

Good evening. We are fortunate as a group to have a considerable number of new members who have joined in the last couple years. ... This brings to my mind the guidelines I received for choosing a paper topic. "Take a subject you know little or nothing about—something outside your principal work or profession, learn something about it, think about it, and then report back to the group. My original goal for this presentation was simply to present a fact base which can serve us as we struggle to figure out how to reduce greenhouse gas emissions. For me, preparing this paper has been an extremely interesting experience, because in addition to confronting a mountain of new information, and even learning some of it, the effort to make sense of all this information has led me to a profound change in my thinking about the proper role and the appropriate limits of government involvement in our every day lives.

Since my earliest understanding of alternative philosophies of government I know that I have always had a passionate belief in our economic and government system, with free markets and minimal government involvement. Ever since high school, I know that my mantra (though I did not use that term then) was "That government governs best which governs least." (T. Jefferson "...because its people discipline themselves.") I have always been a true believer in our system, and given my family's experience in this great country, why would I not be? (another topic could be how members of same family have similar experiences but reach different conclusions!)

When I first learned about the "Invisible Hand" I was in awe of its effectiveness in driving an economy, and I became a strong advocate of our economic system. I believed, and I still believe, that our system, which gives people an incentive to produce, even though it permits big differences between winners and losers, is still the best way to organize our economy. It is the best way to raise



the standard of living for everyone. I do not want to abandon it. (of course the winners should not abuse it as many have recently—but that too is another topic)

But—and this is a big exception—it is clear that the Invisible Hand does not work for reducing carbon or GHG. The Hand needs help, in the form of new boundaries, new parameters, within which it can still work its magic. There is a tide quickly rising that will bring in new legislation that will begin to implement those new rules, new parameters, and these changes will be big. I have heard words used like “transformational,” or “biggest change since the industrial revolution.”

Many big companies and organizations already understand this, and are involved feverishly trying to shape the debate and the outcome. Many others are in danger of being left out or left far behind. This is clearly an issue to which a Washington maxim truly applies: “If you do not have a seat at the table, you will be an entry on the menu.” Or even more succinctly, “you are either at the table or on the menu.”

The people or entities in danger of being left behind are still worrying about debating the science underlying global warming. The underlying science is NOT the topic tonight. We’ll have plenty to discuss and argue about a bit later. But I want to emphasize that the underlying science is not the topic tonight, because from the standpoint of politics, and from the standpoint of smart business, the scientific debate is over. The debate is not about IF global warming is true, or IF government should do something about it. The debate is about WHAT government should do.



Normally, I would consider governmental involvement as “guilty until proven innocent.” I can imagine someone stretching a point to say that preventing global warming was not a power granted to the federal government in the constitution, so forget about it. Well, very clearly that is not going to happen.

For international law and treaties, there is a well established principal which I had not heard of called the “Precautionary Principal.” This basically says that if there is a potential threat to common welfare that is bad enough, it is entirely appropriate to take strong preventive action before the threat is clearly proven, because by then it may be too late.

I personally come to a similar conclusion by applying the sort of managerial economics that we use to make decisions in business and other aspects of life.

Explain with coin toss and oil well (good bet even though you have a 90% chance of a dry hole)...

In this case, even if there is small percentage chance that this global warming threat is true—and with the overwhelming % of scientists in the relevant fields agreeing that it is, I think we can agree that the chance must be at least 1 in 10 that it is. We can also agree that if it is, the result would be horrendous. And as we have seen, even a small chance of a horrendous result justifies making a big effort, and spending a LOT of money to prevent it.

Moreover, once the debate starts over exactly what to do, and all the lobby groups are trying to keep their clients off the menu, it will be essential to remember the original basis for action. That is, there is a meaningful chance that doing nothing leaves us with a significant prospect that a lot of people will



either fry or drown. Therefore if we are going to do anything, it is essential that we get it right. We cannot afford a typical half-baked measure with lots of compromises and nothing substantive, or rules which can easily be scammed.

One of the reasons I have always been so skeptical of governmental involvement in solving problems is that so often it simply doesn't work, or even makes things worse. E.g. "minority owned business" promotion which resulted in lots of sham companies and no meaningful change. Or programs to aid single parent families. A lot of kids got help, but the program also enabled a lot more single parents in numbers and percentage of population than we had before the program started.

Again, remember the stakes here. Bigger than ever. We must not get it wrong. That is why Jeffrey Immelt, the Chairman and CEO of General Electric, says, "There's no percentage for any CCEO in the world to run his or her business thinking that there are not going to be carbon caps someday. Because the day it becomes law, you're five years late. And you either get out ahead of these things or you get stomped by them." That's his version of the table/menu quote.

He also said (this was in a recent WSJ interview, from 3/24/08) "you can't get a coal plant permitted. There's no leadership about what we want to do. So where we are today, I would argue, is like the worst of all worlds." He said in the same interview that in his 26 years at GE, they are on their 8<sup>th</sup> iteration of technology in the health care field. But they are still selling the same energy products they sold 26 years ago. He believes that correctly designed governmental leadership could correct that.



The leading bill that will start to address this, and which you will be hearing more about if you have not already, is S2191, the Lieberman Warner bill. It is still being worked on and debated extensively, and it not likely that anything will pass until next year. However, it is important to know that all three of the leading presidential candidates have endorsed it .

All this reflects context and thinking about what I was originally going to present to you this evening, which I shall now do in very condensed form. The company I used to work for before coming back to Holland, McKinsey and Company, recently completed a huge study, analyzing over 250 options for reducing carbon emissions. Over the next 25 years. It is staggeringly complex, but I will try to present what I feel are some of the essential points.

First, I will explain some basics. They assumed no changes in “utility” or behavior. They acknowledge that conservation efforts could help reduce the size of the task, but held consumption constant for purposes of the analysis. They translated everything into metric tons of CO2 emissions, and spoke often of megatons (millions of metric tons) and gigatons (billions; 1 gigaton is equivalent to the emissions resulting from the entire economy of Germany in one year). They translated everything into 2005 dollars, and used a 7% discount rate for future cash flows. Plus this is ONLY about the US—lots lots more to discuss re international, etc

\*1\* Base case or reference case shows GHG emissions rising from 7.2 gigatons of CO2 in 2005 to 9.7 gigatons in 2030 due to Economic Growth, 2 Population growth and 3 increased carbon intensity of power generation



\*2\* and that still assumes a lot of improvement already happening. (Frankly I am skeptical of some of that, especially the nuclear)

\*3\* Goals reflected in various bills plus a consensus from international meetings (Kyoto, Bali, etc) call for getting to 1990 level of emissions, or 1990 minus 27%. This would mean reductions of 3.5 to 5.2 gigatons as compared with the base case.

