

US EPA ARCHIVE DOCUMENT

## **Quantifying the Jobs Impact of Clean Energy**

### **U.S. EPA State Climate and Energy Technical Forum**

**Moderator: Catherine Morris**

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Catherine Morris: Hi, this is Catherine Morris with the Keystone Center. I am going to pause for just a minute until we get some more of our participants on but I did want to welcome you to the third in the series on assessing the impact from clean energy. This Webinar is going to be on assessing the jobs impact. So we'll get started in a minute but we've had a little bit of lag between the people that are trying to join the audio. In the mean time for those of you who have joined you might want to download some of the presentation materials at [www.epatechforum.org](http://www.epatechforum.org). You'll see that at bottom of the agenda and you can find there both the background materials as well as the presentation materials to follow along.

We will – in about a couple of weeks - we will also post the recording for this so that you will be able – for those of you, I know I got a couple of messages from some of you, who can't stay the whole time or are joining late. Again that message is – or that Web site is: [www.epatechforum.org](http://www.epatechforum.org).

Everybody is muted as you enter the room so when you want to ask a question we ask that you use the Q&A bar on the right hand side, where you have a control panel. Please feel free to type in your questions as the speakers are speaking and we're going to pause after each of our speakers and allow them a chance to answer some of your clarifying questions. Then we will save the bulk of the questions till the end of the three speakers or four speakers and have a little bit more discussion.

So we have about 130 individuals joining us today and I will turn it over to Denise Mulholland at EPA to get us started.

Denise Mulholland: Thanks Catherine. Well hi and thanks everybody for calling in to listen to the Webinar as well as those who are going to be speaking at today's Webinar.

I just wanted to welcome you today and again my name is Denise Mulholland and I work for EPA's State and Local Climate and Energy Program. What I am going to do is I'm going to get us started before the three main speakers come on and give you an overview of how clean energy investments affect jobs.

I'm going to describe at a high level the methods that are available and things to consider as you estimate the potential job effects of clean energy, and then I'm going to pass the baton to the other three speakers who will describe what they have done to estimate jobs in their state.

So Catherine is going to get my slides up here and ready to go and then I'll just jump right in.

OK, so what do we mean by clean energy? Clean energy initiatives are those that encourage energy efficiency, renewable energy or clean distributed generation. So when we're trying to decide - when policymakers are trying to decide - what initiatives to choose, policymakers or analysts typically quantify the cost but not necessarily the benefits of clean energy and doing this is underestimating the value of clean energy. And what kind of benefits do I mean? There are benefits to the environment and public health; there are benefits to the electricity system of clean energy, as well as benefits to the economy including the creation of or support for jobs.

So, by quantifying these benefits what you can do is beef up the benefits side of the benefit-cost equation so that you can more accurately and fully reflect both the cost and the benefits and then make decisions by factoring in both of those aspects. Quantifying these benefits can also help you show how clean energy can achieve multiple goals and, maybe not just the initial perspective that you're looking for, the initial purpose that you're going for, but it can

help you identify other ways that clean energy can achieve your goals and then it can bolster support for community initiatives.

So – let me move to the next slide. How does clean energy affect the economy? Next slide please. Investments in clean energy result in both costs and benefits, and what these costs and benefits do is they change the flow of goods, services and income through the economy. I'm waiting for the slideshow to catch up.

Catherine Morris: So (Margaret) if you could hand the controls over to us and we will pick it up from here. Sorry folks.

Denise Mulholland: So typically – I'll just keep talking while we're working on getting the slides - I said that there are costs and benefits to clean energy, and we typically do see the costs reflected in the analysis. And what types of costs am I talking about? Well there are program administrative costs that you need to think about when you're considering a program or a policy, and these are the costs that it takes the government or a utility or whatever to run the specific program that you're considering.

There are also equipment purchase, operation, and maintenance costs. So what those are, are the costs that essentially your program is probably encouraging or inducing by requiring investments in specific technology. That's a cost that has to come from somewhere and somebody's pocket unless it's all their savings.

In addition, there might be some decreased demand, revenue and jobs from those companies that don't provide the clean energy technologies or for fossil-based electricity companies, for example. So perhaps an electric utility that uses generally only fossil-based electricity or generates only that (type of electricity) may see a decrease in their demand if there is a renewable portfolio standard put into place. So that might then decrease their (own) demand from their suppliers for input, and these types of effects can filter through the economy and potentially lead to job loss which then reduces the amount of money that some workers might otherwise be spending in the economy, on groceries, eating out, that sort of thing.

So these are some of the costs that folks typically consider and that are important to consider when you're exploring or looking at a potential initiative for clean energy, but these only tell part of the story. There are benefits that come from clean energy programs both directly and indirectly that are important to consider as you're looking at policies. What type of benefits am I talking about?

We have increased demand, revenue and jobs for those companies that do produce clean energy technologies and equipment services. And then when they see an increase in their demand they have to produce new appliances or more appliances that increases their demand from their suppliers who give them the inputs that they need to develop those products, and that can increase - it can lead to - jobs through the expansion of companies, and then that gets more people spending more money locally— on their groceries and on their entertainment and that sort of thing.

So it also – one of the economic benefits can also be lower energy and fuel costs that accrue to the consumers, companies or utilities over the targets of the program based on the fact that they don't have to spend as much money on these fuels. We may see deferred costs for new power plants, programs that can reduce the growth in energy demand might defer or put off the need to build new power plants then we don't have to spend that money today, we can put that off for 10, 20, 30 years perhaps.

We may also experience reduced healthcare costs and increased labor productivity because we now have better air and we have less illnesses and less people having to take days off of work and spending money at the hospital. Essentially we have more productive people who can spend money on other things. We also might see enhanced property values because of cleaner air and cleaner water. Your communities or your State may be more desirable for people to want to live in and work in and play in.

So considering both the costs and the benefits of an initiative will produce a comprehensive analysis that more accurately depicts the full value of clean energy in your area and will help you choose those options that will be both beneficial to you and match your priorities.

So what are we missing? I think I just jumped ahead here. So what are we missing now in terms of job support if we exclude the benefits and where the money goes? What I have – what I'm trying to flip through next is a slide that will give you a visual illustration of what happens on the benefits side in terms of where the money goes and how it flows through the economy.

And so what I want you to think about is: Imagine the government launches a rebate program and so a variety of jobs are going to be supported along the way, as indicated in yellow boxes. We have the government and they spend money and they spend money on – they hire consultants or marketers or auditors to help them run the program and then they issue rebates to businesses consumers or to industries.

And those folks (consumers or industries) then spend those rebates, they spend that money on investing in energy efficiency or renewable energy technology. And that to build that technology you need inputs and you need labor, this is really a simplification just to give you the idea. You need labor. You need folks to build the equipment and you need inputs to the equipment, maybe it's steel for windmills or for specific appliances.

So with the folks that are now building the equipment, what do they do with their money? They spend the money in the economy on their mortgage and rent and entertainment and goods and services, big screen TVs, that sort of thing, and these expenses support jobs in those particular industries or businesses.

Moving down to the steel or the input side of the equation, what do they need to get steel? Well, you need raw materials and you need labor and you need energy to get your product, and in order to get the raw materials out of the ground, say it's iron, you need people to do it and you need equipment to do it.

