



## **Retrofitting existing HUD subsidized, privately owned affordable housing—a literature review of research that demonstrates job creation as a result of greening multifamily buildings.**

### **Job Creation while reducing Energy Consumption**

There is a growing body of evidence to support the conclusion that energy efficiency initiatives have a positive effect on employment by either directly creating new business opportunities or indirectly where money saved on utility costs can then be spent in other ways.<sup>1</sup> The purpose of this brief is to review recent research conducted in the field and to highlight studies that make evident the positive impact energy efficient retrofits— from multifamily properties, to single family homes, to commercial developments— have on job creation and stimulating local economies.

*National Association of Home Builders.* A recent study by the National Association of Home Builders (NAHB) notes that 1.11 jobs and \$30,217 in taxes is generated directly for every \$100,000 spent on residential remodeling in a typical metropolitan area of the United States.<sup>2</sup> Although the NAHB remodeling report does not address green job creation, NAHB notes that the report could be used to estimate green job creation arising from energy efficient retrofit projects. The estimated cost of a typical multifamily retrofit project could be used to estimate the number of green jobs created, applying the ratio of money spent to jobs created, found in the remodeling report. For example, using NAHB's ratio, we can assume that an energy efficient retrofit project would generate 3.33 full-time jobs if the project consisted of 100 apartments costing \$3,000.00 per retrofitted unit, totaling \$300,000.00.<sup>3</sup> To date, the largest and most ambitious retrofitting project is the German Alliance for Work and the Environment. Under this initiative, 342,000 apartments were retrofitted and 140,000 jobs created or saved.<sup>4</sup>

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<sup>1</sup> Diana Ürge-Vorsatz and Aleksandra Novikova, 2007: Residential and commercial buildings. In *Climate Change 2007: Mitigation. Contribution of Working Group III*

to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 417

<sup>2</sup> Helen Fei Liu and Paul Emrath (October 7, 2008). "The Direct Impact of Home Building and Remodeling on the U.S. Economy," National Association of Home Builders, p. 1.

<sup>3</sup> It is important to account for the possibility that a typical energy efficiency retrofit may be more labor intensive than a normal remodeling job and the retrofit may call for workers with specialized skills.

<sup>4</sup> Michael Renner, Sean Sweeney, Jill Kubit, *Green Jobs: Towards Decent Work in a Sustainable Low-carbon World*. Worldwatch Institute. United Nations Environment Programme, International Labour Organization, International Organisation of Employers, International Trade Union Confederation, (September, 2008), pp. 133-34. It was originally estimated that 200,000 new jobs would be created under the program but actually 25,000 jobs were created and 116,000 jobs were saved during a recession of the German economy. 140,000 new or saved jobs is thus the official job number.

U.S. Conference of Mayors. The United States Conference of Mayors (USCM) and the Mayors Climate Protection Center released a report in October, 2008 entitled, "Green Jobs in Metro Areas." USCM's study provides a forecast of the number of green jobs that will be created by 2038 due to building retrofits. USCM bases its job growth estimate on the projected amount of energy that will be saved during the next thirty years.<sup>5</sup> USCM assumes a 35 percent reduction in energy consumption by 2038.<sup>6</sup> A 35 percent reduction would equal incremental savings of 32,000 million kilowatt-hours per year with 81,000 green jobs created to achieve this energy efficiency goal.<sup>7</sup> 49 percent (15,680 million kilowatt-hours) of the annual energy savings would be in the residential sector and approximately 36,000 of the 81,000 green jobs created, would be in the residential sector.<sup>8</sup> The USCM's ratio equals 2.3 green jobs created for every million kilowatt hours saved.<sup>9</sup>

Center on Wisconsin Strategy. Preliminary analysis by the Center on Wisconsin Strategy used modeling to estimate the labor content per \$1 million investment in measure installation for multifamily and single-family housing and for commercial (office buildings) in Chicago.<sup>10</sup> The findings demonstrate several points:

