



# Methodology

- This analysis estimates the impact on average monthly residential electricity bills in 50 states of the U.S under the allocation plan of the Waxman-Markey Bill (H.R. 2454)
- Important factors affecting change in electricity bills include the number of allowances received relative to emissions associated with electricity delivered and the assumed allowance price
- Under the Waxman-Markey bill allocations to LDCs are calculated based 50 percent on their total delivered electricity and 50 percent on associated emissions
- In estimating the total number of allowances that LDCs in each state would receive under the Waxman-Markey bill, this analysis utilizes publicly available data sources to determine –
  - electricity delivered in each state by LDCs; and
  - emissions associated with the delivered electricity.
- While total electricity delivered is readily available, the estimation of emissions associated with them require assigning an emission factor to each state in the U.S.
- In order to assign an emission rate to a state, this analysis looks at multiple factors (please see the emission rate slide for details) including –
  - average emission rate of all the power plants located in the state;
  - NERC region and sub-region of the state and the average emission rate of all power plants in such region;
  - fuel-mix of the competitive electricity markets of which the state is a part (if applicable);
  - electricity trade balance – whether the state is a net importer or exporter of electricity;
  - market structure of the state – whether it is regulated or competitive;
- States that receive fewer allowances than emissions associated with delivered electricity would see an increase in electricity rates
- To calculate the change in average monthly residential bill, this analysis uses a normalized consumption of 1,000 KWh per month per residential customer in each state and a CO<sub>2</sub> price of \$11.20 per metric ton
- Excess allowances are withheld from states that receive more allowances than their delivered electricity related emissions. These withheld allowances are redistributed to the remaining states on the basis of their emissions.

# Analysis Steps

**Step 1:** Assign Emission Rate to Electricity Delivered in Each State (see next slide)

**Step 2:** Calculate Total Allocation to State Electricity LDCs

$$\begin{aligned}
 \text{Total Allowances Allocated to Electricity LDCs in a State} &= \text{A} + \text{B} \\
 &= \left( \frac{\text{Total Electricity Delivery in State (MWh) 2007}}{\text{Total U.S. Electricity Delivery (MWh) 2007}} \times 0.5 \times \text{Allowances Allocated to Electricity LDCs in 2012 under H.R. 2454} \right) \\
 &\quad + \left( \frac{\text{Total Electricity Delivery in State (MWh) 2007} \times \text{Emission Rate Assigned to State} \times 1.065^\dagger}{\text{Total U.S. Electric Sector Emissions (metric tons) 2007}} \times 0.5 \times \text{Allowances Allocated to Electricity LDCs in 2012 under H.R. 2454} \right)
 \end{aligned}$$

If Step 2 results in a state receiving more allowances than its delivered electricity related emissions, the excess allowances are withheld and redistributed to the remaining states on the basis of their emissions.

**Step 3:** Calculate Electricity Rate Change

$$\text{Change in Electricity Rate} = \frac{\left( \frac{\text{Total Electricity Delivery in State (MWh) 2007} \times \text{Emission Rate Assigned to State} - \text{Total Allocation to State Electricity LDCs}}{\text{Total Electricity Delivery in State (MWh)}} \right) \times \text{CO}_2 \text{ Price}^\ddagger}{1}$$

**Step 4:** Calculate Impact on Average Monthly Electricity Bill

$$\text{Change in Average Monthly Electricity Bill (\$/month)} = \text{Change in Electricity Rate (in cents/KWh)} \times \frac{1000^\S}{100}$$

<sup>†</sup>Emissions are adjusted upward by 6.5% to account for line loss.

<sup>‡</sup>This analysis assumes a CO<sub>2</sub> price of \$11.20 per metric ton.