So you've got jobs there in mining and you need capital equipment which then requires you to spend money on steel and labor and energy. And so with respect to the energy (which you also see down here below as with steel),

energy, in order to make the energy you need to purchase steel, you need to purchase capital equipment and the fuel. Depending on what you're using, this may support jobs in mining and drilling, depending on whether it's coal or natural gas or what type of fuel you're using.

So now this is sort of what happens when you invest in a specific technology, the clean energy technology money flows through, but you may also then see energy cost savings particularly if it's an energy efficiency type of investment. And so with the energy cost savings what that does is that it increases disposable income for consumers and now they can spend more money on goods and services that they would like to spend their money on. And then for businesses what they can do is they either can give it out and they have new profit they can give it out in dividends, they can hire more workers or they can invest in more products and more output.

So this is just a simple illustration of what's represented on the benefits side of an investment that is important to consider as you're moving through and doing your analysis.

So how can States estimate the job impacts of communities? Well, there are a range of approaches to estimate the jobs effect. There are basic methods that are essentially screening approaches that give you a ballpark or a back of the envelope estimate, and then there are sophisticated methods. These are static and dynamic modeling tools that can be proprietary or non-proprietary, but they generally are more sophisticated or more complicated, but they are available to states and local government.

Our speakers today are going to – they've used a variety of methods to conduct their analyses and they're going to describe them shortly and then I'm also going to direct you at the end of my presentation to a resource where you can find out more information about the different types of methods that are available as well as tools that are available to you.

So once you know what the tools and methods are, how do you pick among them? Well, there are many factors to consider including: time constraints - Is your analysis, do you need it tomorrow or do you need it a year from now?;

Costs - how much just the model costs, how much money do you have; Data - do you – how much data do you have available to you and how much data does the approach need; As well as your internal staff expertise - you're not going to invest a lot of money in a big sophisticated tool if you don't have the staff to run the model. And also there is overall flexibility and applicability of the particular tool that you need to consider.

So the table below - I'm not going to walk through it because you can do that certainly on your own and there is more information at the resource that I will direct you to - but basically what it just shows you is that there are advantages and disadvantages with the different methods and there are appropriate times to use each one – things that you should consider when you're choosing a method for estimating jobs.

So things to consider, in addition to those as you're moving forward with your analyses and you're thinking about and you're listening to the speakers that follow me: First: all methods involve inherent uncertainties and numerous assumptions. These are not crystal balls, we do not have a crystal ball. You need to understand the different strengths and limitations of the approaches that you're using or that others are using and make sure that it's appropriate and you use it appropriately.

When you're planning an analysis take a step back and think how the money is going to flow to the economy. So who is going to pay for the particular program? Where does that money come from and then where does it go? These are all important questions that if you give somebody money it has to come from somebody else. And if you take money from somebody you have to give it to give it to somebody somewhere in the economy. You need to just think those things through and map them out and there are some suggested questions to think about on my slide.

You should also be very clear in your assumptions and your sources regarding both your costs and your benefits. What do your results include or not include? Are you – for example, are your job estimates net estimates or gross estimates, are they in job years or in jobs? Is it a rough estimate or is it a

pretty sophisticated analysis? Those are things that you should just be clear about when you're reporting your results.

And then finally I encourage you to invite experts to provide input to the analysis and your assumptions as well as to review your results because that will really help improve the credibility of your analysis as well as bolster support for it in the way that it is received.

So with that I want to just end by directing you to the resource that I mentioned to you: EPA's Assessing the Multiple Benefits of Clean Energy: A Resource for States. You can see the link on my slide on the screen right now. There is also a four-page background document on the Tech Forum website that Catherine mentioned where you can find more information about this document and receive all the links to it, and certainly you can feel free to follow up with me if you have any particular questions about it.

And what I would like to do now is ask you to hold off on any questions for me until the end of the call, you can send them in but we won't answer them until the end of the call, and what I would like to do now is turn it over to our next speaker and have him describe to you what he did in the State of Massachusetts to help them estimate the job impact of their clean energy and climate plan.

With that let me introduce Dr. Marc Breslow. Dr. Marc Breslow is the Director of Transportation and Buildings Policy with the Massachusetts Executive Office of Energy and Environmental Affairs. In 2010, he helped lead the team that developed the State's clean energy and climate plan for 2020. And he is now charged with coordinating and implementation of that plan. He is also currently the Co-chair of the Climate Change Steering Committee at the conference of New England governors and Eastern Canadian Premiers.

Before joining the administration of Governor Patrick in Massachusetts, Dr. Breslow was Executive Director of the Massachusetts Climate Action Network. He has a PhD in Economics from the University of Massachusetts in Amherst and Dr. Breslow, I welcome you and turn the controls over to you.

Thank you.

Marc Breslow: Thank you. I appreciate you having me around here. Just one second here, OK? So hopefully we're going to bring up the presentation. It's going to show my screen somewhere, all right. Can someone say whether you can see my screen now?

Catherine Morris: We can see your screen.

Marc Breslow: All right good.

Catherine Morris: You might want to make it –

Marc Breslow: With the slideshow, right? Slideshow, OK, here we go. All right, so we're going to first go through some slides that show our estimates of energy cost in Massachusetts. This first slide here is the direct energy cost for households. Basically just homes and personally owned automobiles as these are estimates for 2008 and that's a fairly substantial cost, a little over \$5,000 per household and that's giving you the general sense of this is where the jobs are going to derive from largely, which is reducing people's energy costs.

The next slide, these are now the costs for all forms of energy usage in the State not just direct costs to households, the cost to business and institutions also, and you add them all up, all fuels plus the non-fuel costs of electricity and the average in 2007 to 2009 was about \$25 billion for the State which comes out to a bit over \$4,000 per resident in the State. Or you're talking a bit over \$8,000 per household in the State.

Then one analysis we did was just asking how much of this money leaves the State? Massachusetts is a State that has no energy production of our own and no refining of fuels, so this is somewhat more dramatic for us than it would be for other States since it's largely a loss.

And what we found is that approximately 80 percent of the money related to energy expenditures leaves the State. It's paying either for fuels or for imported equipment, imported materials or it's paying for the capital cost of constructing facilities and you pay for those capital costs through either debt

service to banks or other lenders or to payments to bond holders or payments to stockholders of companies and since capital markets are nationwide or worldwide, practically all the funds for capital costs or debt service can be assumed to leave the State.

What we found is that if you count all the costs of households, businesses and institutions, the amount of money leaving the State is a bit over \$8,000 a year per household in the State. Another way of looking at it is how much of our economy does that constitute and it's a bit over 5 percent of the State's total economic output that's leaving the State, just to pay for energy costs.

Now what do we do about that and how do we propose to create jobs? Mass's energy and climate policies were greatly revamped in 2008, we passed several pieces of legislation. The first one is called the Green Communities Act and one of the provisions of that legislation requires all electric and gas utilities in the State to fund all energy efficiency if it's less to the degree that it's less expensive than providing new electric or gas supply.

People, is this help thing on the box showing up on the right on other people's screens and blocking it, blocking part of the screen?

Catherine Morris: No, that's just on your screen, don't worry about it.

Marc Breslow: Just on mine, OK, fine.

Catherine Morris: If other people would like to – minimize your control bar, there is a red arrow on the tab on the left hand side and you can – that will minimize it and get it out of the way but that shouldn't be – yours isn't blocking anyone's Marc.