- Efficiency work, if brought to scale, will create thousands of installation jobs
- The precise number and type of jobs created will depend partly on program design and partly on wage scales
- Higher costs, including those for labor, will mean less energy efficiency work per unit of investment
- Based on typical construction crew make-up, about 30 percent of the work would be considered entry-level, which might provide an opportunity for modest wages, assuming the positions afford workers a way into better paying jobs<sup>11</sup>

Data from two surveys published in 2000 and 2005 by the Energy Center of Wisconsin quantify efficiency measures that would be cost-effective in various building types – energy savings would pay for the measures in 10 years or less.<sup>12</sup> The ECW report on multifamily buildings provides measure frequency by building size (units per building), where these findings were applied to Chicago's multifamily building stock.<sup>13</sup>

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<sup>5</sup> United States Conference of Mayors and the Mayors Climate Protection Center, "U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy" (October 2008), p. 15.

<sup>6</sup> *Id.*

<sup>7</sup> *Id.*

<sup>8</sup> *Id.*

<sup>9</sup> The USCM's study lumps multifamily and single-family homes into the "residential sector" in making its job growth estimate, thus making it difficult to determine exactly what portion of job growth can be attributed to the multifamily sector.

<sup>10</sup> 2008 Center on Wisconsin Strategy (COWS) study for the City of Chicago (as of yet an unpublished memo). The model used for this report – developed by COWS and the University of Florida's Powell Center for Building and Environment – is based on construction estimation techniques, taking out contractor's profit and overhead, cost for materials, and then allocating the labor portion of the investment based on loaded labor rates and typical crew make-up. The estimates do not account for other program-related costs, such as auditing or engineering studies, general program overhead, or customer service.

<sup>11</sup> *Id.*

<sup>12</sup> Scott Pigg and Andrew Price (April 2005). "Energy and Rental Housing: A Wisconsin Characterization Study." Energy Center of Wisconsin. Scott Pigg (October 2002). "Energy Savings from the Wisconsin Energy Star® Homes Program." Energy Center of Wisconsin.

<sup>13</sup> Abby Vogen (May-June 2006). "Best Practices for New Multifamily Buildings." Energy Center of Wisconsin.

By inputting loaded labor rates into the analysis, costs the contractor must pay, including liability insurance, benefits and other costs, COWS conducted three runs for each building type which resulted in the following labor rates:

1. Costs for an all-union workforce which included supervisory and skilled work at the journeyman rate, semi-skilled work at the full apprentice rate, and entry-level work at 80 percent of the apprentice rate
2. The costs to reflect a mix of union and non-union workers and arrangements to reduce contractor liability
3. The costs reflecting smaller non-union contractors<sup>14</sup>

These inputs provide a range of job-creation estimates, and highlight the tradeoff that policymakers face: To start, the higher the pay for measure installation, the fewer jobs are created for the same investment. For example, in commercial buildings, \$1 million invested in efficiency measures would produce an estimated 4.3 job-years.<sup>15</sup> The same investment would produce 5.4 job-years in the union/nonunion scenario and would result in 11.5 job-years based on the Powell Center's loaded wage survey.<sup>16</sup>

COWS "Implementation Strategy" draft provides an estimate of employment in job-years. (One job year is a full-time job for one person for one year, so 100 job-years in a 10-year program would provide 10 full-time jobs per year.):<sup>16</sup>

- The single-family residential program produces 4,864 to 12,262 job-years.
- The multifamily residential program produces 2,432 to 6,444 job-years.
- The commercial program produces 4,089 to 10,882 job-years.

