Testimony of Mark D. Levine, PhD
On the Findings of the Fourth Assessment Report by the Intergovernmental Panel on Climate Change, Working Group III: Mitigation of Climate Change
Before the Committee on Science and Technology
May 16, 2007

Introduction

Mr. Chairman and distinguished members of the committee, thank you for holding this important hearing. It is my honor to be here today and I hope that I can be helpful to you and your staff as the Committee considers the findings of the report and work to address its policy implications.

My name is Mark Levine and I am a senior scientist at the Lawrence Berkeley National Laboratory and formerly the Division Director for the Lab's Environmental Energy Technologies Division. However, my testimony here today is not on behalf of the Laboratory, but rather as a participant in the IPCC Working Group III on mitigation.

I was the convening lead author for the Second Assessment Report for the Chapter on GHG emissions on buildings and was the co-coordinating lead author for the 4th Assessment for the same topic (with Professor Diana Urge-Vorsatz of the Central European University, Hungary). I am testifying in this role, on my own behalf and as a result of my expertise in this role.

The Committee has asked me address two issues. First, to discuss the findings from Chapter 6, Specific Mitigations in the Short and Medium Term – Residential/Commercial Sector. And, second, to explain how the findings of this Fourth Assessment report differ from those of the previous Assessments of Mitigation of Climate Change.

I am interpreting the second question narrowly, as it relates to Chapter 6 – the area of my direct expertise.

Major findings of Chapter 6

The highest level findings from Chapter 6 are contained in the Summary for Policy Makers (SPM). The SPM notes that "energy efficiency options for new and existing buildings could considerably reduce CO_2 emissions with net economic benefit." It goes on to state that "(m)any barriers exist against tapping this potential, but there are also large co-benefits *(high agreement, much evidence)."* In summary the working group found that:

- By 3030, about 30% of the projected GHG emissions in the building sector can be avoided with net economic benefit
- Energy efficient buildings, while limiting CO_2 can also improve indoor and outdoor air quality, improve social welfare and enhance energy security

- Opportunities for realizing GHG reductions in the building sector exist worldwide. However, multiple barriers make it difficult to realize this potential. These barriers include availability of technology, financing, poverty, higher costs of reliable information, limitations inherent in building designs and appropriate portfolio of policies and programs.
- The magnitude of the above barriers is higher in the developing countries and this makes it more difficult for them to achieve the GHG reduction potential of the building sector.

Commentary on Findings

These findings have been agreed to by all of the countries at the meeting, after a line by line review. It is fair to say there is unanimity among a diverse body with representatives of all major countries of the world. This careful review, supported by a great deal of background work, gives these findings standing in the international community. The full chapter on buildings is 90 pages of detailed text and references. It has been subject to extensive review by experts and governments before the IPCC meeting that concluded on May 4.

There is significance in the findings that may not be apparent. 30% of projected CO_2 emissions can be avoided at net economic benefit. This occurs when cost-effective investments are made in energy efficiency. Such investments are beneficial to the consumer, who gains more than she or he pays on an annualized basis, as well as to society.

An important contribution of the AR4 was its thorough review and effort to put on a common footing the different "bottom-up" studies of energy efficiency potential in buildings. By "bottom up" is meant a characterization of the key technologies that can reduce carbon dioxide emissions, their cost and the quantity of emissions reductions that can be achieved throughout time. The analysis involved a review of 80 studies and a thorough assessment of 17 of these. Such an extensive comparison of the major "bottom up" analyses had never been done before, nor had they been applied to cover the globe. This effort alone has added a great deal of confidence to the analysis of emissions reductions.

It is important to ask how far this energy efficiency will get us in the direction of climate stabilization. To simplify the discussion, I address the question of the degree to which emissions in 2030 might, through energy efficiency alone, be equal to those in 2004. Scenario B2 (one of the two commonly used cases) has ~30% higher emissions in 2030 than in 2004 (11.4 Gt/yr vs. 8.6 Gt/yr). Applying all cost-effective mitigation options to buildings would result in constant emissions throughout the period for a B2 baseline scenario. By comparing this result with Figures SPM 7 and 8, this level (if achieved by all other sectors) is consistent with Stabilization Scenarios II and III, 500-550 ppm CO_2 eq. These stabilization levels result in about 3 degree Centigrade temperature increase.