The study looked at what it would take to achieve this, and focused only on initiatives costing \$50 per ton or less.

\*3\* they developed 3 curves—low (1.3) medium (3.0) and high (4.5), with most focus on 3 to 4.5

\*4\* Here is an important slide for seeing the big picture. There is a lot of detail here, and I have copies of these slides, plus additional detailed backup which we will not discuss tonight unless there is a special request.

The key thing to note is that there are a LOT of “negative cost” options. These could account for 40% of the target. A “negative cost” means it would actually be an economic benefit. The theory would be that if we could get cracking on these negative cost options asap, we could harvest the benefits and use them to pay for the high cost options over here.

There have been some articles about this report, and the most glib simply say the study shows we could meet the targets with a relatively small overall cost to our economy overall. Almost reassuring if



we look no further. But, the devil is in the details, as always. Why are we not already seizing all these great negative cost opportunities? Because they are negative cost to our economy as a whole. There is a big gap between the original investor and the later beneficiary. Think of a developer building a spec house or a condo development and then selling it and moving on. Examples of this are everywhere.

\*5\*The report shows how the size of the opportunities varies geographically, based on things like population density, type of power used, etc.

\*6\*They grouped the opportunities into 5 broad sectors.

Buildings and appliances	710-870 megatons
Transportation	340-660 mt (note hybrids are over \$50/ton)
Industry	620-770 mt
Carbon sinks (forests, ag, etc)	440-590 mt (note huge opportunities in rain forests, Etc. but that raises "Carbon Colonialism issue)
Power	800-1570mt. Obviously huge, but also expensive.

One big key is CCS = carbon capture and storage (sequestration) Expensive, complicated, uses 30% of power generated, but a critical opportunity.

Charts with more detail on each of these to be handed out, but not discussed.



The report offers no prescriptions for legislation. It was a “just the facts” sort of effort.

But it emphasizes that there will be huge dislocations, winners and losers. There are major obstacles, not least of these is the different time horizons of various participants.

They said achieving the high case would be the equivalent in difficulty of our country winning a medal in every single Olympic event. (in a speech—not in the report itself)

Also, no one option covers more than 11% of target. We need to be comprehensive, and have Many initiatives. There is no one magic bullet.

Also, time perishable options. Each building built to less than best available will be there for 40 years. Retrofitting far more expensive. Each year we wait means more cost later, and this is ON TOP of the national debt we are leaving future generations.

So, tho not specific, they say

1. Get after negative cost stuff NOW. Energy efficiency. Standards, building codes, (e.g. with solar panels. Property tax or building code) Energy Star



2. Stimulate action via sending clear signals that this is real and it is safe to invest. This is what Immelt called for. This will include the cap and trade and resulting exchanges. There is a CCX in Chicago already, operating voluntarily. Plus means for verifying actually doing what is said, and guarding against "leakage." Lieberman-Warner is a start 500 pages. NAM opposing --not sounding smart, calling for anecdotal evidence to give to Senators. (e.g. from prior effort SO2—said it would cost 10 times what it cost. Trade in credits helped greatly)
3. Huge effort to develop low carbon infrastructure. We need to increase our carbon productivity (= GDP per ton of carbon) by 90%. Need big R&D for solar, hybrids, cellulosic biofuel, CCS (NRDC actually likes this, Nuclear (NRDC does not like); permitting!
4. Behavior modification—not in this report.
5. Embedded carbon—not here or in law. Getting a correct carbon report on products. Not enough to be just a localvore. Have to measure more than miles

JSP additional ideas.

1. Energy Star—why can they sell non-starred new products
2. Railroads—outrageously inefficient
3. Utilities. Why is private better than BPW
4. Just so Rob does not think I have completely gone over to the other side—Right to Work. Rail Union obstacles must be eliminated



There will be huge opportunities to fill the need . New products. The new parameters with clear signals will allow the Invisible Hand to get back to the work, this time including the cost of carbon emissions. Product ideas include feedback devices, time of day pricing, consumption reports vs neighbors.

End with tipping point stories Radio, 1 day; Berlin Wall, 1 month, NYC 3 years. Change can happen, and it can be fast, but we must work to prepare the context—to create an environment is ready for the change. And at the same time, we have to prepare ourselves, and our businesses.



