I. Overview of Modeling Approach

The Washington Climate Collaborative (WCC) methodology used to evaluate the Carbon Pollution Accountability Act, centers around the combined use of three models: an energy price model known as the Carbon Tax Analysis Model (CTAM), an economy-wide price model, and an input-output model.

The Office of Financial Management (OFM) and Washington Climate Collaborate (WCC) analyses employ similar modeling approaches. Both WCC and OFM employ three models; the CTAM energy price model, a price model that maps how price changes translates into changes in output throughout the economy; and both analyses employ a standard input-output model.

1. *CTAM* - The CTAM model and underlying assumptions that went into estimating the energy price impacts of the CPAA are nearly identical, and both analyses agree that the proposed policy will increase all fossil-based energy prices.

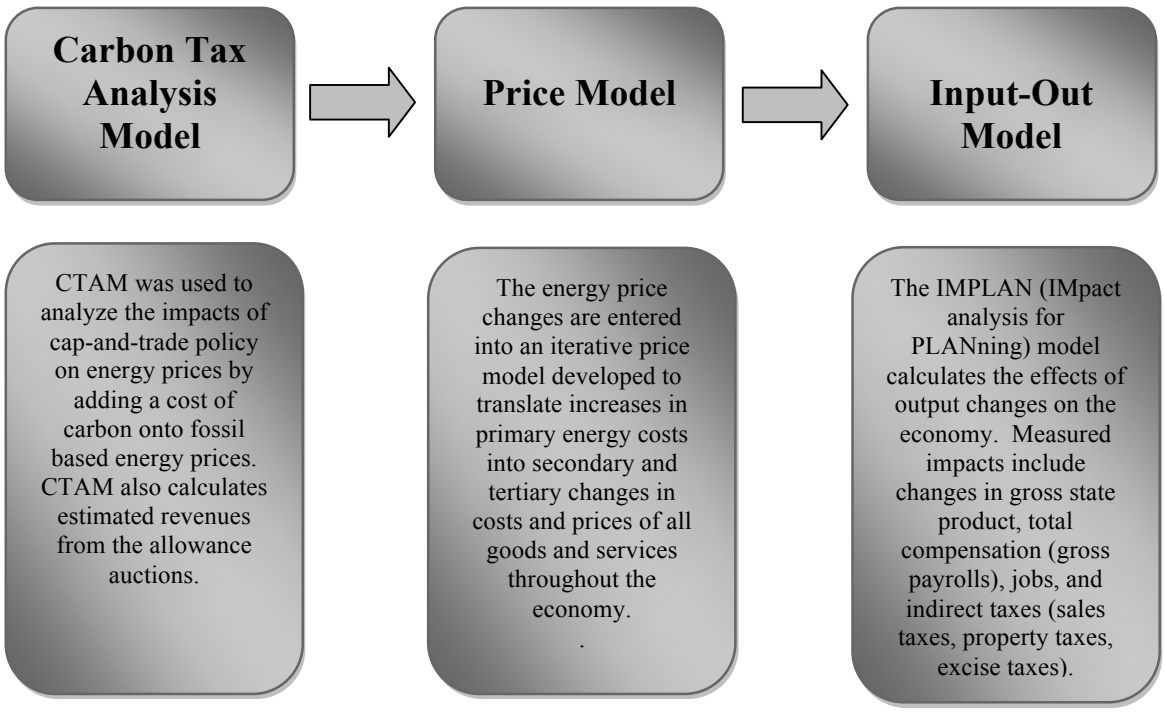
2. *I-O Models* - The WCC analysis used the 2013 IMPLAN I-O model of the Washington State economy. IMPLAN is a widely used input-output software and is employed in a large array of public and private sector project analyses. The IMPLAN model applies its matrix of inter-industry multipliers to calculate the effect of an initial change on the economy and estimate the total impact on the economy as a whole. More importantly, IMPLAN is transparent. All underlying data, linkages and algorithms are documented and publically available.

   The state of Washington has used IMPLAN in previous analysis of public policy issues but for this analysis the OFM selected the REMI price and I-O model package. REMI is ***not*** an open source model and REMI's algorithms are proprietary. However most major input-output models employ similar methodologies in their creation and the multipliers that are used in both REMI and IMPLAN are assumed to be similar in magnitude.

