Energy Market Game – Externalities

BC Econ 3391

How would a carbon tax = SCC change this market?

Pre-solved game with a carbon tax of $163/ton

Bids set to marginal cost (private mc + tax)

Team: Big_Coal / Current game: carbon

Period 1 | Period 2 | Period 3 | Period 4

Column descriptions

MW = Expected capacity (MW)
PRICE = Bid price ($/MWh)
$X/ton = Marginal cost ($/MWh) incorporating a carbon price of $X
CO2 = CO2 emissions (tons) if plant runs at full capacity

PLANT	MW	PRICE	$0/ton	$163/ton	CO2
HUNTINGTON_BEACH_1-2	300	80.66	$28.50	$80.66	96
REDONDO_5-6	350	83.29	$29.50	$83.29	116
REDONDO_7-8	950	83.29	$29.50	$83.29	314
FOUR_CORNERS	1,900	108.65	$19.00	$108.65	1,045
HUNTINGTON_BEACH_5	150	132.89	$46.50	$132.89	80
ALAMITOS_7	250	147.67	$51.50	$147.67	148

Team: East_Bay / Current game: carbo

Period 1 | Period 2 | Period 3 | Period 4

Column descriptions

MW = Expected capacity (MW)
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CO2 = CO2 emissions (tons) if plant runs at full capacity

PLANT	MW	PRICE	$0/ton	$163/ton	CO2
PITTSBURGH_5-6	650	72.77	$25.50	$72.77	188
CONTRA_COSTA_6-7	700	79.66	$27.50	$79.66	224
PITTSBURGH_1-4	650	82.29	$28.50	$82.29	214
CONTRA_COSTA_4-5	150	117.11	$40.50	$117.11	70
PITTSBURGH_7	700	119.74	$41.50	$119.74	336
POTRERO_HILL	150	141.41	$48.50	$141.41	85

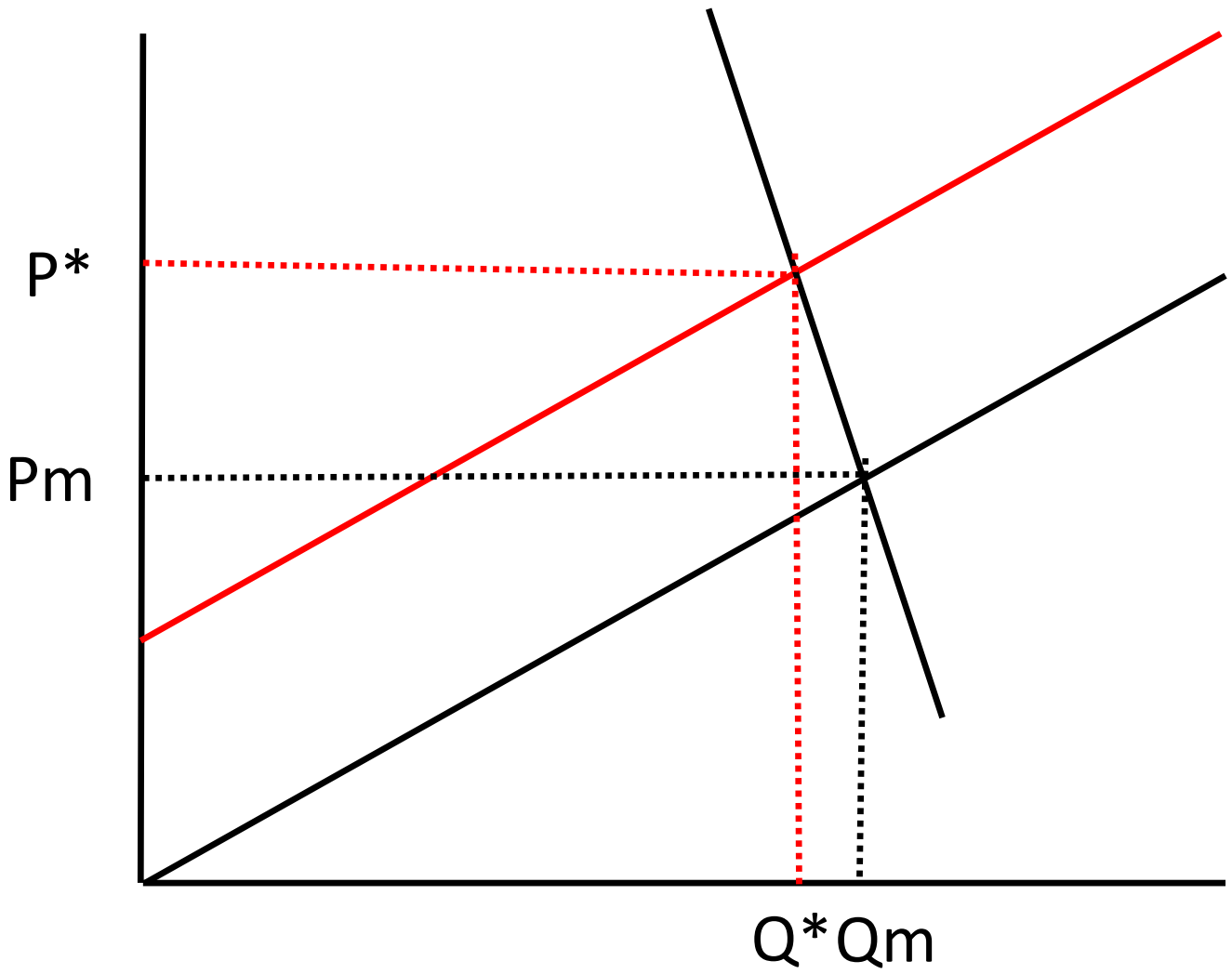
Update (Must click "Update" to update bids)