**How a Free Market True Believer**

**Can Start Sounding**

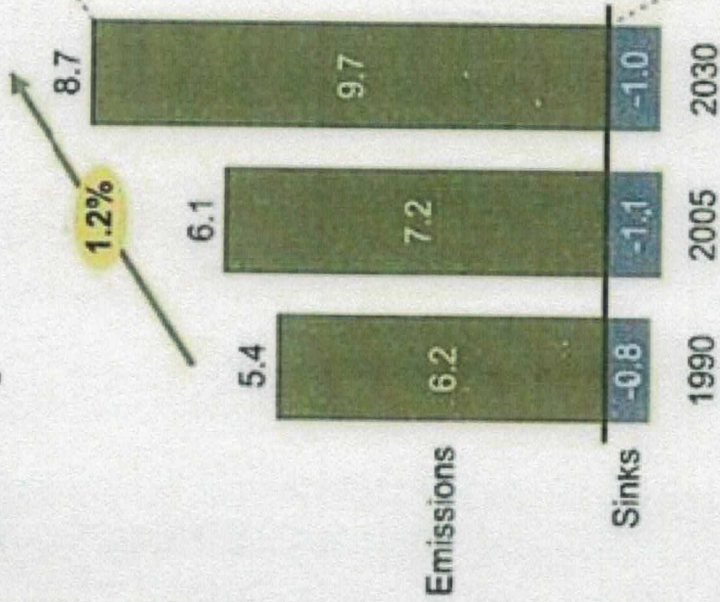
**Like a Big Government Liberal**

**(almost)**



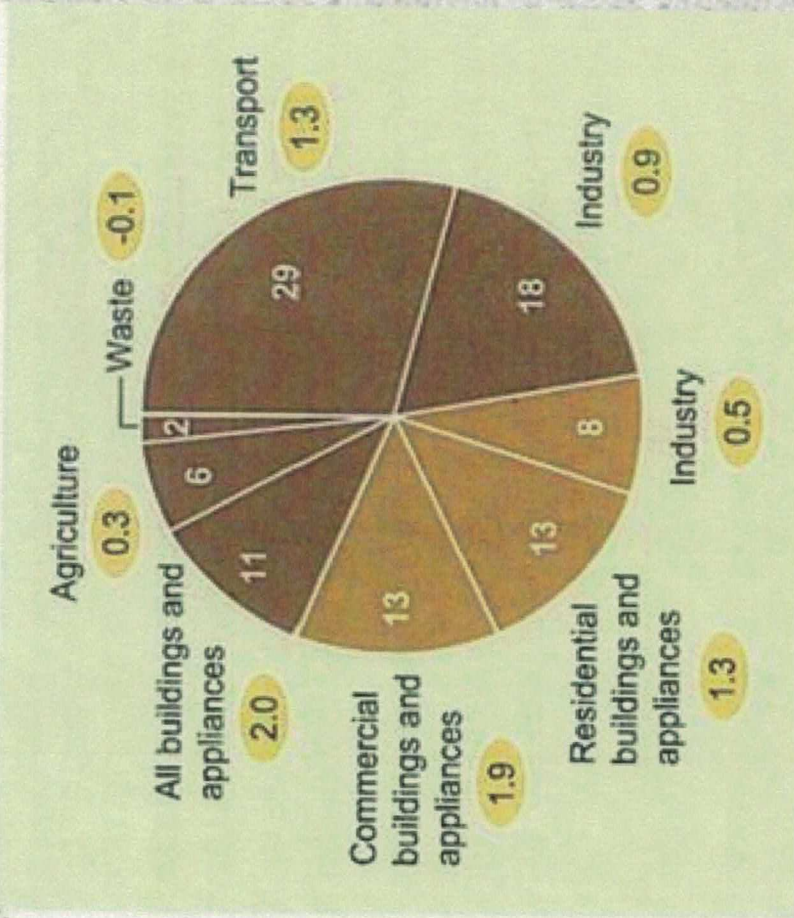
# GOVERNMENT REFERENCE CASE FOR U.S. EMISSIONS

Overall GHG emissions – 1990-2030  
Gigatons CO<sub>2</sub>e



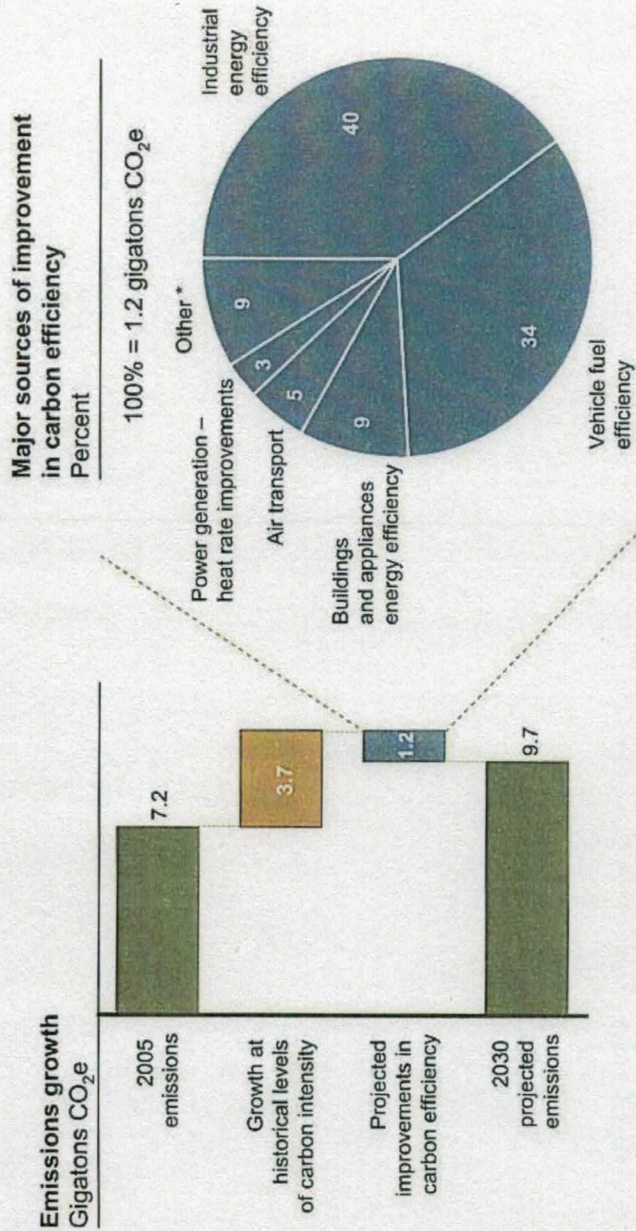
GHG emissions by sector – 2030

Percent





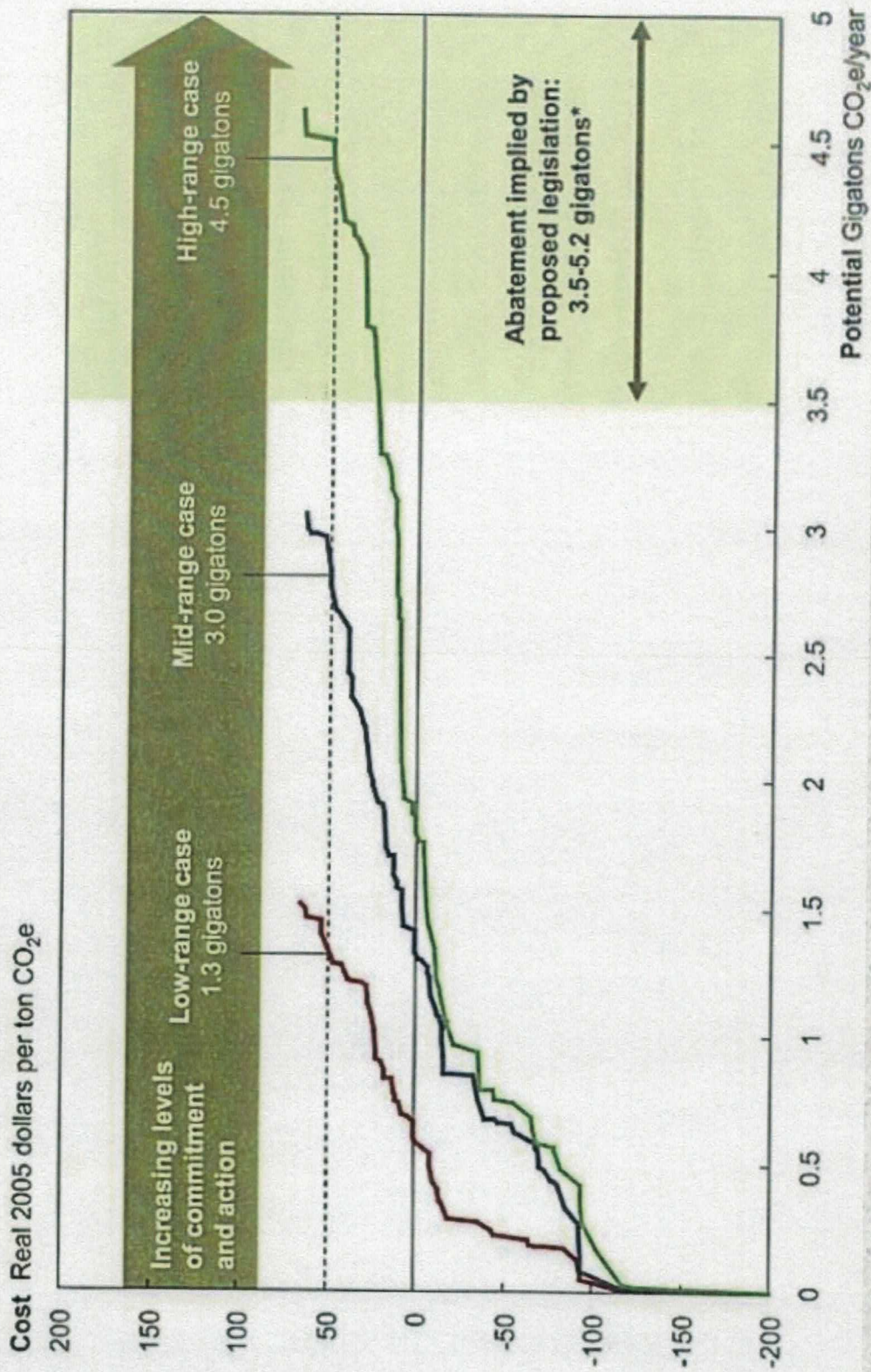
# CARBON REDUCTIONS EMBEDDED IN THE REFERENCE CASE



\* "Other" includes other transport (7%), agriculture (1%) and waste (1%)  
 Source: U.S. EIA Annual Energy Outlook (2007) "Reference case," U.S. EPA; USDA; McKinsey analysis

