Buildings Technology Research and Development Working Group Meeting

May 28, 2009

Location: 950 L'Enfant Plaza DOE
Time: 1:30-3:30 p.m.

Attendees[1]	Agency/Office	
Shyam Sunder	DOC/NIST	BTRD Co-chair
Jerry Dion	DOE/EE-Buildings	BTRD Co-chair
Kevin Hurst	EOP/OSTP	
Paul Domich	DOC/NIST	BTRD Ex-Sec
Dru Crawley	DOE/EE-Buildings	
Alan Schroeder	DOE/EE-Buildings	
Mike Ritter	DOI/USFS	
Andrew Nichols	PNNL	
Patrick Hughes	ORNL	
Paul Torcellini	NREL	
Sean McDonald	PNNL	
Bobbie Lippiatt	DOC/NIST	
Steve Bushby	DOC/NIST	
William Brodt	NASA	
Bob Thompson	EPA	
Dale Manty	EPA	
Diana Bauer	EPA	
Doug Elloitt	PNNL	
Hany Zaghloul	USACE	
Chris Smith	Architect of the Capitol	
Larry Bank	NSF	
Ewa Lewandowska	Smithsonian Institution	
Terry Watson	Architect of the Capitol	

Next Meeting: June 18, 2009, 1:30 - 3:30 PM, 950 L'Enfant Plaza DOE

June 18, 2009
July 16, 2009
August 20, 2009
September 17, 2009
October 15, 2009
November 19, 2009
December 17, 2009

[1] Active Members not attending identified in light gray

Introductions: Working Group Co-chair Paul Domich opened the working group meeting of the Subcommittee for Buildings Technology Research and Development (BTRD) welcoming the agency representatives and thanking them for their participation. Participants provided self-introductions.

Review of Minutes: Informal review of Minutes for April 16, 2009 was performed prior to the start of the meeting.

Presentation on "Quantifying Water Impacts of Buildings' Energy Usage: Doug Elliott (PNNL) provided a presentation on recent work at PNNL to quantify the impact of energy consumption on water usage. Due to the cooling requirements of thermoelectric power plants, the indirect water impacts of energy efficiency efforts are significant. DOE's interest is to fully capture, understand, and convey program impacts, many of which are external and cannot easily be converted into dollar terms. This modeling effort is based on PNNL's Building Energy Analysis and Modeling System (BEAMS), which is used to estimate: energy savings; required investments; and external impacts such as avoided carbon, CO, SOx, NOx, VOCs, PM10, and now H2O withdrawal and consumption.

Preliminary slides provided an overview on the impact of energy consumption on water, and the vulnerability of electrical power generation using scarce or variable water resources. The use of water in energy production is very large due to generation plant cooling requirements. From 2000 USGS data, thermoelectric-power withdrawals accounted for 48 percent of total water use, 39 percent of total freshwater withdrawals for all categories, and 52 percent of fresh surface-water withdrawals." Elliott highlighted that most water withdrawn for thermoelectric power generation is returned to the water system (albeit at an increased temperature) and the actual consumption/loss of water is a small fraction.

The analysis may be performed on either a "by plant" (base load plants, intermediate load plants, and peaking load plants) or "weighted" (aggregated across plant type) basis. The former approach is a time-of-use approach, allowing specification of activity-specific "avoided" power generation mixes of the three plant types. The type of plant technology used affects the water withdrawal and consumption factors (ranging from 15.691Gal/kWh to 0 Gal/kWh and 0.456 Gal/kWh to 0 Gal/kWh, respectively). Employing a range of energy efficiency technologies and strategies provided by DOE's Building Technologies Program, avoided water withdrawal can be significantly reduced - which in turn saves additional energy that would have been used to treat and transport the water. The avoided freshwater withdrawal ranges from 161 billion gallons per year in 2010 to 2,430 billion gallons per year in 2030. Similarly, freshwater consumption ranged from 4 billion gallons per year to 66 billion gallons per year over the same time period.

Elliott also described other possible alternatives to avoid a similar amount of consumption, such as switching to low flush toilets or Energy Star clothes washers. Such a toilet program, if implemented across all households in the U.S., would require roughly $1B investment. It is estimated that U.S. per capita annual domestic use in 2000 was 33,600 gallons (roughly 100 gallons per day per person), which does not include the water used to generate power, develop products, or deliver services.

During the Q&A, Elliott revealed that associated energy costs are not included for the treatment of thermoelectric plant discharge water and that other losses of water due to building HVAC systems such as evaporative chiller units are not included in the analysis estimates.

World Business Council for Sustainable Development Report "Transforming the Market": Discussion on the Roles of Regulation, Building Codes, Policy Changes, and Incentives: Paul Domich provided a brief overview of the "transforming the market" report (see also attached notes). As a caveat to the report's conclusions, the report was developed over a 4 year period beginning in 2006. During that period, the economy grew and then collapsed along with the price of oil. Assumptions made in the paper on the price of oil and the overall economic environment are for analysis purposes only and may not reflect current conditions.

