Fueled by concerns about energy, greenhouse gas emissions and indoor air quality, an explosion of interest in green building is creating new job opportunities in the construction industry. A 2008 report from McGraw Hill Construction, “The Green Outlook: Trends Driving Change,” notes that the size of the national green building market has expanded five-fold over the last three years, and is projected to triple again in the next five years, reaching $96-$140 billion.

To meet the demands of government programs and increasingly stringent regulations regarding energy efficiency, alternative energy use, water conservation and environmentally-friendly building materials, working professionals such as plumbers and electricians find that they need training on new equipment and technologies. At the same time, entirely new jobs are emerging, such as solar panel installers, energy efficiency building auditors, and recycling specialists.

According to a recent report from the Vocational and Technical Education Act (VTEA) Industrial and Technical Statewide Collaborative, 30,450 new employment opportunities are projected in California construction occupations between now and 2016. In contrast to this increasing demand, VTEA notes that an aging workforce, and a negative perception of construction as “common, dirty work,” have restricted the pipeline of new workers.

As the first state to enact a Green Building Code, and the home of numerous local governments that have mandated green standards for new construction, California is poised to set the standard for greening of residential and commercial structures. Effective outreach and training programs for green construction jobs are crucial if the state is to make the most of the current potential for economic growth and increased sustainability. These can help men and women from all sectors of California’s diverse student and working populations gain access to a range of high-paying jobs that also offer the reward of tangible and immediate impact on environmental quality.
Green Construction Jobs: What's Different?
The U.S. Environmental Protection Agency defines green building, also known as “sustainable” or “high performance” building, as:
“... the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building’s life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.”

The factors that differentiate “green” construction derive from a new set of expectations relating to structures and their function. Green buildings aim to maximize efficiency in their use of water, energy and other resources, to minimize waste, pollution, or other contributions to environmental degradation, and to create environments that contribute to health and productivity.

The Green Jobs Guidebook (Environmental Defense Fund 2008), thought by many to be the definitive green jobs report to date, lists 41 job classifications directly related to green building. Among them: Green Building Project Design and Development; Green Building Design and Engineering; Green Building Operations; Energy Efficiency Services and Installation. Other green jobs that relate to construction include: Solar Power Installation; Maintenance, Development and Manufacturing; Wind Power Installation; Geothermal Operation and Development; Plant Environmental; Health and Safety Facility Positions; Environmental Consulting; Municipal Waste Treatment and Recycling.

A project underway by the California Employment and Development Department utilizes the fluid medium of digital publishing to accommodate continuously evolving information from government agencies and private organizations working to define the green jobs market. It has engaged a consortium of local, state, and federal entities to review “green” literature and assist in compiling a “Digest of Green Reports and Studies.” Its summary of green jobs drawn from reports listed in the Digest includes a wide range of professions that play a role in building construction (see chart, “Green Construction Jobs”).

**GREEN CONSTRUCTION JOBS**
Source: California Employment and Development Department

- Air-quality auditors
- Appliance installers
- Architects
- Building Materials Specialists/Sales Reps (green/sustainable building materials)
- Buyers and Purchasing Agents/Managers
- Carpenters (green building)
- Civil Engineers
- Concrete machine operators
- Construction Managers
- Construction laborers
- Construction Supervisors, First-Line
- Cost Estimators
- Customer Service Representatives
- Drafter/Design Technicians
- Drywall and ceiling
- Electrical and Electronic Engineering Technicians
- Electrical Engineers
- Electricians
- Energy auditors
- Energy Engineers
- Engineering Managers
- Facilities Manager
- Fuel Cell Test Technician
- Geothermal Analyst
- Geothermal Heat Pump Installer
- Glaziers
- Hazardous materials removal workers
- HVAC Service Technicians and Installers
- HVAC Salespersons
- Landscape Architects
- Plumbers
- Pipefitters
- Refuse and recycle material collectors
- Roofers
- Sheet metal workers
- Solar Thermal Installer or Technician
- Solar Photovoltaic Installer or Technician
- Solar Installation Manager or Project Foreman
- Sales Representative
- Steamfitters
- Truck drivers, insulation workers
- Welders
- Wind Energy Technician
A list of “Occupations Involved in Green Activities with Reskilling Opportunities,” from the California Green Jobs Council, includes both the number of workers involved in each job classification now existing in California, with salaries and training levels, and estimates of the number of workers that will be needed in each job by 2016. Projections for growth in construction-related jobs show substantial increases: 12.2 percent for carpenters; 17.2 percent for construction managers; almost 22 percent for cost estimators; 12.7 percent for HVAC mechanics and installers and 12.3 percent for plumbers, pipefitters and seamfitters.