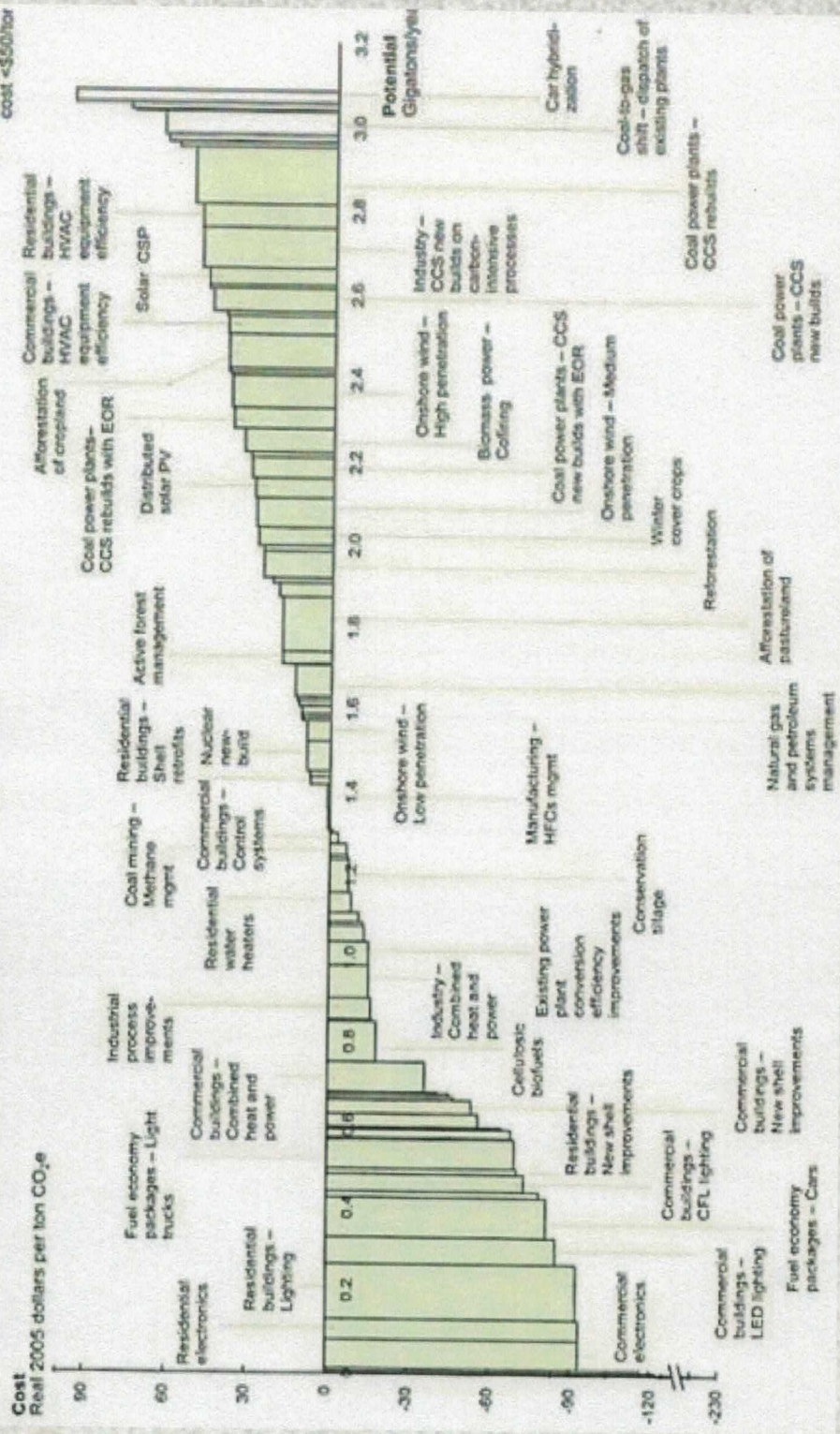


# U.S. GREENHOUSE GAS ABATEMENT POTENTIALS – 2030





# U.S. MID-RANGE ABATEMENT CURVE - 2030

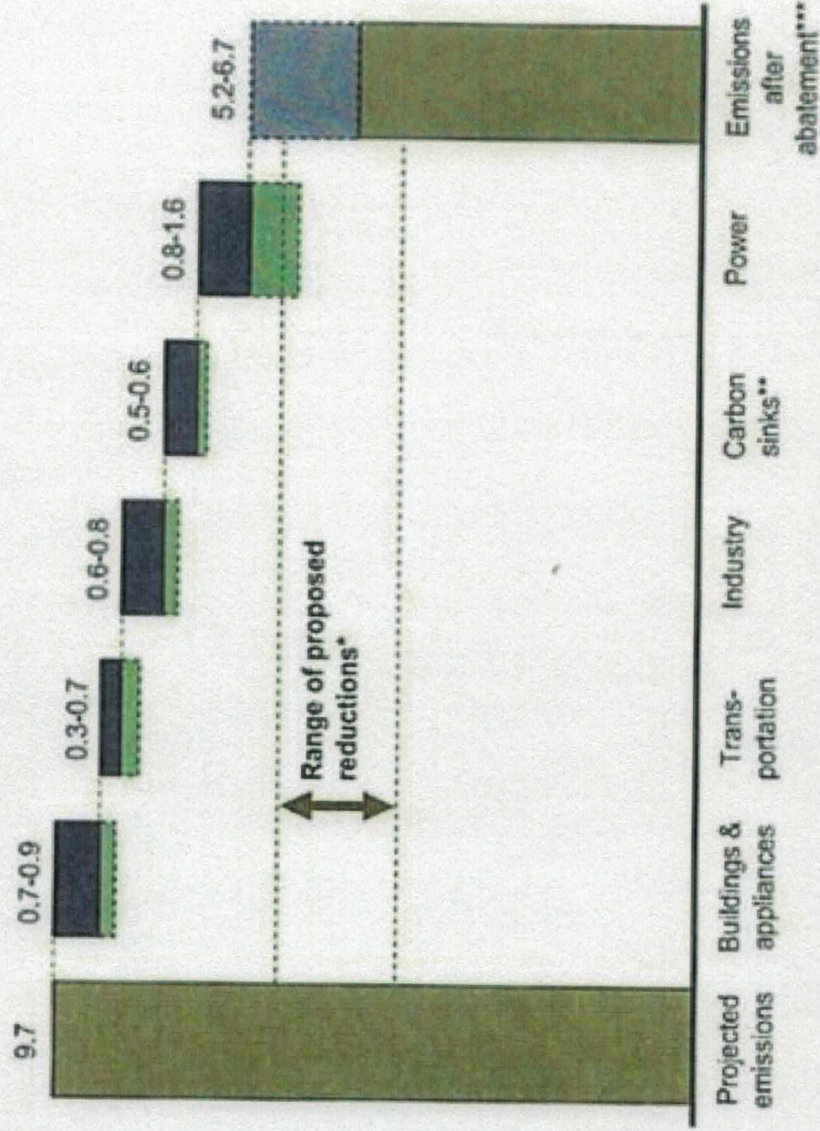




# CLUSTERS OF ABATEMENT POTENTIAL – 2030

Gigatons CO<sub>2</sub>e, options