Marc Breslow: OK, good. So that was probably the most important part of the Act. There were also a number of other parts including ramping up our RPS requirement.

A second law passed in 2008, The Global Warming Solutions Act, required us to reduce greenhouse gas emissions by 10 percent to 25 percent below 1990 levels in 2020 and 80 percent in 2050. And the percentage between 10 and 25 was left for later decision and that decision was based on our energy and climate plan that we developed over a couple of years, and at the end of that

development process at the end of 2010 we set the greenhouse gas reduction requirement at 25 percent for 2020.

Between the laws and that plan that determine the actions that we were going to take to get there, on this next slide what you see are some of the – most of the largest items in our plan, and how much money we expect them to save both households and consumers as of 2020. This is based on some very extensive analysis and figuring out implementation of bills and it's also both State law and taking account of the impact of federal standards on our State.

You'll see for electric efficiency which is based on that 2008 law, we're estimating a reduction in electric cost of about \$2-1/2 billion in 2020, that's the largest item in our bill, and that's through very aggressive electric efficiency programs which, I think, we now have the highest targets of any State in the country for that for the year. Just to give you some sense of the numbers for the year 2012, which is the furthest outlook currently projecting in detail, we're estimating that the electric utilities – their target set by the plan is to reduce energy sales by 2.4 percent through efficiency programs conducted during the year 2012.

And then you've got natural gas efficiency, fuel oil efficiency, building codes, appliance and product standards which are largely federal in California, vehicle efficiency standards both for light duty and heavy duty, and then the last two policies are State policies which are in our plan but not yet implemented that we expect to have implemented well in advance of 2020. Altogether we're expecting to save over \$6 billion in 2020.

Not in this list are renewable policies for which the analysis is more complicated and the cost less certain. So for the purposes of today's presentation we were just looking at the policies that are clearly energy-saving and cost-saving.

All right then – well then – so these are all dollar savings and then you want to go from here to job gains and then you need other methodology for doing that. There are several methods for that, Denise talked about it a little bit and I'm just going to go over this very briefly. The simpler methods are what are

called input-output models, the more complex ones are kind of metric models or other general equilibrium models.

In our analysis we – and I used the RIMS II data from the U.S Department of Commerce which is the cheapest thing to do. I don't necessarily recommend doing this because you have to know how to use the data otherwise you're just going to get the data and you don't really get – the Department of Commerce is not set up to really explain to you how to use it, it's not a full piece of software that you manipulate, it's just data.

Slightly more expensive but easier to use is the IMPLAN data system which is doing something quite similar but is a full piece of software. So either of those will work, it's relatively simple, if you do good econometric methods you're getting a more complex analysis, a somewhat fuller analysis but it's also going to cost you more and take more time to use.

I'm not sure how I can explain well in a very brief period the difference between the two, but in simple terms or just to give an example, if you're doing an input-output model and you implement a large-scale energy efficiency program, an input-output model is not going to tell you that if you implement this program and you put a lot of skilled electricians to work in making electric efficiency upgrades in both residential and commercial buildings-- it's not going to tell you that you might tighten the labor market for electricians in your State, raise their prices to some degree, cause a shortage of electricians and make it harder to implement the program and make it more expensive and therefore, reduce your gains.

An input-output model is not going to show you that kind of a price change to the labor market, whereas in theory anyway, an econometric model such as REMI will do that.

For relatively small scale changes to an economy, if what you're doing is only a small piece of the economy, you can probably live without those complexities, but they could have an effect and the example I gave is one where what we're doing to our energy sector is large enough that you actually could get such an effect on the labor market. And you could also get costs on

impacts like that on product markets or on materials. And I won't say any more about that for now.

Now why do you get an increase in jobs from cutting energy costs? Well, what people mostly think of is the direct job creation in the efficiency industries, in construction, in consulting, in manufacturing, and that's what's easiest to talk about, those are the direct jobs. But in my calculations and I think in most people's calculations it's actually not the biggest impact, the bigger impact comes from keeping more money within your geographic region, whether that's a State or a city or a county or whatever you're looking at.

And this holds more surely if your energy is mostly imported, and what's happening is you're simply reducing both households' and businesses' expenses on energy that's coming from outside your area, and they can then take that money and use it on other things. And those other expenses will tend to be more locally-based, whether you're spending money on house maintenance or medical care or buying food or education, whatever it is, it's almost assuredly more money staying in the State than on energy in most geographic areas.

Also efficiency programs – implementing the programs themselves tends to be more labor-intensive than energy supply costs, depends on what you're doing, there's a variance there. For example, if you're installing installations that's more based on local labor cost than if you're putting new lighting technologies in a commercial building in which more of the money is paying for the lighting of the light fixtures themselves than it's paying for the labor costs. And then also payments for capital cost which are a higher portion of the cost for energy supply than for efficiency largely go out of State.

This slide now gives our general estimate for how many jobs you get per dollar of spending of a particular type, and what you see is that for a million dollars of spending, if you spend it, and this is specific to Massachusetts since we have no energy supply of our own, if you spend it on an energy industry, you're getting in the neighborhood of one job per million dollars of spending.

General household spending, which goes all over the place, some of it goes out of State but most of it stays in the State, that's for all the things the households put their incomes to, is getting you around nine jobs per million dollars. So you're getting an increase of eight jobs or a bit more for every dollar that you can shift from specific energy expenditures back to households.

You get a similar effect for business, the calculation of both the household spending, jobs multiplier and the average business spending multiplier are kind of complex. It's one of the more complex parts of doing this analysis and they'll be different in every State.

The data source –

Catherine Morris: Marc, I just want to give you a quick time check, we've got about two minutes.

Marc Breslow: OK, I'll try to be quick here. These are the primary data sources used to construct these multipliers and from doing all of that, when you combine the multiplier numbers with the total savings that we were estimating both in transportation and in buildings, in which you're reducing the first three items, are all buildings-related energy costs and gasoline is obviously transportation.

When you combine energy and transportation policies with these multipliers, you then get our job – the job changes. As I said most of it comes from reducing spending by households and businesses, some come from the efficiency programs themselves and there are some job losses in the energy supply system, and interestingly, quite substantial job losses by cutting how much driving people do and the speed at which they drive a little bit. You actually cut down on medical costs, insurance bills and auto repairs which have a lot of jobs in them.

And these were the results that we got from Massachusetts for 2020 in which we estimated about 13,000 jobs total (entrenched) to our transportation policies, and about 23,000 in buildings, and then a number in renewables which I'm not really talking about today.

Just from the efficiency policies we were getting about 36,000 jobs in 2020, and these are jobs, not job years, in that we expect these to continue to the degree that it's based on saving energy which is most of it, the saving energy is a permanent effect. To some degree it's also based on the spending on efficiency industries which will go on for some years – I don't know how many years it will go on but we're not anticipating ending that after a year or two. If that was to terminate at some point then these numbers would go down.

And this is how you can reach me if you've got more questions.

Catherine Morris: Thanks a lot Marc.

Marc Breslow: Sure.

Catherine Morris: We – any questions, just clarifying questions before we move on to our next speaker, please enter them into your control bar over on the right hand side.