There are at least three factors that affect these conclusions relating to how much buildings can contribute to mitigation of carbon dioxide:

- The baseline may grow faster or slower than B2 which we have chosen. The baselines studies on which the buildings energy and carbon potential were assessed depended on assumptions in the individual studies we reviewed. Overall, they saw a CO_2 emission growth from 8,6 Gt CO_2/yr in 2004 to 14.3 Gt/yr in 2030. (In the B2 scenario, the growth was to 11.4 GT/yr in 2030. In A1B, the other often cited case, the growth was to 15.6 Gt/yr in 2030.) Using the middle baseline, buildings-related CO_2 would grow to1.4Gt/yr more by 2030 than in 2004 (or 16% above 2004 levels) with all cost-effective energy efficiency.
- The supply side can contribute considerably to CO_2 reductions. In the United States, 70% of total primary energy used in buildings is electricity. Any decarbonization of the fuel used to generate electricity translates directly into lower emissions resulting from energy use in buildings. This suggests that over time as more low-carbon supply options become available for electricity generation, energy-related emissions in buildings will decline.
- Notwithstanding these opportunities, a general concern needs to be raised about the fraction of the cost-effective potential that can be realized in this time frame. This will depend a great deal on policies that countries have chosen to implement, and the willingness of citizens to spend time and money on energy efficiency,

This brings us to the issue of policies. The current report reviews performance of a large number of policies in many countries. No single policy is seen to work everywhere. Yet, unlike the previous assessments, there is evidence of considerable success with individual policies in different places. We have reviewed programs aimed at the whole building: building codes; building certification and labeling programs; and education, training, and energy audits. We have reviewed programs aimed at appliances, lighting, and plug loads: standards and labeling; voluntary agreements. We have studied cross-cutting programs, including utility demand-side management programs; elimination of energy subsidies; creation of financial incentives for energy efficiency; public sector leadership and procurement programs; promotion of Energy Service Companies; energy efficiency obligations and tradable energy-efficiency certificates; and Kyoto Protocol's Flexibility Mechanism. All of these – which the exception of the last which does not apply to the United States – has a realm in which it is highly effective in bringing forth energy efficiency. In addition, to be successful in mitigating emissions over time, the report notes the importance of expanding R&D efforts.

Findings from Previous Assessments[1]

The previous assessment (the Third Assessment Report TAR) devoted little attention to sectoral analyses of GHG mitigation. In spite of this cursory assessment, the report did estimate that the buildings sector had the potential to achieve levels of carbon emissions in 2010, 2020, and 2050 that were roughly equal to those in 1998 (Synthesis Report,

[1] I should note that I was a lead author in the TAR and a convening and coordinating lead author in the SAR and AR4. Thus, I am in a good position to observe the evolution of the reviews over a fifteen year period.

IPCC TAR, pages 315 and 316). These estimates are similar to those obtained in AR4—somewhat more optimistic depending on the baseline assumption. However, they are based on very little evidence, as much less rigorous literature review was conducted to support the findings. They were largely based on expert judgment.

The Second Assessment Report, on the other hand, devoted a full chapter to mitigation of greenhouse gas emissions from buildings. The chapter provides a description of technologies for energy efficiency in buildings. It is not as complete nor as rich as in the AR4. The chapter describes the key policies and programs that had been attempted to that time. In general, the policies were well described in the report, but there was much less information available about evaluation of policy results. While this area has improved in the AR4, it is still evident that evaluation of policies and programs is not adequate. The SAR does not attempt an evaluation of bottom-up assessments. It reviews several scenarios that project additional energy efficiency as compared with baseline cases, but is not able to pull out of them any direct information about emissions reductions from buildings.

Conclusions

I do not find anything contradictory among the three assessments. In reviewing the SAR, I am struck by how little information on economics or projected savings was in that report. It was primarily focused on describing what was known about energy use in buildings, including data on how energy has been used in the buildings sector. But there was little information that might be seen as policy relevant.

The TAR provided much less information. But the authors were willing to make guesses on the potential for emission reductions at cost-effective levels. These were based on a given baseline and a very small number of studies that were cited in the chapter. Thus, it would not have been possible for policy makers to place much reliance on the mitigation potentials from the TAR.

AR4 has come the farthest in generating information that can be useful for policymakers. . We can be certain that there are many technologies to reduce emissions. Many of these are described in depth in the report. There is experience with a wide range of policies and programs, some of which have shown considerable success in individual countries. The report casts a broad net in assessing mitigation potential in the sector and finds consistency among many different studies in different countries.

There remain major shortcomings. The mitigation potential studies are still too limited in technology scope and much effort was needed in putting them on a relatively consistent basis. These studies focus attention on technologies that are available today. They shed little light on the question of the magnitude of energy savings and CO_2 mitigation possible as a function of higher carbon charges. This is because there are so many energy efficiency options available that are presently not being adopted that the authors do not address advanced technology.

There is one other important point ot make about the sector. Unlike the supply sector, where carbon charges will be needed to bring about adoption of certain advanced technologies, the buildings sector generally needs targeted policies – including regulatory policies and market based approaches – to achieve mitigation goals. This is because of the large number of barriers that exist in the marketplace that deter investment in energy efficiency.