3. *GSP and Employment Forecast* - In addition, the WCC modeling assumptions also used OFM's base case forecasts of Washington State employment and gross state product from 2015 to 2035

4. *Revenue Recycling* – WCC and OFM's estimate of the amount of allowance revenues was generated by the CTAM and a nearly identical amount of allowance revenues were assumed by both to be recycled back into the economy.

The flow of analyses conducted in the WCC analysis is outlined below.



Key Difference in Modeling Approaches

While there are a number of similarities in the modeling approaches adopted by both WCC and OFM, there are important differences that account for the disparity between the results.

1. *Price Models* - First, because WCC and OFM both used CTAM and similar I-O modeling approaches, we believe the most significant difference in the economic results and reported impacts on the Washington state economy are attributable to the different Price Models employed by OFM and WCC. The WCC price model represents a comprehensive approach for estimating the flow of energy price increases as they ripple throughout the Washington State economy. The price model translates changes in primary energy prices into secondary and tertiary changes in prices for all products and services throughout the economy. The model captures the fact that rising energy prices affect virtually every consumer and every producer in Washington State. The WCC price model calculated the following three tiers of effects on the Washington State economy:

    - First Tier: The model estimates the economic impacts of increased energy prices (i.e. the primary impacts) such as electricity, gasoline, diesel, natural gas, and others on business and consumer spending in Washington State.
    - Second Tier: The effects on business production (i.e. secondary impacts) and consumer spending from the increase in the prices of all other goods and services.
    - Third Tier: The effects on all the prices of final goods and services (i.e. tertiary impacts) produced in Washington including the goods and services exported from Washington State. The

analysis includes the changes in the competitiveness of Washington State products exported to the rest of the U.S. and abroad

The three tiers can be best explained using the example of aluminum manufacturing. The first tier calculates the effects of rising energy prices on aluminum companies. The second tier calculates the effects of rising aluminum prices on the production of goods requiring aluminum inputs (e.g., airplane manufacturing). The third tier calculates the price increases of all final finished products containing aluminum (such as airplane travel) and the exports of aluminum to the rest of the U.S. and abroad.

The OFM price model is "built in" to the REMI software platform. REMI software is proprietary and publically available documentation on how REMI accounts for price increases is not available. As best as we can determine from the OFM legislative testimony and the "White Paper," we believe that the REMI model only accounts for the First Tier of price effects on the Washington State economy. It does not seem to incorporate subsequent price effects and leads to results that significantly understate the impact of rising energy prices on the Washington State economy.

Using the aluminum manufacturing example above, the OFM analysis appears only to account for the initial effect of rising energy prices on aluminum companies. They don't account for the effect of rising aluminum prices on intermediate goods and services in the supply chain or the price effects on final goods and services such as airline manufacturing, and ultimately ticket prices for air travel. If, as we suspect, OFM's REMI price model understates the price effects, the reduction of output by industry that is entered into their input-output model is similarly understated and smaller than what the WCC analysis entered into the IMPLAN model. This would account for the largest portion of the differences in economic impacts of the two analyses.

2. *Alignment with Economic Theory* - Another difference between the WCC's and the OFM's results is how each aligns with accepted economic theory. The WCC analysis is consistent with economic theory in that we show that increasing production costs through taxation (i.e. energy costs) leads to a reduction in output and employment. The OFM analysis contradicts standard economic theory. It predicts that energy price increases will generate economic growth in jobs and gross state product. OFM has not explained how they got these results. Taken to its logical conclusion, higher taxation becomes an economic development and jobs policy; the higher the tax imposed on industry the greater the job and GSP growth. Anyone managing the family budget knows that an increase in expenses doesn't lead to an increase in purchases. At some point consumers and businesses run into their budget constraints.

3. *Economic Impact of Government Expenditures* - A third contributing reason for the difference in the results is that the WCC analysis predicts that on net government spending is less efficient than the private sector. In order to get the results reported by OFM we believe the REMI model and OFM analyses assume that government expenditures are more efficient at producing goods and services than the private sector. Following this logic, the redistribution of economic activity from the private sector (in the form of higher taxes) to the public sector increases economic output and employment throughout the economy. An economically inconsistent prediction.

II. Critique of OFM and other Panelists Comments to the House Appropriations Committee

The testimony by the OFM on the Governor's cap-and-trade proposal before the House Appropriations Committee also critiqued several points of the WCC economic impact analysis. Those comments and our response are summarized below.