We don't have any right now, Marc, but we are going to come back to you at the end of Karl's presentation; we may have some come in at that point. I'm going to go ahead and introduce Karl Michael. He is our next speaker and he is the Program Manager for the Energy Analysis Program at the New York State Energy Research and Development Authority or NYSERDA.

Michael has been there for – I have over 20 years but then that information was probably about five or six years ago, so Michael you have probably been there almost 30 years by now and he has really been in charge of the modeling and analysis for all the State energy planning, including the environmental modeling, economic modeling, forecasting activities, and in that position he has covered everything from the modeling related to the RGGI project, the Regional Greenhouse Gas Initiative in New York, the Greenhouse Gas Taskforce that New York launched.

The Acid Deposition Reduction Program, the Clean Air Interstate Rules, just about everything, and he is going to talk today more about the work that he has been doing modeling the benefits under the Energy Smart Program which

is the energy efficiency and other programs funded by the System Benefits Charge in New York.

I'm going to go ahead, and Karl, if you will just let us know when you would like us to advance your slides and I'll hand it over to you.

Karl Michael: Yes, you can go ahead and advance the slides. As Denise said, yes, I have been doing this a long time-- we'll just go with that. And I want to point out a fundamental difference in what I am about to show you from what Marc talked about is we are looking back whereas Marc was looking forward.

The analysis that we are showing you here is our best estimate through the year 2010 based on dollars that have been spent over the past 10 years. These are based on data that was gathered the best that we could for the programs that we've run over that time period and so of course we've set these benefits to go forward but just understand that this is our best estimate over what has been accomplished today.

Our first question, and Denise asked me to focus on this, why did we do this? Why do we want to estimate jobs, and the best answer I can come up with is, well, everybody wants to know. Anytime jobs just seem to be the one metric that people can hold in their hands; every politician is talking about creating jobs in a time of questionable economies and economies that are sometimes either stagnant or going backwards.

Anytime anybody can come up with a government policy that one can demonstrate and be convincing that we indeed are creating jobs, doing good things for the economy, that is the best way of arguing that we do is worthwhile, it's a good way of spending public funds. That's why we do this-- people want to know how many jobs did you create.

And we are able to do that part way. One thing is that anytime we talk about jobs people want us to put our names and addresses and they want to say who are these people and where do they work and which company are they employed at and which I want to make it clear when we do this stuff, while we are trying to make estimates on what we have already done, these are still

models, these are still theoretical jobs, they are based on ratios of what happens in the economy and a given dollar expenditure for various things.

So that's why we have to draw the lines that we believe the numbers that we put out here, but physical estimates – don't ask people their names and the people and the companies that they work for.

These are still estimates and these are still models but nevertheless, we think they are pretty good estimates and always emphasize that we do everything on a very conservative basis because people love tearing this stuff apart. I was told that anything we estimate is on the wrong side; it's a lot of things that jobs can be created out of, work that we do that we are not counting here. So we are trying to count the concrete stuff. But increasingly, over the last 10 years there is just a lot of pressure if you work for the government to justify spending public money, so that's what this is all about. It's about showing that we can spend public money and that we can get benefits that exceed the cost.

So if you go to the next slide I just want to talk real briefly about government programs, it all comes down to benefit cost ratios, and that is the one universal metric that is used to measure programs and I am guessing that people have some familiarity with this employment thing then we could talk for hours about how to calculate benefit-cost ratios but I just wanted to emphasize that the job's calculation is part of the benefit-cost ratio and we start out with –just calculate basic ratios based on resource benefits and that's just a very simple energy saving and so that's the most concrete kind of calculation.

The jobs benefit is the second thing, which is non-energy impacts and the point of showing the benefit cost ratios is that the adder that's due to the jobs benefit is very substantial. If you look at total resource cost at the jobs benefit, if we are looking at the total benefit cost ratio of a 2 to 1, the jobs benefits are on the order of between 25 percent and a third of that. So they were very substantial.

That's the only point and we can talk – it's another whole discussion about how are benefit cost ratios-- but in terms of the universal measure, these jobs

impact, they really matter. We also do benefit cost ratios without the jobs impact and it's really important to know what are the contributing factors and if you go up the scale here the numbers become less and less certain, but they are very important. So keep going to the next slide.

Next slide- I'll keep talking as we are working on changing it, but there we go. The analysis I am demonstrating here is based on our Energy \$mart program that goes back to 1998. Our programs are run by a charge on dollars – cents per kilowatt hour across the State, not every kilowatt hour but I am not going to go into that (most of the kilowatt hours that are sold in the State of New York are subject to a small adder that goes into the System Benefits Charge fund that's used to run programs). The amount is escalated over time but in recent years it's been on the order of 175 million per year and that all adds up to 1.4 billion that we've spent through year 2010. So that's the dollar amount on which the numbers I am going to show you are based, so keep going.

The – switch in that flipped slide and I'll keep talking. You've heard a model mentioned, REMI model. That is the model that is used to come up with the numbers that I am about to show you. REMI is a proprietary model that we do pay for and there is some expense, whether it's expensive or reasonable depends on – that's all relative but we've determined in New York that it's worth our while to spend money because it's a way of demonstrating the value of what we do.

The advantage of using this REMI model compared to some of the other things that Marc went into more detail about- and there is no need for me to do right here- but there is an important distinction of REMI compared to some other kinds of analysis. That is its dynamic capability as opposed to just a snapshot in time, whereby REMI allows the economy to make changes according to the country changes that you've input into the model, the energy saving, any time a dollar is spent in the economy there is a ripple effect.

It ripples through the economy, through other sectors, and in the case of saving dollars for energy efficiency, particularly in the commercial sector it causes, because of reducing operating costs, it causes additional dollars to be

invested in those businesses and those numbers don't stop with spending that dollar in the economy, there is some inertia to spending dollars in the economy that results from energy savings. And some of the slides I'll show you later show how some of that works.

For purposes of this analysis we assume that the dollar spending stopped in the year 2010, but the graphics that I'll show later on are going to show you how the benefits continue after 2010 even if you don't continue to spend dollars. Not that we are saying we won't continue to spend those dollars, we have every intent of continuing to spend those dollars but the jobs estimates that I will be talking about here are jobs that our estimates to occur in 2010 and you can also see how the jobs continue in the future based on the dollars that are already spent, not assuming that dollars continue to be spent in the future.

Next slide. Some of the things we are not counting here, I said we are being conservative, there is no health impact measured here. We don't assume that energy prices go up in the future and we don't assume because of the market transformation while we – it's one of our great goals and what we do is try to transform markets. We only count concrete benefits that have already occurred, no market transformation is assumed. Keep going.

It's a little term – the term net jobs is absolutely critical to any analysis that one does. We are modeling both the positive things and the negative things. We are modeling the positive benefits of spending dollars on energy efficiency type equipment, lighting, motors, HVAC equipment. We are spending – bill savings-- get spent in the economy and we're counting that fact that we've lowered the price of electricity by eliminating some generation on the margin that's the price depression). Those are the positive benefits.

OK, next slide. Absolutely critical to doing a fair and sensible analysis is to count the negatives as well. And Denise had started to talk about this. The important thing is this money did not come from nowhere. It did not drop out of the sky. In our case in New York what we are doing is we are charging repairs more for the electricity and so we are counting the – that's a negative impact on the economy because consumers could have spent that money on

other things. So we are choosing to take money away from repairs, spend it on energy efficiency programs and so we are counting that as a negative cost.