The Council also provided examples of existing occupations where skills can be updated to meet the needs of the green building industry.

### PATHWAYS INTO GREEN JOBS

**OCCUPATIONS (Before Reskilling)**

**GREEN OCCUPATIONS**

- Construction Managers
- Loan Officers
- Loan Interviewers and Clerks
- Management Analysts
- Real Estate Brokers
- Energy Auditors, Commercial and Residential
- Carpenters
- Construction Trades, Helpers
- Glaziers
- Insulation and Weatherization Workers
- Carpenters
- Electricians
- Heating and Air Conditioning Technicians/Installers
- Plumbers
- Roofers
- Sheet Metal Workers
- Solar PV Panel Installers and Technicians

It is important to note that programs that provide green skills will not serve workers well by ignoring fundamentals. Construction training specialists warn that “boutique” training for specific green applications, such as solar panel installation, is not only limiting for the worker, but can also be dangerous. Union job training pathways last from three to five years, teaching workers the fundamentals of a trade to which green skills can be added. Almost any job in green construction can be enhanced to include green aspects, but specialized training on green equipment without the fundamental training in electronics, plumbing, carpentry, etc., can make the worker less employable in the long term.

“In reality, a water heater is a bomb,” says Philip Campbell, a training specialist with the United Association of Plumbers and Pipefitters Union. “Whether it runs on natural gas or propane or solar, it still needs to address the same problems with pressure. There are reasons why water heaters require permits all over the country, and in some cases, an inspection – and why every job, whether it’s electrical or plumbing, needs to be done by a licensed plumber or a licensed electrician.”

In addition to new methods and materials, the culture of the green construction site can be different. According to Bill Stough, CEO of the green building consulting firm Sustainable Research Group, green construction involves “maximizing energy efficiency and material efficiency so there is less waste being generated on a construction site – the waste that is generated on the construction site is reused to the maximum extent possible.”

For example, deconstructing a building in preparation for new construction is another aspect of high performance building standards that requires special training. Recycling of building materials and debris left over from clearing the site earns points for green building certification through programs such as the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) green building rating system. In addition, secondary jobs are created in the marketing of the refuse – jobs for processing the material and making it ready for use in other, less valuable products, called “downcycling.”

The specific consequences of California’s aggressive energy policies on building construction are hard to pre-
dict. The California Public Utilities Commission has set the goal of all new homes meeting net-zero energy standards (producing as much energy as they use) by 2020, with commercial buildings required to meet this challenge by 2030. Fueled by this policy mandate, and huge investment in California-based green energy companies, alternative energy solutions are proliferating.

As evidence of this trend, a 2008 report by the Centers of Excellence (COE), states that there are about 770 solar firms in California, 86 percent with less than 25 employees. All together, solar firms employ between 14,500 and 17,000 workers, and are expected to increase the employment 29 percent by the end of 2009. Most relevant to this discussion, 90-95 percent of these companies are involved in installation, not manufacturing.

THE ARCHITECT’S POINT OF VIEW

Mark Smeaton, an architect and project designer with Crux Studio, offers an example of the need to stay informed about new green building products. “We’re looking at using plastic lumber on a building, and it’s presenting some problems with the city, because it’s a new product and there are not yet the right report numbers to prove that it’s viable. But that information, those comments can come from the subcontractor [who gets the information]. We try to find if there’s a local manufacturer of that product [to educate us]. We’re always at the forefront of the research on the innovative products or things we find. And then sometimes a sub will back us up and will say, ‘yeah, but I’ve used this,’ and then we’ll go in that direction.”