less than \$50 per ton CO<sub>2</sub>e

Mid-range case  
High-range case



**Additional potential:**

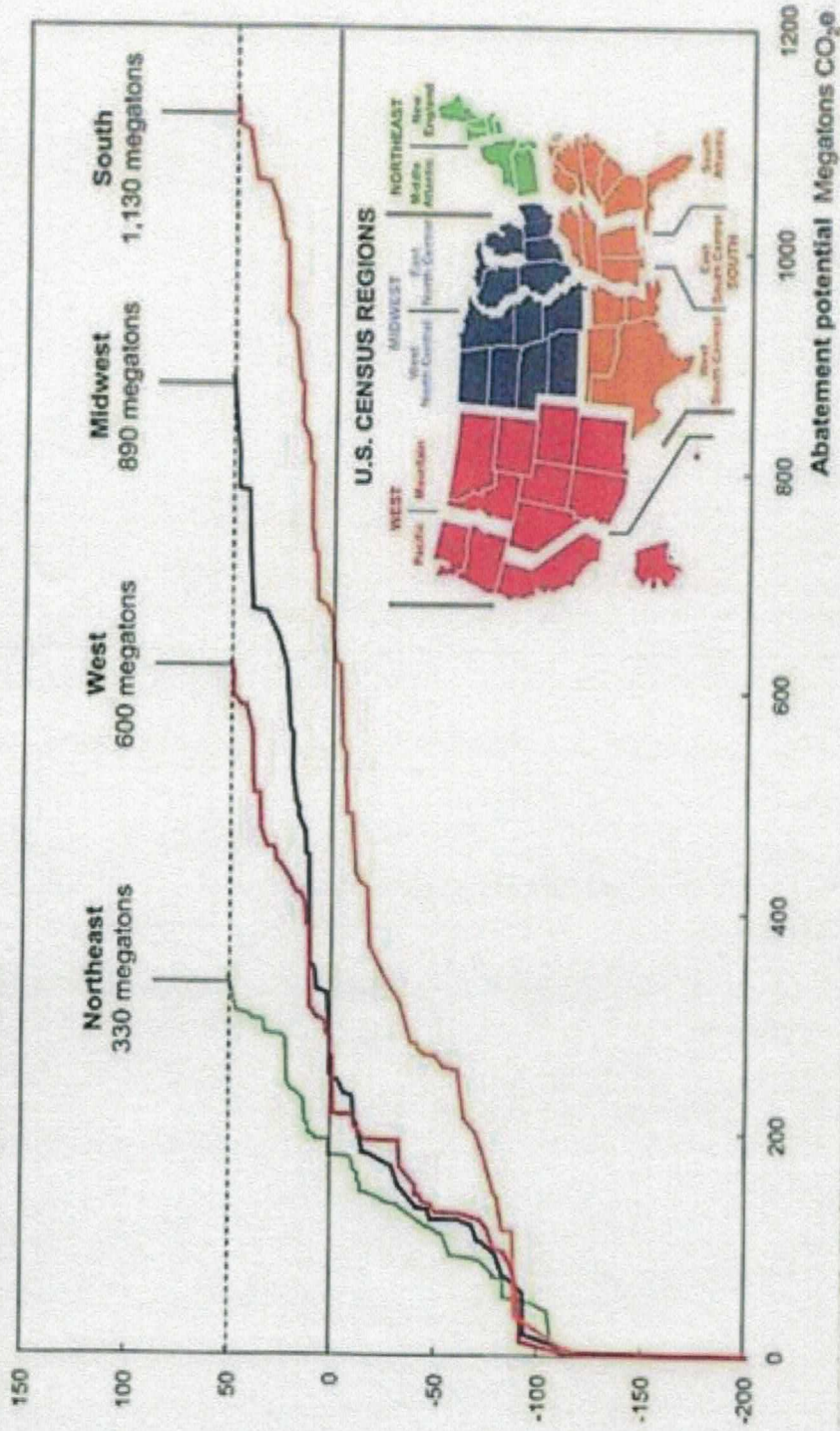
- Options >\$50 per ton
- Demand response
- Breakthrough technology innovations
- Lifestyle choices