The program participants are also spending some of their own money and that's also money that could have been spent on something else. So we also count that as a negative and there is also the negative impact on the energy industry because they are producing less product, so it's absolutely critical that you count both the positives and the negatives. And as we show the positives outweigh the negatives but it's – the negatives are not trivial. And this is the criticism that we often find with other analysis that we see done, is that only the positives are counted and the negatives are kind of ignored. So we would say that it's absolutely critical. Keep going.

Catherine Morris: Karl, just a time check, you have got about five minutes.

Karl Michael: OK, we are doing good. OK, this slide is the result of the analysis that was done here for our programs through 2010 and the – I just want to really emphasize that there are a lot of different ways of measuring jobs and they get reported in a whole lot of different ways, and as Marc was careful to say we are reporting jobs, not job-years.

This is a very important distinction. Job analyses often get extrapolated to include job-years-- what we are saying is in 2010 our programs have created about 4,000 net jobs. And what we are saying is there are 4,000 people working in 2010 that would not be working had our programs not occurred. And I also noticed that this graph shows above the zero those are the factors that are positive. The factors that are negative are shown below the line, the black line shows the net impact when the negatives are subtracted from the positives.

And just to give you some idea of how numbers are often reported, there is the concept of job-years and that would mean that you would sum up all the jobs from 1999 to 2010 and might report that our programs have created 24,000 jobs, those numbers are in that box at the top.

And I am just pointing this out to show some ways of seeing through the rosiness of some analyses that are often held up for various entities to brag about programs. Again, we are trying to be very, very conservative but if we wanted to count the job years through 2010, same number of dollars, same number of gigawatt savings in 2010, we could say that we have created 24,000 jobs, and if we were going to count the jobs that result from – because these jobs don't stop in 2010 even if we stopped spending money-- based on those energy savings, will continue to result in job savings going out in time so then we could say we created 70,000 jobs.

It's – but we feel like pointing out, measuring jobs for 2010 is the number that you can hold in your hand, you can understand what it is next to total employment and we feel that's the best way of reporting, it's the most fair, it's the most honest and it's the number that – you can understand what it is. Otherwise it currently has the appearance that you're just throwing out some big numbers that sound really good but when you look at current employment they're hard to hold in your hand and understand what they mean, so that's the way we report numbers.

Keep going forward. I want to emphasize that in doing this analysis we analyze each of these factors separately so that you can see what each factor is doing. And this is the impact of the spending on programs, you can see in the orange is what New York State spent. This is the repair money collected from all the repairs, whether they participated or not. The blue is the spending of the customer's own money-- that is. the participants in the program.

And notice that when the spending stops there is actually a negative sort of a – the economy trying to recollect itself, when you pull money out of an economy, there are some negative effects that are somewhat persistent. Keep going, I just want to show it's less important what each of these things are but just the fact that we are analyzing each of these factors separately and in the end aggregated them all to see what they all do together, and the energy savings-- this is the one that is absolutely critical, the total result is most dependent on these energy savings.

A lot of the other factors tend to kind of cancel each other out but it's the energy savings that drive this analysis. And notice that in 2010 we stopped spending money but those energy savings remain because equipment is installed. It continues to operate so you keep getting those benefits.

And the reason it dropped off, we've only assumed a 15-year life and again that's one of our conservative assumptions because you like to think that you transform the market and people aren't going to go back to the old kind of equipment but we are only counting the direct impact for 15 years.

Next slide. This is the negative of having taken money away from repairs to pay for these programs. Notice that after we stop taking money away from repairs there's still some more residual negative effects. Again we're being conservative and we're trying to not paint an overly rosy picture here. We're trying to show what happens in the economy when you pull money out of the economy, takes a lot to recover. So we count that too.

Keep going. This is the slide that I want to end with and this is the same slide that you saw five minutes ago. It's got one change to it, I just want to emphasize a kind of a universal one-size-fits-all metric that we've come up with because these numbers only reflect New York, I wanted to give some idea of kind of unitizing these numbers.

Any time we create a new program we don't necessarily go through this entire analysis to figure out what the impacts are but we found that if we look at – because programs tend to be – the net impact tends to be the impact of the energy savings of a lot of those factors, when you count the positive ones, when you count the negative ones, they roughly cancel each other out and what really drives the results is the energy savings even when you count all the other things that you need to count.

We have found that in a given year you take the jobs that you've created and you divide it by the gigawatt hours that you have measured in savings. A rule-of-thumb estimate for what you might create in a program: if you know the number of gigawatt hours– the savings that you have created with the dollars that you've spent is roughly 1.1 net jobs per gigawatt hour. Daily we

get calls from other people and organizations looking at program design and ‘how many jobs will I create if I did this?’

And rather than run an entire analysis if you want to get some general idea directionally of what – what kind of job creation that you might see, we’ve found this number to be extremely useful looking either backwards or looking forward so that if you are talking about energy efficiency programs and you’ve done things like subjected programs to resource cost tests where you know that the benefits exceed the cost.

I would comment that you could be – your program is creating jobs and I would suggest that the order of magnitude of the net jobs in a given year that you might create might be in the order of 1.1 net jobs per gigawatt hour. I’m not saying go out and use that number to measure as a substitute for doing modeling for what it is you’re doing. But if you’re looking for an order of magnitude, we found this to be a useful number. I expect a lot of different programs, if you know the number of gigawatt hours that you’re saving in a given year, that job creation numbers would look something like that.

That is – that concludes the formal part. I’m happy to answer lots of questions and I would emphasize to anybody that I would be happy to discuss this in any more detail, into some more detail the questions that I went once over lightly, but I’m trying to give you some idea of the kind of analysis that we’re doing here and –

Catherine Morris: Thanks Karl.

Karl Michael: which factors are important and how they work.

Catherine Morris: Thanks. We do have some clarifying questions and I want to let our viewers know that we are posting the contact information for all the presenters up on the website so that you can get in touch with them afterwards if you do have follow-up questions. That’s again: [www.epatechforum.org](http://www.epatechforum.org).

Karl, one of the questions was regarding the distinction you started to make between job years and jobs. Could you just put a finer point on that, what is the difference between job years and absolute jobs?

Karl Michael: If you could – a job year is one person working for one year. If you create one job and that person works for 10 years, that could be called 10 job years. And it's extremely confusing in terms of reading reports of analysis that are done because often these numbers are not distinguished. You will hear that X number of jobs was created but in reality they're job years. And so we're trying to be very careful about saying that in 2010 we're talking about 4,000 jobs and that is 4,000 people working in 2010 that would not be working if certain programs had not occurred. But the fact is –

Catherine Morris: I think that helps, thanks.

Karl Michael: Yes, OK. That –

Catherine Morris: One other question was that in your assumptions you mentioned that you hold the energy costs constant. Can you explain why that assumption holds?

Karl Michael: We're just trying to be conservative. Most people believe that in general that energy prices will go up over time and we're trying not to make analysis subject to differences in forecast of what fuel prices might do and if fuel prices go up in the future that makes the number of job estimates that would go up and so we're not counting that. It's just a way of being conservative.

It would be an overly high estimate to believe energy prices are going to go down but we're just trying to take that out of the analysis of what the expectations for energy prices are.