Smeaton says it’s extremely helpful when subcontractors are knowledgeable about green products and how they are used, but unfortunately many times they are reluctant to try new things. “We’re in bid process right now on a job, where we have specified the use of plastic lumber. We get feedback [from the subcontractors] like, ‘geez, how do we nail this plastic lumber? It’s not wood. What do we do?’ I tell them to find out, call the manufacturer, talk to them. The plastic lumber nails and cuts the same way as wood, and it’s recyclable.

“There’s a learning curve for everybody. We’re using cork flooring in a project. Cork has been around forever, but a lot of installers haven’t installed cork, so there are concerns. We’re using some resin plastic fencing material that’s a little out of the norm,” he says, “and anything out of the norm will ruffle feathers. The architect has to warm everyone up a little bit to the idea. And the general contractor has to too.”

The mindset clearly has to change, says Smeaton, “because green building has become almost the norm. It’s becoming so prevalent that these guys that were unwilling to change are not going to get the work.”

WHAT SKILLS DO GREEN WORKERS NEED?

Lighting

Familiarity with sophisticated lighting systems is key, according to general contractor Andy Kaplan. For example, daylight harvesting allows natural light to come into rooms through tubes, often referred to by their trade name, Solatubes®. There are also sensors that can be placed in a room that measure how much daylight light is in the room, either at a floor or the desk level, connected to controls that dim or turn off lights when full lighting is not needed. “If you’re an electrical contractor who wants to get into this kind of thing,” says Kaplan, “you’re going to want to know about the different systems that are out there.”

Plumbing

On the mechanical side it’s similar, but probably not as technical, says Kaplan. “Thermostats are thermostats. There are [air conditioning] units that now use a different gas, but as far as installation goes, we’re still putting in similar air conditioning units that we were way back when. Components and equipment are starting to evolve and become more environmentally friendly. Mechanical engineers are going to start specifying these on drawings, and they will be a little more sophisticated than just a simple thermostat that tells the unit when to turn off and on and when it’s hot and when it’s cold. It’s evolving all the time.”

Being able to read and understand product manuals is of primary importance, says Phillip Campbell, of the
Plumbers and Pipefitters union. “If you’re going to install a piece of equipment, the manual has to be read,” he says. “Whether it’s a solar water heater or a regular water heater, we have to make sure what the specific manufacturer requires. We have to read that manual and install it according to those requirements, or the warranty on the piece of equipment may not be validated.”

The report “Water Efficiency Technology in the Plumbing Sector” notes that those who wish to be green plumbers are an ability to read plans and interpret building code standards and written instructions. Other skills include an ability to inspect, test, diagnose and repair plumbing systems, and to have a good mechanical aptitude in general.

It is also essential to have a good working knowledge of hydraulic heating systems and gas pipelines, water efficiency and energy efficiency systems. Good math skills help with measuring and estimating. Verbal communication skills are important for communication with contractors, home or building owners.

Also included in the report is a survey of employers (plumbing contractors and others). When asked how important it is for new applicants to have a certificate or specific training in plumbing before they are hired, four out of five employers said it was either very or somewhat important. 34 percent said it was important for new applicants to have some training or experience in green or sustainable plumbing techniques, and, 42 percent of the survey respondents expect that green plumbing certificates will become more important in the future.

HVAC
The Education Portal is an excellent source of information skills required and training programs available in various industries. According to this resource, to become a heating, venting, air conditioning and refrigeration (HVAC) technician, “it will be necessary to take a certification test offered by North American Technician Excellence, Inc. (NATE), which is the standard professional certifying body in the HVAC/R industry.”

Heating, venting, air conditioning, and refrigeration installation and maintenance workers do more than install and maintain equipment. Their knowledge of new greener technologies with climate control systems can keep indoor environments working efficiently, producing less greenhouse gases, and free of contaminants caused by leaks and other system flaws. Technicians with a knowledge of green HVAC systems are employed at schools, universities, businesses, and retail stores, where they sell products and consult with others who are looking for more efficient, cleaner equipment.

The majority of employers in the heating, venting, air conditioning, and refrigeration fields prefer employees who have had training at either a technical institute or the equivalent of a trade school. In some cases however, employers will hire employees to train on the job. According to the Bureau of Labor Statistics, those who acquire their skills on the job usually begin by assisting experienced technicians with simple tasks such as carrying materials, cleaning furnaces, or insulating refrigerant lines. Eventually they move on to more difficult tasks, like cutting and soldering pipes and sheet metal and checking electrical circuits.