# GEOGRAPHIC DIFFERENCES IN ABATEMENT COST

MID-RANGE CASE - 2030

Cost Real 2005 dollars per ton CO<sub>2</sub>e

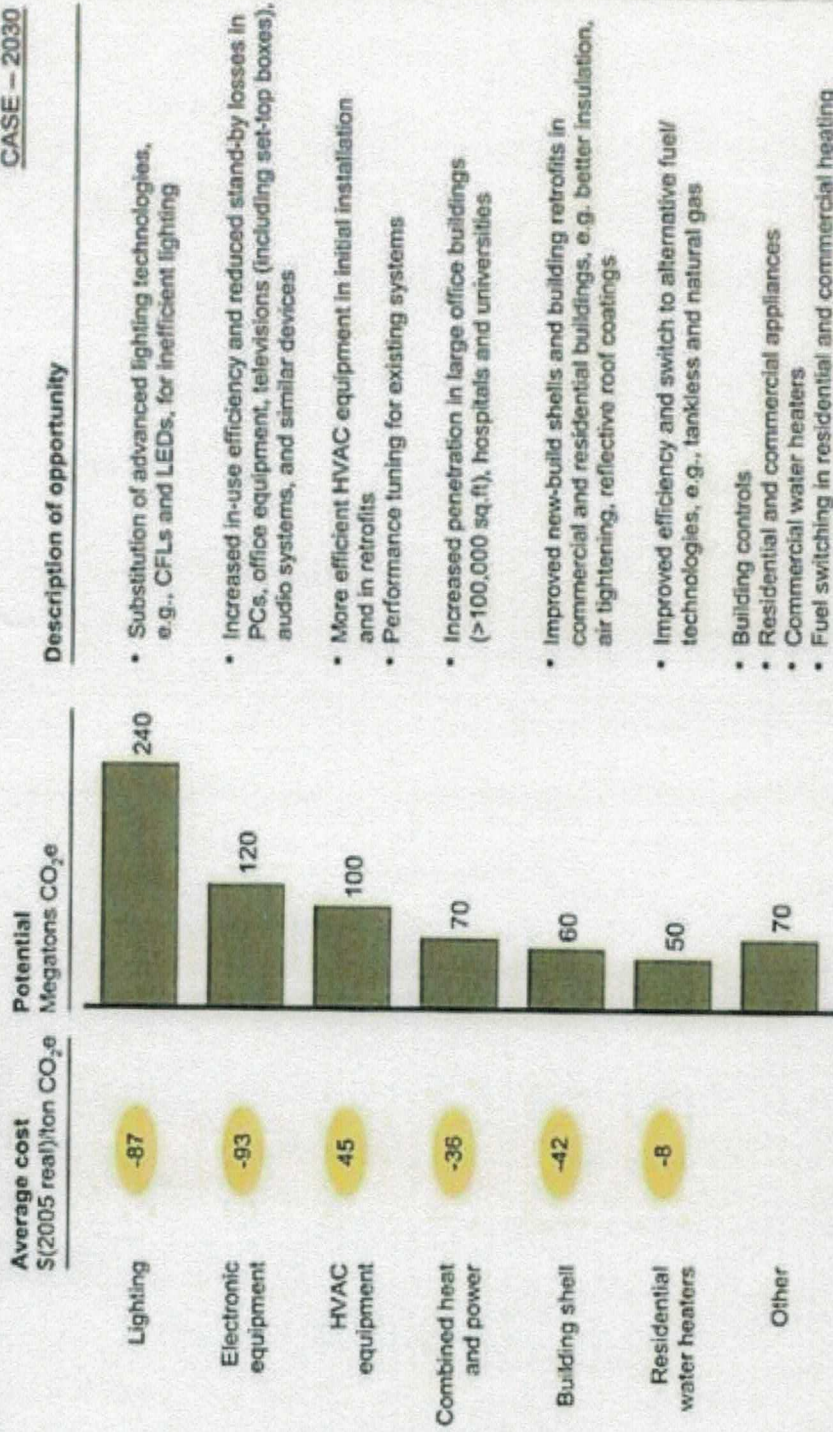




# ABATEMENT OPTIONS – BUILDINGS-AND-APPLIANCES CLUSTER

Options less than \$50/ton CO<sub>2</sub>e

MID-RANGE  
CASE – 2030

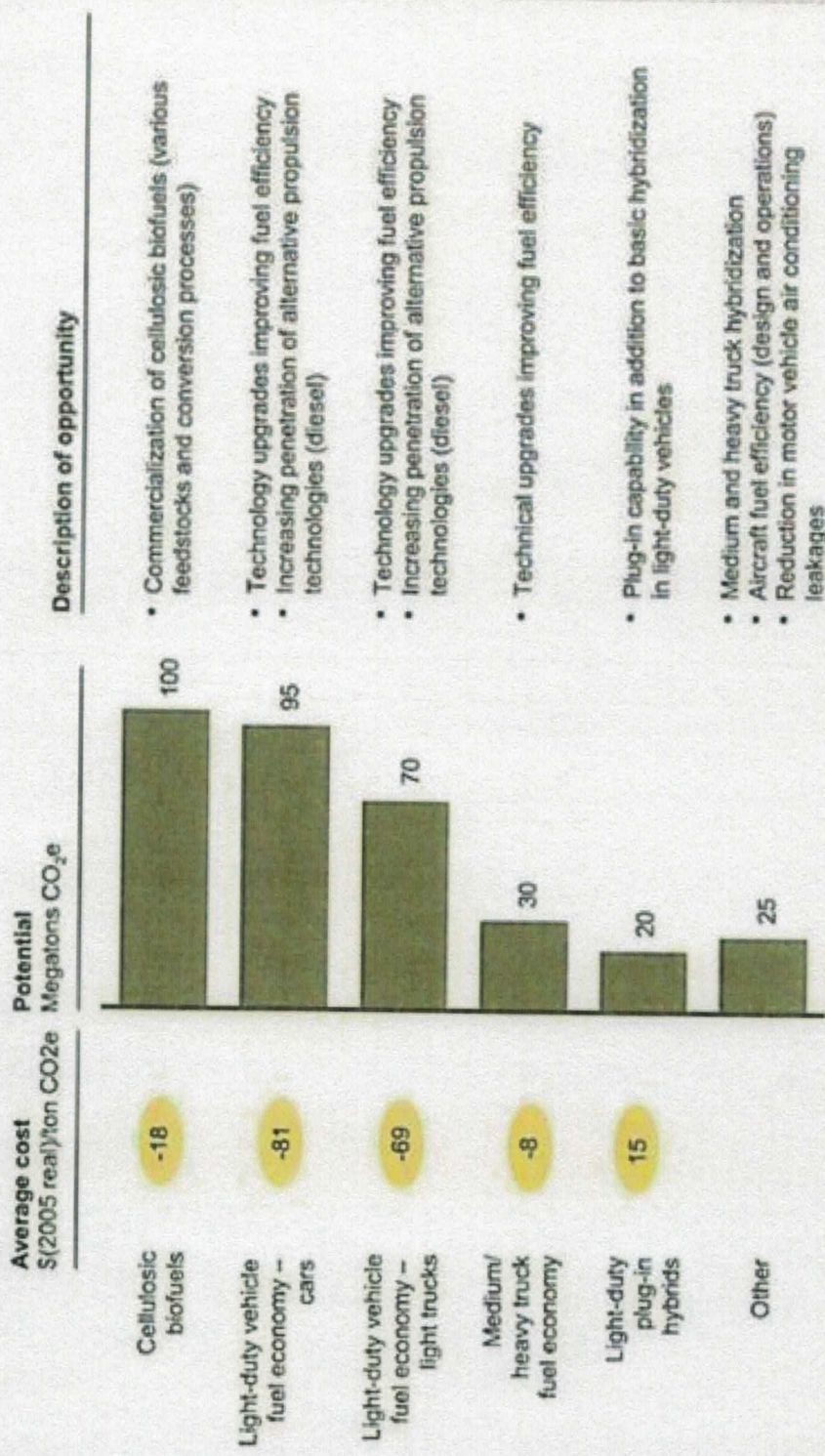




# ABATEMENT OPTIONS – TRANSPORTATION CLUSTER

Options less than \$50/ton CO<sub>2</sub>e

MID-RANGE  
CASE – 2030

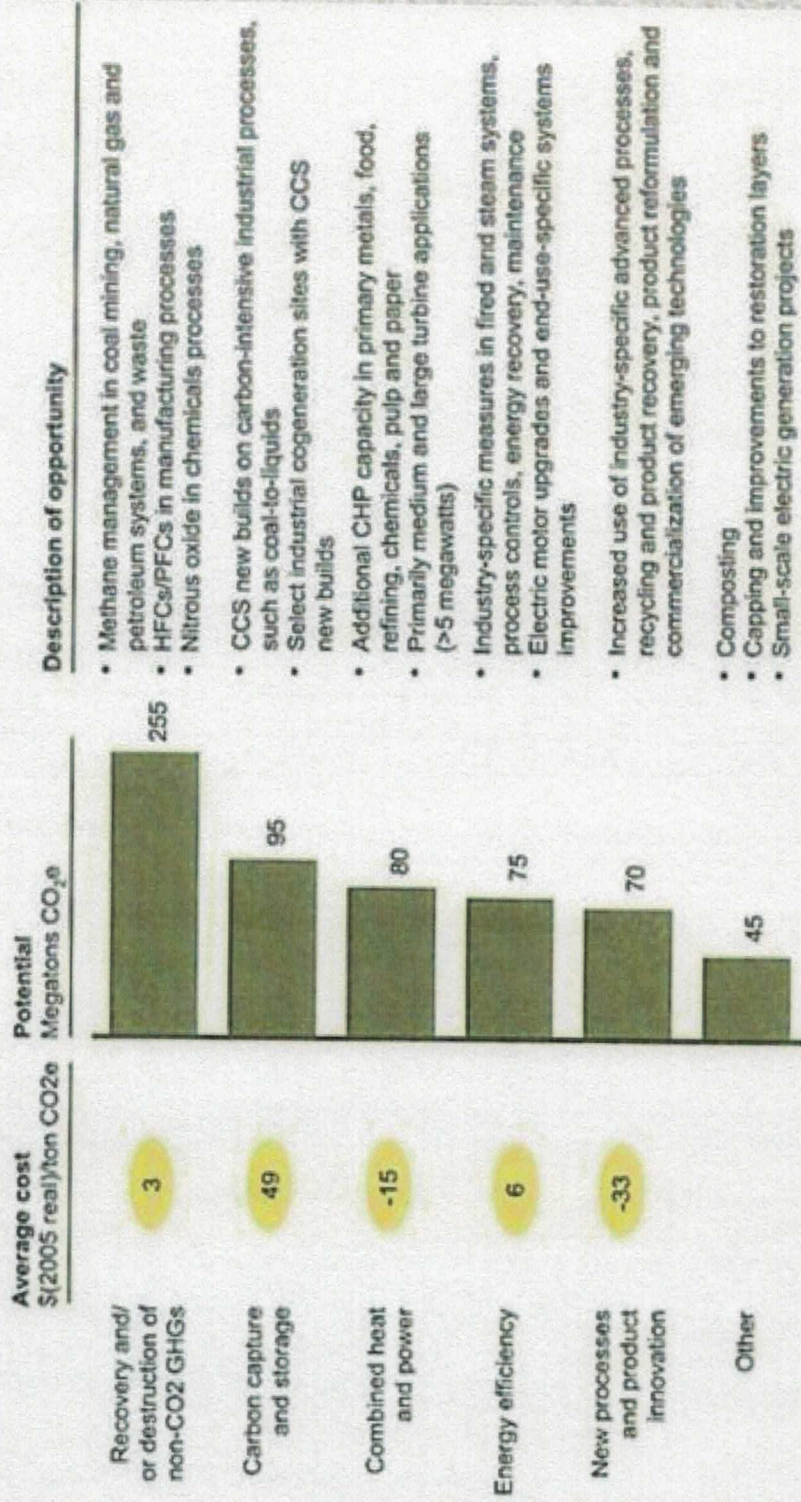




# ABATEMENT OPTIONS – INDUSTRIAL AND WASTE CLUSTER

Options less than \$50/ton CO<sub>2</sub>e

MID-RANGE  
CASE – 2030



## Description of opportunity

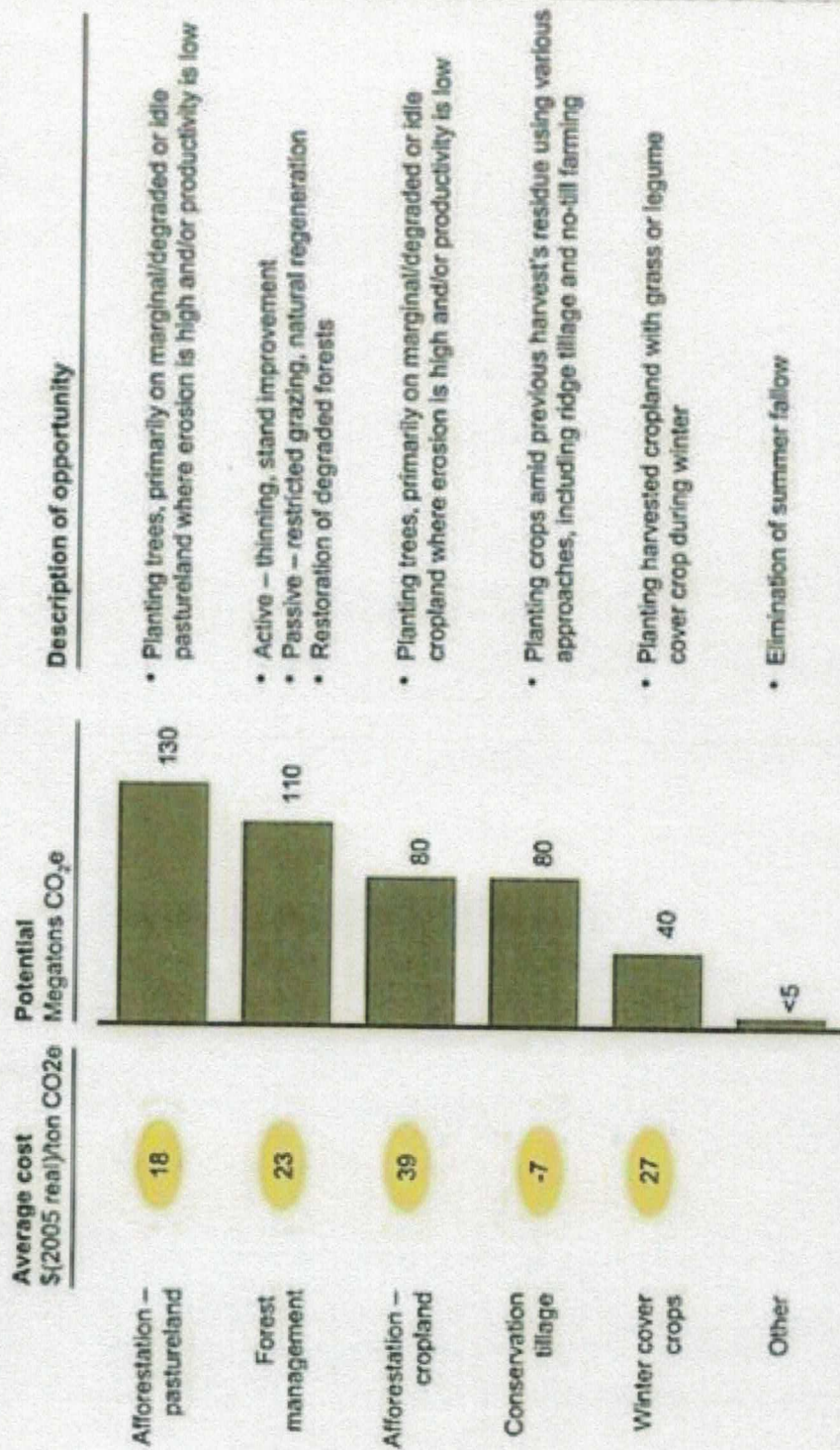
- Methane management in coal mining, natural gas and petroleum systems, and waste
- HFCs/PFCs in manufacturing processes
- Nitrous oxide in chemicals processes
- CCS new builds on carbon-intensive industrial processes, such as coal-to-liquids