Catherine Morris: Thanks. One other was whether or not you've looked at the distributional aspect of job gains and losses. That is how they are distributed across the State?

Karl Michael: Yes, we have and it's part of the standard output of this model and output for REMI would be something like 80 different sectors, so yes, those 4,000 jobs

could be spread out across 80 different sectors. We just didn't show them there.

Catherine Morris: OK. If I could go back to Marc, Marc, there were several – as soon as we moved on to Karl, a number of questions came in. One was a topic that Karl has brought up a couple of times: the distinction between net and gross job gains. Did your analysis take into account the job losses? And is it – so all the jobs that you were talking about were net of losses?

Marc Breslow: Yes, it is, it is net. If you're looking – that's a general answer and for example with the efficiency programs the savings being shown in 2020 are net dollar savings, so it's the savings to businesses and consumers net of the cost in the year 2020 of spending on the programs by both businesses and consumers and by the utility subsidies which is what Karl was showing with some slightly different wording in his presentation.

Catherine Morris: Yes. Thanks. That's helpful, and a follow-up question was similar to the one that was asked of Karl. Did you look at where the geographical distributions or the sector distribution of where the job losses occurred?

Karl Michael: You said – did you say geographic?

Catherine Morris: Well yes, this is for Marc, I'm wondering if Marc – and you said you looked at it but I'm wondering if Marc did it that way.

Marc Breslow: The jobs gains or losses or –?

Catherine Morris: Well, I guess both. They did ask about losses but it would be interesting to know if you looked at that aspect.

Marc Breslow: Right. Not in the kind of detail that he did. In general you can say that the major job gains are in the efficiency industries themselves and then another big part are simply in the ways that households in Massachusetts spend most of their money, if they're not spending it on energy. So those are just the big spending sectors which you can just think about how you spend your own money. It goes to housing and food distribution and healthcare and education and so on.

And then the job losses come principally in narrow sectors where we're reducing cost, so that's energy supply and distribution to the extent that it exists in Massachusetts, so you're talking about retail distribution of fuels and electricity. And then interestingly as I said on the transportation part there were some fairly substantial reductions in expenses going to healthcare, auto repair and insurance.

Which brings up an interesting point that all spending may not – should not be regarded as equal in that there are ways of creating jobs which certainly we like and ways that we don't like. So, for example, we could have lots more auto accidents and create lots more jobs dealing with the consequences of auto accidents, we probably don't think that's a good idea.

Catherine Morris: OK, there are quite a few other questions that I hope we can get back to but I want to go ahead and introduce our final speaker, Suzanne Tegen.

Dr. Tegen is a Senior Policy Analyst at the National Renewable Energy Lab, and she's been particularly focused on the economic impacts of wind energy including spending a year as the NREL Liaison to the Department of Energy Wind Program in DC. She also works on supply chain questions and renewable energy policy issues, so we've asked her to talk a little bit about a model that has been developed to estimate – I'm going to pronounce this thing correctly, I don't know if it's JEDI, but it's a model that she's developed the job and economic impact model. So I'll hand it over to you and I see that your presentation is already up and running.

Suzanne Tegen: Thanks and yes, you did pronounce it correctly- it has nothing to do with Star Wars- but it is pronounced JEDI for Jobs and Economic Development Impact. And I'll just say upfront that the JEDI model is based on past projects, on real projects that are on the ground, we do interviews with developers and others involved, but it estimates jobs and impacts for future projects.

We created the JEDI model in 2004 to answer questions like these ones: how many jobs will be supported by wind in my community: if the new wind farm is put in, in my community, how many jobs will that be; what kinds of jobs will there be; and how much money will stay in my State as opposed to go out

of State? Local and State decision makers were asking us these questions and that's why we created the JEDI model.

This is just a brief overview to point out that analyzing jobs and impacts is important and of course today everyone wants to hear about jobs like we've heard today already. But it's only one component of an overall analysis. There are lots of other things to consider besides jobs and economic impact. Hopefully you wouldn't put in a power plant just based on job creation- especially with wind- you want to make it as a good resource and that kind of thing.

The JEDI model is user-friendly: it's a very simple, calculative, input-output model. This is a gross economic impact, so it's different from the other two that we've heard today. And the individual projects vary in key aspects that effect economic development in the local region: one example is if you have a local manufacturer in your State, then obviously your State is going to receive a much greater economic benefit than if you don't have local manufacturing.

It's very important to acquire as much project-specific information as possible when you're running the JEDI model: the more accurate the inputs, of course, the better the outputs, which is true with any input-output model. There's just an e-mail down below for questions if you have them and I'll show you that one again.

So, who uses the JEDI model? People like you and I, this list is not exhaustive but it just gives you an idea: we've performed State-level analysis for the Colorado Public Attorney Commission; for the Michigan TSD; several governors' energy offices; we've done reports for different States (Texas); and we've also help other people when they're running JEDI models in their States. We've done this in Illinois and elsewhere.

You can download the JEDI model for free on this Webpage. If you don't feel like writing that all down you can also just google JEDI or search for JEDI at our site, [nrel.gov](http://nrel.gov).

Today we're talking about the wind JEDI model but we do have other models as you can see there. We've got solar models, ethanol, coal, natural gas,

marine and hydrokinetic and more are coming. We have a transmission model that I'm actually working on, that's under development, a geothermal one is about to be online, conventional hydropower and then different size winds. We're hoping to someday also get a nuclear one, but we don't have that yet.

After you learn the JEDI model, and I'll go through in a second kind of how that works, you'll see JEDI results in three different categories and this has been talked about already today. In different analyses they're called different things but we call this the ripple effect and our first category only includes labor. Your output from your result is going to include project development and onsite labor impact, that's those jobs that you see right there, and a few others. But here if you're more of a visual learner, here are some samples jobs.

The second category includes the turbine, the wind turbine, and all of the supply chains as well as the jobs that go along with that. We've got steel mill jobs, parts and services, all the equipment, all the parts – it's been estimated that there are approximately 8,000 parts that go into a wind turbine and that's counting little nuts and bolts as well. In this category there are also property taxes, the financing, banking and accounting and all the jobs that go along with that too.

The third category is called induced impacts and we've heard different things from our two speakers before me, but these are- I can show you the slide which is what I call my shiny, happy people slide- and some people don't count these but I think these are actually really important impacts. This is money spent in your locality when a new wind farm goes up in your area.

And there really is increased revenue to- maybe not the flower shop- but you've got increased revenue to the hotels, increased revenue to the gas stations and the sandwich shops, definitely. So this is an important thing to count and we count it in this impact category here.

This is, if you had downloaded the model, this is the screenshot that you would see, and I'll just go through really quick instructions on how to run the

wind model. This is a screenshot of the Start page with high level instructions on running the model: you just press 'Start' from this page to begin your model run.

The model contains multipliers for analysis at the State level. If you don't want to use your State as the starting point, you can also customize it to run at the county level or several counties. But usually the default is your State level and it has State level multipliers for you. And our multipliers come from IMPLAN, you've already heard a little bit about REMI and IMPLAN. The backbone of the JEDI model is IMPLAN.