Landscaping and Water Management
Sustainable landscaping is a broad field that is becoming an increasingly important aspect of green building and construction. It includes landscape design, installation and management. It also includes “interiorscaping,” or creating and maintaining natural indoor live plant areas. The College of Marin in Northern California is one of the first community colleges to specialize in sustainable landscape by creating an Environmental Landscaping Program.

According to the U.S. Environmental Protection Agency, sustainable landscaping includes designing landscapes that are natural to the environment where they are located, containing native plants and diversity. This type of landscaping retains storm water and helps significantly to keep the buildings they surround cool and more energy efficient. A knowledge of natural alternatives to pesti-
cides and herbicides, water and energy conservation, plant nutrients, composting and mulching are all necessary for creating sustainable indoor and outdoor sustainable landscapes.

Information and a publication on sustainable landscaping and jobs is available at the California Integrated Waste Management website.

IS LEED ACCREDITATION A PLUS?
The U.S. Green Building Council’s LEED (Leadership in Energy and Environmental Design) rating system is the preeminent green building rating system in the U.S. There are several categories of certification, including those for new and existing buildings, campuses and building interiors. Buildings can be LEED Certified, LEED Silver, LEED Gold or LEED Platinum, which is the highest rating. Many contractors, architects and other professionals take classes and tests to become LEED APs, or accredited professionals. Recently, the USGBC, responding to requests for accreditation for more entry level green building professionals, began offering a Green Associate program.

A knowledge of LEED qualifying points is becoming increasingly important to contractors. As green building becomes more commonplace, contractors must create the documentation to show that sustainable features are in place. Additionally, green products and equipment are being developed and marketed at a rapid pace. Those who take the initiative to research these products and suggest them to builders and contractors can become invaluable as support personnel.

GREEN CONSTRUCTION TRAINING PROGRAMS
A variety of organizations have created programs that can enable workers to gain the skills they need to find work in the green construction industry.

Community Colleges
The more than 100 community colleges in California provide a number of two-year degree and certification programs for those seeking green jobs. Green Job apprenticeship programs are offered at many southland colleges, including Cerritos College, Foothill College, Long Beach City College, Los Angeles Pierce College and Los Angeles Trade-Tech. The EDF Green Jobs Guidebook provides a list of the programs. The list expands almost daily; see the Green Jobs Guidebook for a list as of 2008 of community colleges offering green job apprenticeship programs and other green construction courses.

Los Angeles Trade-Technical College
Los Angeles Trade-Technical College (LATTC), and its Regional Economic Development Institute’s L.A. Infrastructure and Sustainable Jobs Collaborative have made major contributions to the greening of many established courses and development of new courses focused on green building.

The purpose of the collaborative is to bring together key public, private and community partners “to plan and implement a seamless education, training and workforce infrastructure that connects low income, disadvantaged populations to livable wage jobs with career paths within the energy-utility industry.”

According to Marcy Drummond, vice president of Academic Affairs for LATTC, “[Green aspects are] embedded in all the courses throughout the whole program. The whole materials class related to carpentry would have instruction on green materials. The techniques class would have techniques related to green carpentry techniques. In plumbing, when they do installation of toilets, they also talk about low flow toilets. So we don’t have courses that you just take just to be green carpenter. It’s about being a carpenter, with all the training that you get to be a carpenter, and the parts if the job that are changing because of the new green technologies and techniques.
She continues, “Architecture isn’t new, but the greening of architecture and learning how to design buildings so that they can be LEED-certified, that’s new, and it’s being incorporated into that program. The brand new courses that never existed before that were created because of the American green economy are things like weatherization, energy auditing, and solar installer technicians. Those are new. And you can come and take the solar classes. But in a lot of cases, you’re not going to be successful unless you have either a background in construction, or you take some of the construction classes first.”

LATTC has been developing on entry-level programs to introduce students to green construction. “It’s a utility and construction program is a short-term, intensive program just to introduce people to what it’s like to work in these careers, Drummond explains. “It works on their conceptualized math and English skills and some of the basic skills for construction. So this is intended for people who have no experience whatsoever in construction or utility-related careers to get them prepared to go into a more intensive training program.”