1. **Comment (Marc Baldwin):** *To get the WCC employment impact number you need a $4 billion change in demand. Somehow in their model a $1.3 billion charge becomes a $4 billion negative impact on the economy. In other words the negative impact is 4 times the cost of the charge (cost of allowances.) Baldwin suggests the economic impacts are disproportionate to the level of the carbon tax that would be imposed on industry emitters.*

   Response: As stated earlier, we believe the OFM price model understates the effect of rising energy prices on the Washington State economy. Had OFM accurately accounted for the effects of higher energy prices the additional $1.3 billion costs (tax) to purchase allowances would have translated into a significantly higher impact on final demands that are ultimately entered into the REMI input-output model.

2. **Comment (Marc Baldwin):** *The WCC modeling and analysis predicts between 50-70 thousand jobs lost per year. That is the same number of jobs the Washington economy has been adding each year during the recovery. So, they (WCC) predict a carbon tax totaling .25% of the Washington economy's GSP would essentially undo Washington's state job growth.*

   Response: The OFM is confusing an average annual jobs change from the baseline with a cumulative employment impact. The WCC analyses predict a slowing of future economic growth, not a net decline in economic activity. For example, the OFM baseline forecast (with no CPAA policy) predicts a cumulative total of 576,000 new jobs will be created over the period 2016 to 2035 in Washington State. The WCC estimates *average* annual job reduction from the baseline is 55,538 jobs less than the projected new job total. WCC's analysis still shows cumulative job growth of at least 520,462 jobs, which represents 90% of the job growth projected by the OFM baseline.

   Drawing from Mr. Baldwin's example to illustrate this point, the Washington economy created 220,821 new full and part-time jobs from 2010 to 2013. The WCC model and analysis predicts that had the Governor's cap and trade policy been in effect during this period the economy would have experienced at least a net increase of 165,283 jobs instead of 220,821.

   The estimated reduction in job growth predicted by the WCC analysis is notable… but contrary to the claims of Mr. Baldwin it does not "undo" the growth in Washington's economy.

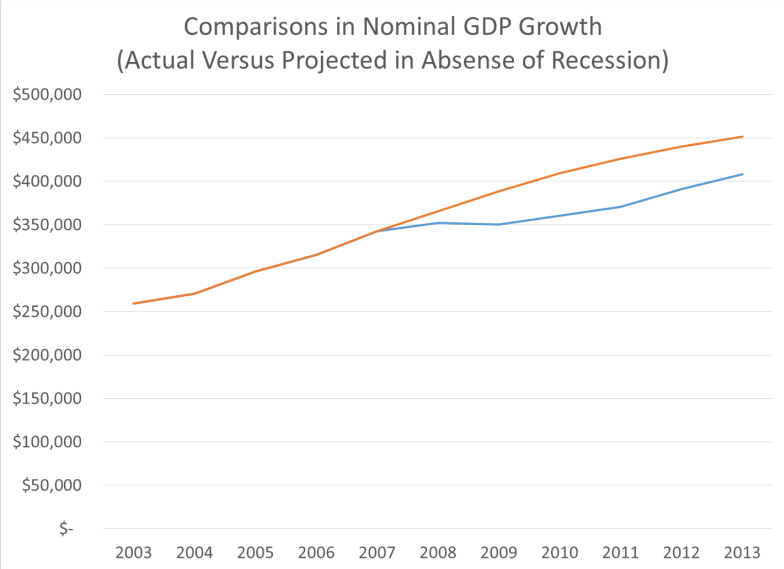
3. **Comment (Marc Baldwin):** *Another way to look at this (i.e. WCC's estimated $5.7 billion impact on GSP) is, in the great recession the Washington economy lost $ 1.7 billion in GSP dollars in its worse year, 2008-2009. The WCC model predicts an average of $5.7 billion dollar loss each year as a result of a $ 1.3 billion dollar carbon charge.*

   Response: The OFM statement to the House Appropriations Committee makes two fundamental errors. First, the magnitude of the recession is not measured by a one year drop in nominal output. It is measured by the aggregate difference in output between where the economy bottomed out and

where it would have been in the absence of the recession. The true loss to the Washington State economy as a result of the great recession was not $1.7 billion as stated by Mr. Baldwin. Had Washington remained on its projected growth path prior to the recession the economy would have been, in nominal terms, nearly $38 billion dollars larger in 2009. Accordingly the economic loss to the Washington economy from the recession is not $1.7 billion; the loss is $38 billion.