This screenshot shows the basic user input and all you need to do to run a JEDI analysis is put it in the State where the project is to be located, the start year and the project size. And then at this point you can press the 'go to summary impacts' button and that will give you the default data. However, it would be a lot better if you choose 'no' with that little 'Y' and you scroll down and choose 'no', and input your own project-specific data if you have it. And all of the white stuff here, and then in the other ones that you indicate places where you can put in your own data, so you put in your own operations and maintenance costs, you put in your own – the number of turbines or whatever it is.

These are the detailed user inputs, if you do have a lot of cost detail or other input. For example, there's an area here on the right for each line item where you can modify the local share percentage, and local share is the percentage of how much of the resources coming from in-State. If you have a blade manufacturer, for example, you can see there, on row 34, way over to the right on your local share you want to put 100 percent local if you're going to use blades that are manufactured in your State, and then you'll see that the result is a really huge economic benefit to your State.

I need to mention these caveats so people don't use the JEDI model to making them sort of exact numbers. The JEDI model is a simple input-output model, it is better than a rule of thumb calculation and it's based on real projects that are in the ground today. All the defaults are based on actual interviews of actual people. It's not a precise forecast, it's an estimate of overall economic

impacts and they need your context, like I said before, if you've got the good inputs like cost information then that's great to put in there.

The size of the project of course is important, and we've already talked about gross versus net jobs, so I won't go into that very much but just to say that this is a gross jobs model. That means that when you put – when you get a result from this it just means in your State this is how many jobs will be due to that wind project. It doesn't mean these jobs aren't coming from somewhere else, it doesn't – you can't tell whether the person who is employed now to install these blades was employed before or was unemployed or where they were employed or anything like that. You just know somebody in your State has a job because of this wind project and it counts the number of those people who have jobs.

The local sourcing levels, we've talked about that already a little bit, they have a very significant impact. We also count in full-time equivalent and I think the other two studies, the two, that just means if you have two people working half-time that's counted as one job. And these, already heard about job years so I won't go into that.

In any model you're trading off simplicity and understandability with precision, and so as you add more nuances to JEDI it becomes harder for the outsider to comprehend. Given the purpose of JEDI to stay simple, there's a need to keep the model as transparent and accessible as possible. It's – like I said, it's a simple model and it's an estimate.

If you have something that you're running, that you're going to base your decision on, you would want to use – you would want to pay whatever it is, tens of thousands of dollars and use a more complex model that will be an econometric model or use REMI or something like that.

Challenges to modeling renewables: when you're interested in tracking a more traditional power generation, maybe like a coal plant or something, there are standard industry codes that track coal plants and it's parts and it's workers. But renewable energy, like wind, doesn't have standard industry codes yet

that are used by the Bureau of Economic Analysis, the Bureau of Labor Statistics.

We have to create these industry mixers or industry libraries, is what they're called at IMPLAN, to use in the JEDI model. For example, there's no button that you can click on to see how many jobs there are in the U.S. wind industry right now, you have to really sort of piece that together from different research that you do.

The rest of these things I think I've already mentioned. The next few slides are from some research conducted by a colleague of mine that I helped him with for the Wyoming Infrastructure Authority. They asked us to look at some scenarios for their State. The base case was 9,000 megawatts of new wind to be installed over a period of time over the from 2012 to 2022, so for 10 years, and that's a lot of wind power. Wyoming has a lot of wind potential, as well as 1,800 megawatts of natural gas and then multiple units of transmission.

And this is just showing what their base case was for that, but I just mentioned that 9,000 megawatts of wind, and this is kind of just showing some of the results that you can get from JEDI. This shows the buildup of – as construction is kind of going on here- you can see the supply chain is building up. And then in 2022 when the construction stops, there are still jobs but they aren't as many as during the construction cycle.

This is kind of another way of looking at that, these again are jobs not job years. The axes here are different but this is just to show – you can see the annual employment during construction kind of ramps up there, and then on the bottom we have the installations of wind are increasing so then that's why the jobs are increasing as well.

I'm showing this slide to remind people that it's so important to look at a range of assumptions and inputs and to run sensitivity analyses. You always want to show low, medium and high cases, or something like that, just because no matter what model you're using, and- Denise said this in the beginning- that no matter what model you're using, it's – you're going to be wrong. You might be about right but it's not going to be, it's certainly not

going to be precise to get the number of exact jobs or anything like that, so it's always important to run sensitivity analyses.

And this is from research that I did a long time ago in 2005 but I just actually just added the slide because, when Marc was talking, it reminded me of this kind of flow into and out of your State. And so these numbers are not right anymore, this is from a long time ago, but the gist of this analysis shows that if you have a coal plant in Colorado, you can build that coal plant and most of the money goes out of the State, and in fact for each of these technologies most of the money goes out of the State. But for wind the greatest amount is going to stay in-State, at least in the scenario at that time, so we'd have to rerun this for today. But this is an interesting graphic I think just to kind of show what goes in-State and what goes out of State.

And I've said this before but the JEDI model is State-based and so it really only shows the jobs and output, the overall economic output for your State. You are not – if money goes out of State you don't know whether that goes from Colorado to Wyoming for the coal, you don't know whether it goes to Iowa or whether it goes to Denmark or to China. You just know that it doesn't go in your State and that's the same for the number of workers. It only shows you the number of workers that are in your State and out of your State and if it's out of your State you don't know whether it's domestic or not, but that's because this is primarily for people focused on State-wide economic impact.

I think that – yes, if you are interested in this topic I would encourage you to check out [windpoweringamerica.gov](http://windpoweringamerica.gov). We have lots of reports on this and fact sheets and maps and you have contact links there for if you are interested in doing work like that's in your State or in your county. We can also connect you with other States, with other people who have done this for their State or other people who've done these analyses for their county.

And I think that's all I had –

Catherine Morris: OK, thank you Tegen.

Suzanne Tegen: there is my contact information and I am happy to take questions. It sounds like we have a lot of them so hopefully that wasn't too fast but I tried to kind of push through quickly.

Catherine Morris: Well there is definitely a lot of interest in the other types of models you mentioned, particularly offshore wind. Do you have an estimated time of arrival for the development of that JEDI model?

Suzanne Tegen: I don't. We are seeking funding right now – we have been seeking funding for years for this from the Department of Energy, so contact your Department of Energy or your Congress person and ask them to please fund NREL to do this work. We are really excited to do it. We have developers on board, we have got the industry saying yes, we'll give you numbers, so people want to help and they want to get this model out and I promise I'll get it out as fast as I can but we are not funded to do it right now.

Catherine Morris: One of the participants noticed also that you did not have energy efficiency, nuclear, or (fore-space) biomass on your list of potential development for the model. Is that something that has been talked about or considered?

Suzanne Tegen: Yes, they all have been considered. So energy efficiency is something that I am very interested in, it's actually something I worked on for my dissertation about economic impacts of energy efficiency and jobs. So I'd be particularly interested in that but we don't have funding to work on that one.

Biomass, they are working on bio-power – biomass, a model and I think that there has been a little bit of complication with the funding for that as well but I think that is coming. For the nuclear model, this is one I'd really like to get up on my Web site as well, but: one, we don't have funding; two, we don't have information. Because no nuclear plants have been built, and it's hard to get information, it's easier for us to get information on the offshore wind project even though none of those have been built either, but it's much easier because those numbers are in the press, whereas if you try – I don't know if you have tried to get information from the nuclear industry, it's very tough to get their proprietary data.