LATTC also offers a pre-apprenticeship program for those who don’t have a lot of technical experience or higher education and wish to go into training programs. Drummond feels this is the best way for transitioning populations to get into green jobs “that are becoming available as a result of the reinvestment act and as a result of the new green economy.” LATTC’s courses address all the aspects of green construction mentioned in this report: electrical, HVAC, plumbing and landscaping.

Union Training Centers
According to the Green Jobs Handbook, labor unions in California offer formal apprenticeship programs that relate to green building construction include air conditioning and refrigeration, carpentry, cement-masonry, electrician, heat and frost insulation, ironworking, machinists and mechanics, operations engineering, plumbing, roofing, sheet metal working, solar turbines and steam fitting.

Local unions offer paid apprenticeship programs. Large utilities and other employers also offer such programs.

Bernie Kotlier of the International Brotherhood of Electrical Workers (IBEW) and the National Electrical Contractors Association (NECA) underscores that the path to green jobs passes through a long-established training regimen. “The green jobs within the electrical contracting industry are really interwoven with conventional electrical work,” he said. “As an example, if somebody wants to work in the wind tower segment of the industry, they would be using a lot of the training, experience and knowledge that they gain in other parts of electrical contracting work.”

“The pathway to electrical work is for a person to work as a journeyman electrician,” said Kotlier. “To get there, they need to go through a state-approved electrical apprenticeship program. Those programs vary, but the ones that NECA and the IBEW have are five-year work-study programs where classes are usually taken in the evenings and on the weekends. People who take the courses are very often are working for a contractor during the day, so it’s a work-study type of apprenticeship. This leads to becoming a journeyman electrician. As they gain experience, and as they move through the apprenticeship program, their compensation on the job increases.”

“Many of the green technologies are extensions of, or are integral with, conventional electrical knowledge and experience,” adds Kotlier. “It’s just that the devices may be more efficient, or the generating equipment may be a little different. If solar becomes much more frequently integrated with the glass in a building, instead of being based in solar panels, an electrician will still able to fall back on all the other aspects of his or her training.”

The United Association of Plumbers and Pipefitters Union provides a five-year apprenticeship training pro-
gram and ongoing courses for journeymen level plumbers. According to training specialist Philip Campbell, LEED is part of the curriculum, and their Green Systems Awareness course is in the process of being approved by the USGBC. The course has a certification exam that is third-party certified. “We’re also working with Green Plumbers USA on coursework,” he said.

Carrie McChesney, with Green Plumbers, which began in Australia, says the organization offers five courses containing 32 hours of training. “We have a course that’s strictly about gray water and rainwater,” she says. “We also have a solar hot water course which is definitely getting a lot of interest now with California’s Million Solar Roofs initiative and federal rebates. We have a climate care course which talks about the relationship between energy and water. Our last course, and one of the most popular, is actually an inspection report services class that teaches a fifty-point water energy audit for both residential and commercial building. That’s a very, very handy tool for someone to have an immediately-employable skill where they now know how to go out and perform an audit.”

What sets the non-profit Green Plumbers apart is that attendees do not pay for courses. “We partner with a lot of water utilities,” says McChesney, “agencies that are very interested in getting this information out there and conserving water.” As an example, she notes that the Sonoma County Water Authority recently sponsored all five of the Green Plumbers courses free to the community.

After a year and a half, Green Plumbers has trained over 3,000 people, including licensed plumbing contractors and apprentices. One of the goals, says McCChesney, is to attract more people to the industry and to help them see the kind of impact they can have with water efficiency and energy efficiency.

US GREEN BUILDING COUNCIL (USGBC)

“One of the things we encourage for anybody interested in green building is take the next step in expanding your ability to speak the language of green building, especially LEED,” says Julia Feder, manager of K-12 and Higher Education for USGBC. We want people to have a good foundation in what green building is and why we’re doing it – what are the core concepts and what are the strategies for bringing those concepts them into reality – before choosing an area of specialization.

“If you wait for the tech to plateau you’ll be waiting forever,” says Feder. “Today’s innovation in green building becomes tomorrow’s standard building practices. That doesn’t mean our job is done, it means we have to keep pushing the envelope.”