Skill levels for jobs shown in the results are independent of the union status or pay of the workers, but are instead based on the make-up of a typical construction crew. Nearly 30 percent of the jobs created would be entry level, which might provide a justification for modest wages in those jobs, particularly if the work provides an opportunity to move up into better paying, possibly unionized jobs.<sup>17</sup> Weatherization programs traditionally pay much less than full union or even prevailing wage rates, citing the programs as the first step on a career ladder.<sup>18</sup>

*Kats et al.* A forthcoming book on the costs and benefits of green buildings by Greg Kats et al. finds that "relative to conventional construction, green buildings increase employment by shifting resources from energy spending toward design and construction, efficiency, renewable

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<sup>14</sup> 2008 Center on Wisconsin Strategy (COWS) study for the City of Chicago (as of yet an unpublished memo).

<sup>15</sup> *Id.*

<sup>16</sup> *Id.* Note that the total and per-unit cost estimates in "Implementation Strategy" are based on rough estimates from current Weatherization Assistance programs, which employ non-union workers. Charles Kibert and Richard Fobair (2007). "Assessing the Job Creation Potential of Energy Conservation Investments." Powell Center for Construction and Environment, University of Florida.

<sup>17</sup> *Id.* Note that the estimates in this memo are for measure installation only, and do not include program overhead or the cost of diagnosing buildings for retrofit measures.

<sup>18</sup> *Id.* Loaded labor rates from Leopardo and the Powell Center survey. These estimates do not necessarily reflect net new labor supply requirements, since some new demand is likely to be satisfied by skilled workers who are currently unemployed or underemployed.

energy, and recycling.<sup>19</sup> Analysis was performed for the book using an economic input-output model to estimate additional job creation from a typical green building vs. a similar conventional building.<sup>20</sup> Input-output models have previously shown that for every one million dollars spent on energy from conventional utilities, 2-4 jobs are generated, directly or indirectly. If that same one million dollars were spent on green building, circa 8 to 12 jobs would be generated, directly and indirectly. One can therefore safely conclude that shifting to energy efficiency has the potential to create a substantial net employment benefit for the economy.<sup>21</sup>

Analysis performed for the book assumes that a typical new green building reduces building energy and water use by 30% and requires an additional initial investment of \$3.50/sf compared to conventional construction (~a roughly 2% green premium on a conventional building cost of \$175/sf). Using utility expenditures for a typical office, it is estimated that annual savings on the energy and water bills are on average \$0.50 per square foot, providing a simple payback of 7 years for green building improvements.<sup>22</sup> The increased investment in design and construction provides a short-term stimulus for the economy. Over time, building occupants also have more money to spend as a result of lower energy and water bills, moving money to more labor-intensive segments of the economy.

An input-output model run with the above inputs from a green office building indicates that the net increase in jobs from 92,500sf green office building is approximately 1/3 of a full-time job per year compared to conventional construction.<sup>23</sup> This translates to one net job-year being created annually per additional million dollars invested in green building over conventional building costs.<sup>24</sup>

The book also finds that green buildings can create additional jobs by increasing rates of construction-waste recycling. Past studies have found that recycling generates more employment per ton of waste than landfill disposal or incineration.<sup>25</sup>

*American Council for an Energy Efficient Economy.* The American Council for an Energy Efficiency Economy estimated in their 2008 report that energy efficiency in the building industry currently supports more than one million US jobs, including 332,000 in commercial construction and renovation.<sup>26</sup> Further, a 2007 report also conducted by the American Council for an Energy Efficiency Economy used energy efficiency and renewable energy strategies to assess the economic impact to counter Texas' growing energy demand assuming demand that requires a cumulative \$50 billion investment statewide between 2008 and 2036. It was found that the investment would produce small reductions in profits for traditional utilities by 2035 but, over

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<sup>19</sup> Greg Kats, Jon Braman and Skip Laitner, 2009: "Greening Buildings and Communities: The Costs and Benefits" Unpublished..

<sup>20</sup> *Id.* An input-output model is a set of economic accounts that model how consumers and businesses buy and sell to each other, illuminating how changes in spending can affect the economy both directly and indirectly.

<sup>21</sup> *Id.*,

<sup>22</sup> *Id.*,

<sup>23</sup> *Id.*,

<sup>24</sup> *Id.*,

<sup>25</sup> (2003). *Diversion Is Good for the Economy: Highlights from Two Independent Studies on the Economic Impacts of Diversion in California*, California Integrated Waste Management Board.