- Select industrial cogeneration sites with CCS new builds
- Additional CHP capacity in primary metals, food, refining, chemicals, pulp and paper
- Primarily medium and large turbine applications (>5 megawatts)
- Industry-specific measures in fired and steam systems, process controls, energy recovery, maintenance
- Electric motor upgrades and end-use-specific systems improvements
- Increased use of industry-specific advanced processes, recycling and product recovery, product reformulation and commercialization of emerging technologies
- Composting
- Capping and improvements to restoration layers
- Small-scale electric generation projects



# ABATEMENT OPTIONS – TERRESTRIAL CARBON SINKS

Options less than \$50/ton CO<sub>2</sub>e

MID-RANGE  
CASE – 2030

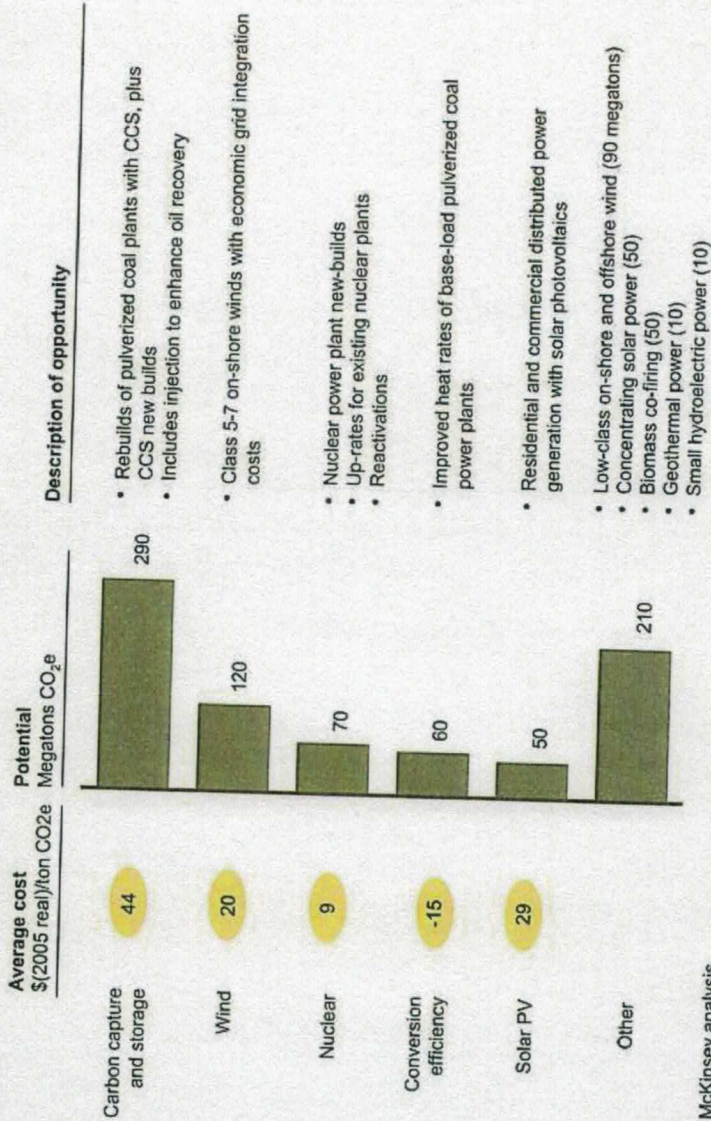




# ABATEMENT OPTIONS – POWER CLUSTER

Options less than \$50/ton CO<sub>2</sub>e

MID-RANGE  
CASE – 2030



Source: McKinsey analysis

The interplay between energy efficiency and additions of zero-carbon energy sources has a noteworthy impact on the cost of abatement. Assuming energy efficiency measures take effect within the next few years, they would “abate” the construction of coal- or gas-fired power capacity that would have otherwise been built to meet incremental demand for electricity. In most service regions, zero-carbon power generation (e.g., renewables, nuclear) will come on line over the next 5 to 15 years, abating the remaining expected new-build fossil-fired capacity and eventually displacing and retiring some base-load fossil-fired power plants. At this point, additional renewable energy sources will incur the expense associated with retiring productive (though aging) assets. As a consequence, the cost of abatement through renewables will rise as their growing presence leads to the retirement of fossil-fired generation capacity.