“The best credential for students would be the LEED Green Associate,” says Jaime Van Mourik, USGBC’s Higher Education Sector Manager. “It gives them a general understanding of green building strategies and best practices and an introduction to the LEED program and all the different rating systems. It’s a good foundation for students, and it’s the most appropriate for those who are not actively working on a LEED project. There are also opportunities on the curriculum side to start to tie in the LEED Green Associate and to utilize the USGBC’s curriculum at the level 100 and 200 courses, which are available both in person and online courses. The level 100 course is called Green Building Basics and Me. The level 200 course is focused on preparing people for the LEED Green Associate certification.

No college experience is necessary for this accreditation, she says. “Anybody can sit through that examination, she says. “USGBC is putting together some study preps material, building out an exam preparation course. Online is best, and this is available to anyone.”

“There is a subgroup of the local chapters that is called
the Emerging Green Builders, she says, “and that’s really appropriate for young professionals that are interested in sustainability and green building. We are starting US-GBC student groups on campuses to engage the student population. There’s no requirement for participation beyond the fact that you’re interested in the environment and pushing sustainability within the building industry in order to be involved.”

Other organizations offering green construction training programs include:

NATIONAL ASSOCIATION OF HOME BUILDERS (NAHB)
NAHB has partnered with Delmar Cengage Learning to produce curriculum resources for the residential construction industry. Their products provide a comprehensive step-by-step guide to the skills, abilities and knowledge needed to work in the plumbing sector.

PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION (PHCC)
One of the key roles of the PHCC is to provide education and training to its members. The association offers home study courses, apprenticeship and journeymen level training, as well as instructor workshops and textbooks.

THE BOTTOM LINE
Training for “green” construction is best viewed as a supplement to traditional programs, not a replacement. Workers seeking green construction jobs should seek training and experience that enables them to master the basics of their chosen trade. Ideally, however, all training, from initial stages through apprenticeship, should help the trainees develop familiarity with green approaches and their benefits.

For years, architects, engineers and designers have expressed the view that the distinction between “building” and “green building” would eventually disappear – why build a structure that wastes precious resources and poses health risks to its inhabitants if an alternative exists? California’s enactment of a green building code suggests that this day may have come, and that distinctions between the requirements for a “job” and a “green job” will also fade.

Widespread adoption of green building practices will bring great benefits to workers, families, communities, and the environment. The effect on the job market is equally significant; according to Philip Campbell of the United Association of Plumbers and Pipefitters, “The simple fact is that a plumber and an electrician not only have benefits, but their wages are about the same as someone with a masters or doctorate degree.”

“In the long term, the economy and the environment are the same thing,” observed Mollie Beattie, the first woman to lead the U.S. Fish and Wildlife Service. “If it’s unenvironmental it is uneconomical. That is the rule of nature.” The possibilities for the green construction industry embody this rule at work – better environmental quality going hand in hand with better jobs. Efforts to bring new workers into this field, and to help working professionals discover how to build green, deserve urgent attention.
Resources:

http://construction.com/market_research/reports/GreenOutlook.asp
http://www.epa.gov/greenbuilding/pubs/about.htm
http://www.labormarketinfo.edd.ca.gov/?pageid=1032
http://www.labormarketinfo.edd.ca.gov/contentpub/GreenDigest/Green%20Occs-Reskilling-Opportunities.pdf
http://www.ua.org/
http://www.sustainableresearchgroup.com/
http://www.usgbc.org/
http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/
http://www.coeccc.net/documents/Solar_KeyFindings_CA.pdf
http://www.Solatube.com
http://www.coeccc.net/logdownloads.asp?url=WaterEfficiency_Scan_GS_08.pdf
http://education-portal.com/air_conditioning_college.html
http://www.natex.org/
http://www.marin.cc.ca.us/PDFs/workforce_development/ELNDBrochure.pdf
http://www.epa.gov/greenacres smithsonian.pdf
http://college.lattc.edu/green/education-training-programs/
http://www.njatc.org/training/apprenticeship/index.aspx
http://www.dir.ca.gov/das/das.html
http://www.ua.org/index.asp
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http://www.phccweb.org/index.cfm
http://training.fws.gov/History/ConservationHeroes/Beattie.html
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