<sup>26</sup> Ehrhardt-Martinez, Karen and Skip Laitner (2008). "The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture" American Council for an Energy Efficient Economy.

the same period of time, the net gain in job-years (i.e. years of full time employment for one person) state-wide would result in 28,300 and a \$1.7 billion net increase in wages.<sup>27</sup>

*Southwest Energy Efficiency Project.* Further, a 2002 study by the Southwest Energy Efficiency Project estimated that increased investment in energy efficiency could generate 20,500 net new job-years in Arizona, Colorado, New Mexico, Nevada, Utah and Wyoming by 2010. By 2020 58,400 net additional job-years would be created under a high energy efficiency scenario ó compared with continuing to invest in conventional technology.<sup>28</sup> Black and Veatch examined the impact of meeting a renewable portfolio standard in Pennsylvania in 2004 and found that relative to a "business as usual" scenario, 85,000 net job-years would be created.<sup>29</sup> Finally, a 2000 report by the Association for the Conservation of Energy in the United Kingdom (UKACE) analyzed the impact of recent energy efficiency initiatives including programs for efficient HVAC systems and improved building codes. UKACE found that for every one million Euros invested in energy efficiency, 8-14 job-years were created. The types of jobs created varied from unskilled labor to skilled trades to engineering and management.<sup>30</sup>

*German Experience.* According to a study of general-efficiency programs in West Germany between 1973 and 1990, approximately 400,000 new jobs were created due to energy savings of 4.1 exajoules per year, which equals 100 new jobs per petajoule of primary energy saved.<sup>31</sup> Other studies performed in Europe and North America in the late 1990s show 40-60 jobs created for every petajoule of primary energy saved.<sup>32</sup>

*American Solar Energy Society.* The American Solar Energy Society (ASES) estimates that by 2030 the energy efficiency industry will create 14.96 million jobs assuming no change in policy and no major energy efficiency initiatives, 17.8 million new jobs assuming moderate federal and state initiative and 32.2 million new jobs assuming aggressive energy initiatives and policies at the state and federal level.<sup>33</sup>

*Apollo Alliance.* Finally, according to a study by the Apollo Alliance, 21.5 new jobs are created in the United States for every one million dollars invested in energy efficiency programs.<sup>34</sup>

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<sup>27</sup> John "Skip" Laitner, M. E., R. Neal Elliot (2007). "The Economic Benefits of an Energy Efficiency and Onsite Renewables Strategy to Meet Growing Electricity Needs in Texas" American Council for an Energy Efficient Economy.

<sup>28</sup> The New Mother Lode: the Potential for More Efficient Electricity Use in the Southwest, Southwest Energy Efficiency Project (2002).

<sup>29</sup> Economic impact of Renewable Energy in Pennsylvania (2004). Black and Veatch, Heinz Endowments, Community Foundation for the Alleghenies.

<sup>30</sup> Joanne Wade, V. W., Ivan Scrase (2000). National and Local Employment Impacts of Energy Efficiency Investment Programmes, Association for the Conservation of Energy, UK.

<sup>31</sup> Eberhard Jochem and Reinhard Madlener, The Forgotten Benefits of Climate Change Mitigation: Innovation, Technological Leapfrogging, Employment and Sustainable Development (Paris: OECD, 2003), p. 18. available at <http://www.oecd.org/dataoecd/6/49/19524534.pdf> 1 petajoule is equal to approximately 277 million kilowatt-hours.

<sup>32</sup> *Id.*

<sup>33</sup> Bezdek, Roger *Renewable Energy and Energy Efficiency: Economic Drivers for the 21<sup>st</sup> Century*, American Solar Energy Society (July 2007), p. 33, 39.

<sup>34</sup> Apollo Alliance, "New Energy for New America" (Washington, D.C., 2004), p. 8.