The report focused on six markets: Brazil, China (Case Study: multi-family homes), Europe (Case Studies: single family homes - France, Retail - UK), India, Japan (Case Study: offices), and the United States. The study used three scenarios to evaluate the effects of various factors in reducing energy use and carbon emissions (up to a limit of a 70% reduction). While three scenarios were used, the most emphasis was placed on the third and most aggressive scenario. This scenario represents a mix of measures tailored to specific subsectors and geographies and includes:

- Strict building energy codes, regulatory requirements
- labeling and reporting mechanisms
- appropriate energy prices and carbon costs
- investment subsidies and incentives
- increased and trained workforce capacity
- evolving energy-efficient designs and technologies that use passive and active approaches

The Executive Summary provided three high level conclusions related to the paper. The first two involved investment levels and expected payback periods related to energy conservation investments. The third conclusion addressed the impact of the cost of carbon from Cap and Trade program. Clarification was made that the stated investments are made annually over a 40 year period ending in 2050. Subcommittee members indicated that without additional

information regarding their assumptions, these conclusions can not be confirmed nor refuted.

Conclusion 1: At energy prices proportionate to oil at US$ 60 per barrel, building energy efficiency investments in the six markets studied, totaling $150 billion annually, will reduce related energy use and carbon footprints by 40% with five year discounted paybacks.

Conclusion 2: A further investment of $150 billion with paybacks between five and ten years will add 12 percentage points (52%). Additional investments to achieve the 77% target will not be justifiable on economic return grounds at today's energy prices and will require the additional steps outlined in this report

Conclusion 3: Increasing the price of energy or carbon will only slightly increase the implementation of energy-efficient options - Reductions would only marginally increase from 52% at today's energy prices to 55% with an incremental carbon cost of US $40/ton.

The overall premise of the report based on these conclusions is that the necessary progress in reducing energy use will not be achieved purely through the market. Market forces will need to be supplemented by effective regulatory environments and fundamental behavior change. The report provided an extensive list of key regulatory and policy questions which must be answered along with an equally extensive list of current barriers to implementation. For both lists, the topic of actual energy efficiency building technologies and related technology advances were minimally addressed and similarly avoided in the remainder of the report.

Domich raised the question whether recent studies focused on similar alternatives for regulatory, policy, standards, and incentive actions for improving energy conservation and reducing carbon emissions and whether these studies were specific to the U.S. and its regional climatic and geographic differences. Andrew Nichols (PNNL) indicated that other policy/regulatory studies have been released (e.g., coming out of PNNL and elsewhere) and that a survey of current studies would be useful. This survey would provide the background and foundation to any future examination of this area by the Subcommittee.

Jerry Dion (DOE) and Shyam Sunder (NIST) suggested that future government sponsored studies into the various policy and regulatory alternatives would be best served if it was requested by White House policy officials (e.g., jointly by the Energy Coordinator, the Council on Environmental Quality, and the President's Science Advisor) with guidance on possible time-based targets for emissions reductions and/or energy use reductions. Such a request would define the scope of the report and suggest the range of alternatives that should be examined.

Subcommittee members offered the following suggestions related to any future study:

- The regulatory/policy alternatives examined should include those alternatives previously postulated but also focus on possible new alternatives which may now be feasible in light of technology and policy advances
- The study should address the impact of advances in new technologies, provide for a flexible program that can be adjusted easily over time as conditions require, and properly incorporate the effects of new technologies on regulatory and policy alternatives
- A phased approach should be used to examine alternatives for various levels of energy use reduction (e.g., 40% to 50%, up to 70%, and net-zero energy buildings)
- Policy development needs to address a number of key considerations to effective implementations (e.g., metrics and measurement techniques, design vs. actual performance measures, integrated design, standards development, new versus existing buildings, etc.)

Such a study should ultimately provide a visionary perspective on the roles and impacts of policies, regulations, building codes and standards, incentives, and training and awareness. It should also address the various roles of federal, state, and local governments, and their traditional responsibilities in the building sector.

Action Item: Paul Domich will contact OSTP on this subject area and arrange a teleconference call.

Comments on the Waxman-Markey Cap and Trade Paper: Domich deferred discussion on the Waxman-Markey paper to a future meeting. The current draft discussion paper recently was marked-up and accepted by the congressional oversight committee. At this time, the discussion paper includes a number of new amendments include one that addresses the energy impacts due to water use.

DOE Energy Frontier Research Centers: The U.S. Department of Energy Office of Science will invest $777 million in Energy Frontier Research Centers (EFRCs) over the next five years. In a major effort to accelerate the scientific breakthroughs needed to build a new 21st-century energy economy, 46 new multi-million-dollar EFRCs will be established at universities, national laboratories, nonprofit organizations, and private firms across the nation. Supported in part by funds made available the American Recovery and Reinvestment Act (Recovery Act), the EFRCs will bring together groups of leading scientists to address fundamental issues in fields ranging from solar energy and electricity storage to materials sciences, biofuels, advanced nuclear systems, and carbon capture and sequestration. The 46 EFRCs, which are to be funded at $2–5 million per year each for a planned initial five-year period, were selected from a pool of some 260 applications received in response to a solicitation issued in 2008 by the U.S. Department of Energy (DOE), Office of

Science. A total of 31 universities, 12 DOE National Laboratories, two non-profit organizations, and one corporation will participate. Please see http://www.sc.doe.gov/bes/EFRC_Award_List.pdf for the complete list of awards.

Information Items: Sunder noted that NIST has embarked on a number projects related to energy efficiency using funds from the American Recover and Reinvestment Act (aka Stimulus Package). This includes construction of a net-zero energy residential dwelling that will be used to test and evaluate metrology and performance evaluation techniques and technologies. For more information, please see http://www.nist.gov/recovery/. Hany Zaghloul (USACE) clarified information regarding a German exchange program with the DoD, and also informed the Subcommittee that he received approval to provide the subcommittee with an overview of DoD's green building activities.

Closure: Domich closed the meeting at 3:30 p.m. and thanked the agency representatives for their participation.