Second, the OFM claimed the WCC analysis showing an average annual drop in GSP from the baseline forecast of $5.7 billion dollars would "wipe-out" the gross state product gains from the recovery. Contrary to Mr. Baldwin's claim, Washington State's real gross state product grew from $356.4 billion in 2010 to $381 billion by 2013, a $24.6 billion increase (as measured by constant 2009 dollars). The WCC analysis indicates that the estimated average annual decrease in GSP would be $5.7 billion lower than the $ 24.6 billion of GSP the Washington economy grew between 2010-2013. In other words the gross state product gains from the recovery would not be wiped out.

Figure 1



4. **Comment (Marc Baldwin):** *What happens in the model is that it accounts changes in energy prices and demand by income category. At some point you will see changes in demand due to price increases in energy. At $12 allowance prices you don't see changes in demand due to higher energy prices. You don't see dramatic changes until you get to much higher prices.*

Response: This is a contradictory statement. On one hand the OFM argues that the energy price increases will not affect consumer behavior because the allowance prices assumed in their analysis are so low. At the same time they argue that the cap-and-trade program will significantly reduce carbon dioxide emissions and achieve the 2020 and 2035 GHG emissions goals because putting a price on carbon will change consumer behavior and reduce consumption of fossil fuels. Is the price change causing consumer behavior to change or is it not?

5. **Comment (Panelists):** *A report by the Environmental Defense Fund (EDF), Carbon Market California (Year 2), was referenced at the House Appropriations Committee Hearing by several witnesses. The report analyzed the performance of the California economy in the context of the state's cap-and-trade program and implied that California's robust economic growth since the 2007-2009 recession is attributable to its cap-and-trade policy.*

   Response: Comments made to the House Appropriations Committee failed to mention important caveats that had a significant impact on California's economic performance reported by EDF. First, the EDF analysis only included years through 2013. However, the California cap and trade program did not go into effect until November 2012, therefore the analysis only includes 1 year of data in which the cap and trade plan was in place. The argument that the economic performance over this short span of positive data represents a trend in any and all circumstances is a fallacious argument.

   Moreover, the California program during this period only covered 35% of the state's GHG emissions and those entities that were covered under the program all received free allowances. Accordingly, we would have been surprised if the macro-economic performance of the economy would have been impacted even at very high allowance prices.

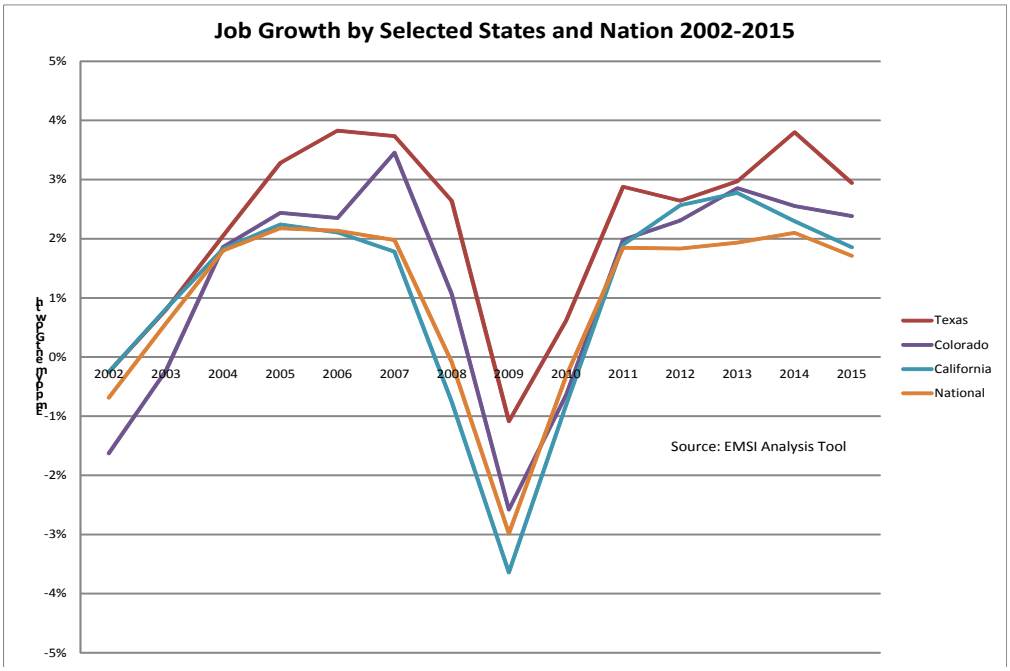
   In contrast, Washington's cap and trade program covers 80% of the GHG emissions and a significantly larger portion of the state's economy. Moreover, the Governor's cap and trade policy does not issue free allowances to covered sources. Unlike California, Washington businesses and consumers will be impacted by the full cost of allowances covered sources will be required to purchase. It is disingenuous to try and project the economic impacts of cap-and-trade on the Washington economy using California's experience as an example. The two programs are not the same.

