with ANSI/IACET 1-2007, an international standard of good practice described elsewhere in this paper.

20. We will not rehearse here the many excellent local examples of coordination and integration of "green" training into existing curricula at community and technical colleges around the country, particularly models like LATTC's Green College Initiative, Centralia College's Center of Excellence for Energy Technology, and many others which we have offered as case studies in the past and which our colleagues at the Corps Network, Green For All, and the Workforce Strategy Center and will be lifting up in forthcoming reports.

21. See *Platform for Creating and Retaining Midwestern Jobs in the New Energy Economy* (2009), available at www.midwesterngovernors.org/Publications/JobsPlatform.pdf

22. Some people we talked to noted the notorious difficulty of bringing employers to the table even in local sector partnerships, suggesting that regional approaches might make more sense than national efforts to develop industry-driven skill standards.

23. See, e.g., Maureen Conway and Allison Gerber, *Construction Pre-Apprenticeship Programs: Results from a National Survey* (The Aspen Institute, July 2009); and Sarah White and Kate Gordon, *Mapping Green Career Pathways: Job Training Infrastructure and Opportunities in Wisconsin* (Apollo Alliance and Center on Wisconsin Strategy, January 2010).

24. For a full list of the training and credentials offered by WRTP/BIG STEP and their minimum qualifications, see www.wrtp.org/pdf-files/Training-Menu.pdf.

25. An ELCS credential can also boost a worker's position in the labor market when WRTP negotiates the particular value of their "specified skills certificate" with each related trade (e.g., plumbers, electricians, etc.).

26. A chart laying out MultiCraft Core Curriculum requirements and career-path flow is available online at: www.efficiencycities.us/062309/BCTD%20TriFold_v6.pdf

27. See, e.g., Washington State Center of Excellence for Energy Technology – Centralia College, *Skill Standards for Wind Technicians* (Washington State University Extension Energy Program and Washington State Board for Community and Technical Colleges, 2009); Alan Hardcastle and Stacey Waterman-Hoey, *Energy Efficiency Industry Trends and Workforce Development in Washington State: Study Report, Phase 1* (Washington State University Extension Energy Program, June 2009/Updated November 2009); Alan Hardcastle et al., *Renewable Energy Industry Trends and Workforce Development in Washington State* (Washington State University Extension Energy Program, June 30, 2009); Alan Hardcastle, *2008 Green Economy Jobs in Washington State* (Washington State University Extension Energy Program and Washington State Employment Security Department, Labor Market and Economic Analysis, January 2009).

28. Washington State, *Skill Standards for Wind Technicians*. For a more detailed evaluation of ISPs, see Scott Cheney, Stacey Wagner, and Lindsey Woolsey, *Evaluating Industry Skill Panels: A Model Framework*, prepared for the Washington State Workforce Training and Education Coordinating Board (PAROS Group and Corporation for a Skilled Workforce, 2008).

29. For an excellent discussion of this process, including the need for, e.g., continuous curriculum improvement and internal validation of standards by individual employers, see: Washington State's *Skill Standards for Wind Technicians*.

30. Ibid. Even without the elaborate machinery of national standards, certification, and assessment, states can help rationalize regional labor markets by convening industry partnerships and getting critical industry leaders in a given sector to endorse locally developed skill standards.

31. The White House Middle Class Task Force & The Council on Environmental Quality, *Recovery Through Retrofit* (Executive Office of the President, October 2009).

32. See Washington's *Skill Standards for Wind Technicians*, op. cit. IREC outlines a similar process for occupational task analysis and renewable energy skill standard development in Weissman, et al., *Best Practices*.

33. Our colleagues at the The Corps Network, in a forthcoming paper, will review in greater detail the barriers and possibilities for youth access to green training and credentials.

34. See White and Gordon, *Mapping Green Career Pathways*, and companion Apollo Alliance reports mapping apprenticeship, community college, and public system pathways in Ohio and Michigan; and Robert I. Lerman, *Training Tomorrow's Workforce: Community College and Apprenticeship as Collaborative Routes to Rewarding Careers* (Center for American Progress, December 2009).