<sup>§</sup>Assumes a normalized consumption of 1,000 KWh per residential customer per month

# Emission Rates of Delivered Electricity

In order to assign appropriate emission rates to delivered electricity in each of the 50 states in the U.S., this analysis classifies states into four categories according to their electricity trade balances and market structures. The analysis then employs emission rate calculation methods as shown in the table below:

Categories	Examples of States	Market Classification	Emission Rate Assignment Method
Net exporters with mostly vertically integrated regulated generation	Indiana, West Virginia, South Carolina, etc.	Regulated	Average emission rate of electricity generated at in-state power plants
Net exporters with mostly independent power producers	Illinois, Maine, Pennsylvania, Texas, etc.	Competitive	Average emission rate of electricity sold within the competitive electricity market of which the state is a part. State of market and fuel diversity reports published by the different competitive electricity markets are used to determine the fuel mix of such electricity markets.
Net importers with vertically integrated regulated in-state generation	Minnesota, Idaho, South Dakota, etc.	Regulated	Average emission rate of electricity generated within the state is assigned to in-state generation. Imports are assigned an average regional and/or sub-regional emission rate.
Net importers with independent power producers for in-state generation	New York, New Jersey, Massachusetts, etc.	Competitive	Average emission rate of electricity sold within the competitive electricity market of which the state is a part. State of market and fuel diversity reports published by the different competitive electricity markets are used to determine the fuel mix of such electricity markets.

		Emission Rate (metric tons/MWh)			Emission Rate (metric tons/MWh)
Market Structure			Market Structure		
<b>AK</b>	Regulated	0.64	<b>MT</b>	Regulated	0.71
<b>AL</b>	Regulated	0.67	<b>NC</b>	Regulated	0.51
<b>AR</b>	Regulated	0.59	<b>ND</b>	Regulated	1.08
<b>AZ</b>	Regulated	0.49	<b>NE</b>	Regulated	0.81
<b>CA</b>	Competitive	0.47	<b>NH</b>	Competitive <sup>†</sup>	0.39
<b>CO</b>	Regulated	0.83	<b>NJ</b>	Competitive	0.67
<b>CT</b>	Competitive	0.39	<b>NM</b>	Regulated	0.90
<b>DC</b>	Competitive	0.81	<b>NV</b>	Regulated	0.49
<b>DE</b>	Competitive	0.67	<b>NY</b>	Competitive	0.64
<b>FL</b>	Regulated	0.55	<b>OH</b>	Regulated	0.67
<b>GA</b>	Regulated	0.66	<b>OK</b>	Regulated	0.77
<b>HI</b>	Regulated	0.75	<b>OR</b>	Regulated	0.30
<b>IA</b>	Regulated	0.81	<b>PA</b>	Competitive	0.66
<b>ID</b>	Regulated	0.31	<b>RI</b>	Competitive	0.38
<b>IL</b>	Competitive	0.74	<b>SC</b>	Regulated	0.51
<b>IN</b>	Regulated	0.95	<b>SD</b>	Regulated	0.81
<b>KS</b>	Regulated	0.86	<b>TN</b>	Regulated	0.67
<b>KY</b>	Regulated	0.93	<b>TX</b>	Competitive	0.64
<b>LA</b>	Regulated	0.59	<b>UT</b>	Regulated	0.96
<b>MA</b>	Competitive	0.39	<b>VA</b>	Regulated	0.52
<b>MD</b>	Competitive	0.67	<b>VT</b>	Regulated	0.10
<b>ME</b>	Competitive	0.39	<b>WA</b>	Regulated	0.35
<b>MI</b>	Regulated	0.67	<b>WI</b>	Regulated	0.75
<b>MN</b>	Regulated	0.81	<b>WV</b>	Regulated	0.90
<b>MO</b>	Regulated	0.92	<b>WY</b>	Regulated	0.87
<b>MS</b>	Regulated	0.66			

<sup>†</sup>With significant regulated generation from PSNH plants.

Sources: EIA 861 (2007), EIA 906/920/923 (2007), EPA, and MJB&A Analysis