6. **Comment (Rep. Joe Fitzgibbon):** *I want to talk more high level about the impacts on the economy and address whether the impacts will be positive or negative. We are not the first state to undertake carbon regulations. Ten northeastern states have joined in a carbon market. California has a cap-and-trade program that has been operating for several years. California is adding jobs faster than the national average.*

   Response: The Representative's conclusions suffer from a flaw in logic, known as the "Post Hoc" fallacy. The logical flaw is this; California passed the CARB policy, then California's economy grew, therefore passing CARB must have caused the economic growth. The problem is in arbitrarily attributing causation to a prior event. Texas didn't pass cap and trade regulations, then Texas's economy grew, therefore not passing cap and trade regulations must have caused its economic growth.

   Furthermore, a single year (2012-2013) does not constitute a growth trend. Following a true time series trend (2002-2015) California's job growth is just above the national rate (16% as opposed to 15%). Since the national growth rate is an average of all 50 states, California is growing about average. This suggests that roughly half of the states have jobs growth rates higher than California. The national and a selection of state annual growth rates since 2002 are provided below (Figure 2).

Figure 2



Moreover, California's gross state product cumulative growth over the recovery period 2009-2013 ranked 27th out of 50 states (i.e. 16% cumulative growth) and is below the U.S. national average of 17% (Figure 3). The more appropriate question to ask is what would California's growth rate have been in the absence of its cap and trade policy?

The fallacy of the Representative using California's economic performance as an indicator of how Washington's economy will perform can also be demonstrated by considering the economic circumstances of the RGGI states that have also adopted a cap and trade program and were mentioned by Representative Fitzgibbon and other panelists. Only two RGGI states, Massachusetts and Vermont, have a cumulative growth of GSP over the recovery period 2009-2013 that is equal to the national average. The remaining 7 RGGI states are ranked 35th or lower. In fact two RGGI states, Maine and Connecticut, are ranked 49th and 50th. The House Appropriations Committee panelists who touted the economic virtues of adopting cap and trade regulation, failed to mention the economic circumstances of the RGGI states who have also been subject to cap and trade regulations for a significantly longer period than California.

The flaw in Representative Fitzgibbon's argument and the same points made by other panelists is obvious. California and virtually every state has been climbing out of the recession, moving back to their equilibrium growth levels for reasons other than cap and trade policy.

Figure 3

Cumulative Growth 2009-2013
Gross State Product

Rank	State	Growth Rate	Rank	State	Growth Rate
1	North Dakota	75%	25	Tennessee	16%
2	Texas	31%	26	Hawaii	16%
3	South Dakota	26%	27	California	16%
4	Nebraska	26%	28	Idaho	15%
5	Oklahoma	24%	29	North Carolina	15%
6	Utah	23%	30	Wisconsin	15%
7	Montana	23%	31	South Carolina	15%
8	Oregon	22%	32	Arizona	15%
9	Iowa	21%	33	Alabama	15%
10	Indiana	21%	34	Mississippi	14%
11	Louisiana	21%	35	New York	14%
12	Minnesota	20%	36	New Mexico	13%
13	Wyoming	20%	37	Illinois	13%
14	Kansas	19%	38	Pennsylvania	13%
15	Alaska	19%	39	Georgia	12%
16	Ohio	19%	40	Maryland	12%
17	Colorado	19%	41	New Hampshire	12%
18	Michigan	18%	42	Delaware	12%
19	West Virginia	18%	43	Rhode Island	12%
20	Kentucky	17%	44	Virginia	11%
21	Arkansas	17%	45	New Jersey	11%
22	Vermont	17%	46	Florida	11%
23	Washington	17%	47	Missouri	10%
24	Massachusetts	16%	48	Nevada	10%
			49	Maine	9%
	Source: BEA		50	Connecticut	8%