We of course don't give their proprietary data out but we do need to know it for the defaults for our model. And we have actually had difficulty getting numbers for natural gas and coal models too but through industry contacts we worked that out. I am hoping as some of you are that we can get those models up.

Catherine Morris: You mentioned that the JEDI model is very sensitive to how much of the manufacturing supply chain is in the State. How do you go about finding out what percentage of the supply chain is in the State?

Suzanne Tegen: We assume that nothing is built in-State because even if you have a wind manufacturing, [if] you have a power manufacturer or something in your State that doesn't mean that your – the wind project that you are looking at is going to use those powers, they could use them from out of State.

Normally the default mile is zero because normally the answer is zero. If you are running the model in a place where there is wind manufacturing and I guess maybe the person was asking how do they find out. There is an annual market report that one for 2010 – excuse me, yes, 2010 just came out. It's called the 2010 Wind Technologies Market Report. It was put out by the Department of Energy and actually done by Lawrence Berkeley Lab. It's a great report for information on wind power and I helped them create a manufacturing map, it's a manufacturing facilities map for the U.S. in that report. You can look it up, you can google that 2010 Wind Technologies Report by Lawrence Berkeley Lab and you should be able to see there is a page in there with a map and it will show whether your State has major wind power manufacturing.

Now your State could have wind power – could have manufacturing that leads to wind power you know it's in the supply chain and then it might not be on there but the major ones are on there. That's one way, otherwise a lot of times your chambers of commerce or things like that will know whether industry in your State is involved in wind.

Catherine Morris: Thanks. I have – we have a few more minutes and I just have a couple of questions to all of our speakers. One question asks whether or not there is a

rule of thumb similar to the one that Karl talked about in translating dollars invested into number of jobs, but is there a rule thumb for it also comparing gross jobs to net jobs or translating the outputs of reports that might be reported in gross jobs into net jobs or vice versa? Karl, you might be able to take that on in terms of how you the handled gross and net in your particular rule of thumb that you are using.

Karl Michael: Yes, one could devise some numbers together and come up with such a thing. Yes, that could be done. We didn't just do that but if I'm just eyeballing that graph, the gross is about twice the net, and that, if you look at every year, if you look at – and I am just looking at the stacked bar next to the black line.

Yes, the gross is about twice the net. And I hesitate to say gee, that's one size fits all but I can say it's probably not a – if you're just looking for order of magnitude-- I don't know, Marc, you could comment on that, I don't know if you –

Marc Breslow: Yes, I would say that probably sounds somewhat reasonable, that energy efficiency programs would be different than renewables. For efficiency programs where the dominant effect is the energy savings to residents and businesses of the State, if you wanted to figure out a rule or a rule of thumb what you'd want to look at is what's the benefit cost ratio that somebody is computed for the efficiency programs? If you are saving \$2-- if your benefit cost ratio is 2 to 1, which means you are saving \$2 for every dollar that you spend-- then in general terms your net benefits are probably something like half your gross benefits. Your gross would be the total spending and the net would be the half that's the savings. And so what Karl's numbers may be telling him, tell me if this is right, well – no, your benefit cost ratio was higher than two there, wasn't it, Karl?

Karl Michael: Benefit-cost ratio was two, yes.

Marc Breslow: The benefit-cost ratio?

Karl Michael: Yes, when everything was included, that's total resource cost that includes the price effect, yes, that would be –

Marc Breslow: Right, I would say that the benefit-cost ratio and the gross-to-net jobs ratio more or less come out the same?

Karl Michael: Yes, like as a rule of thumb, that's what you would expect.

Catherine Morris: Let me see if I can squeeze one more question in here before we close out. Early on one of the participants asked about how or if at all opportunity cost of the energy efficiency investment, and this could apply to any of the renewable investments as well, are evaluated in the models. Do you take into account how either the job implications or how the dollars would otherwise be spent in your analysis?

Karl Michael: Was that question directed to Suzanne or -?

Catherine Morris: All three speakers, so Suzanne if you want to start or have a response, that would be great.

Suzanne Tegen: Can you repeat the last part of the question? I heard the first.

Catherine Morris: Well the question is, does your model in any way take into account the opportunity cost of the, in your case, of the investment in wind in the analysis? How the dollars would otherwise have been spent in the job implications?

Suzanne Tegen: No, this model just looks at if you put a wind project – and usually they are not as big as the one that I showed, that 9,000 megawatts, usually this is 100 or 200 megawatts or something on a farmer's land in a State or that's typically what JEDI is used for. We look at if you put a wind project in, what's the job and economic impact, including the land lease revenue to the farmer and including the property tax benefit from the project developer, for the local fire station and the roads or whatever that is. It looks at all of those things but it doesn't look at if we hadn't put in this wind farm what could we have done with this money?

Catherine Morris: Karl or (Mike) did –

Marc Breslow: Marc.

Catherine Morris: excuse me, Marc, did you have any response?

Marc Breslow: Well, I would say, I mean for Karl and me it's almost the same question as the gross versus net, that by definition we're doing net jobs which means we are asking where else the money would have gone.

For an example to be specific, if I am looking at the jobs from federal fuel efficiency standards, I am saying the loss or the opportunity cost in Massachusetts – well, or the opportunity cost in general, is you're spending less money on gasoline. For Massachusetts, very little of that money spent stays in the State. It's on the order of 10, 12 percent that's going to retail distribution of gasoline, and that's the opportunity cost that would be the losses in that sector. And similarly for any other energy sector.

Karl Michael: And I would say just those opportunity costs were calculated separately for residential customers and commercial industrial customers and the opportunity cost on the residential side is calculated as based on dollars that were collected from ratepayers to pay for programs, those are dollars that consumers did not have to spend for personal expenditures. For simplicity we assume a standard basket of consumer goods that we would compare that to, recognizing that what gets spent or not spent on the margin is not exactly the same as that but we don't know what it is, so we assume it's a standard average basket of consumer goods that is not purchased with the precise amount of dollars that are collected for the State to spend on programs.

That's how the opportunity cost is calculated. It's done the same way for the dollars that the consumers spend on, spend their own money for energy efficiency equipment, let's assume that if they didn't spend it on energy efficiency equipment they would have spent it on a standard basket of consumer goods.

Denise Mulholland: Right, well thank you. Thank you Karl, and actually this is Denise Mulholland again. I wanted just to take the time, it is the end of our call and first I want to thank our speakers, Marc, Karl and Suzanne for giving very informative presentations and certainly their contact information is up on the

Web, please feel free to contact them or to contact myself if you have additional questions.

There were several questions that we did not have time to answer, please feel free to follow up with us. Thanks so much to the attendees. We are still actually more than 120 people on the line and on the systems, I really appreciate the level of interest in this topic and the fact that so many folks have hung in with us till the end.

There will be some survey questions as you exit the webinar that will help us better serve you and provide information about topics that are of interest to you as you move forward advancing clean energy efforts in your States and localities.

And just a final heads up that our next monthly Technical Forum—we'll be taking off I'd say the month of September, so look for an invitation to the next webinar sometime in the early fall.

OK, with that, thank you so much I hope you all have a great day and a great rest of the summer. Thanks so much.

Marc Breslow: Thank you.

Suzanne Tegen: Thank you.

Operator: And this does conclude today's conference call, you may now disconnect.

**END**