Questions

- Do you think prices will go up by a lot or a little?
- Profits?
- What about co2 emissions? Will they go down by a lot?

What are the channels through which a tax on carbon emissions from electric generators reduces carbon emissions?

In markets with *constant* externalities, primary channel is through demand response

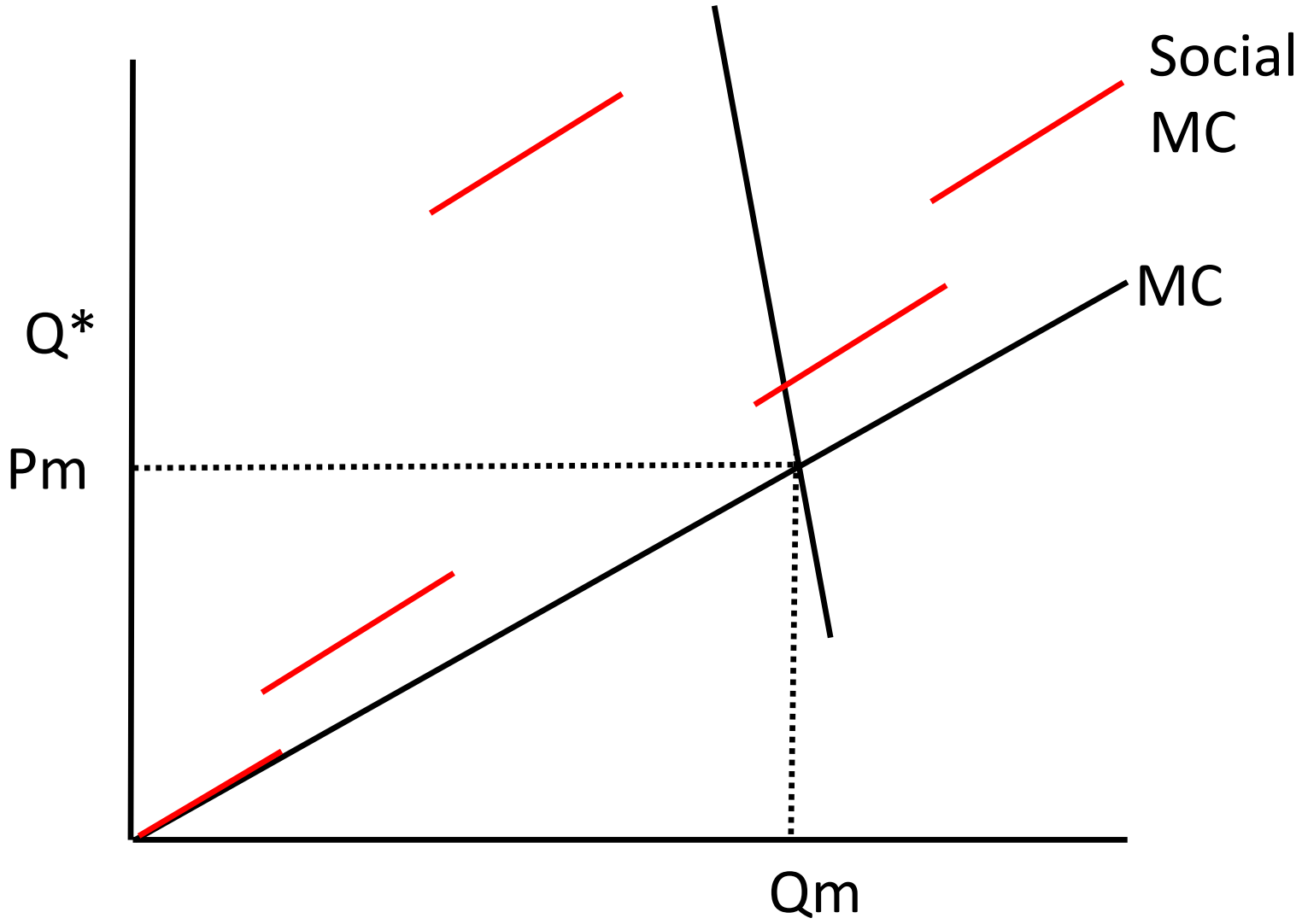


Tax = External MC

As we discussed last week, electricity demand is very inelastic.

So in the short run, this margin is unlikely to significantly reduce emissions

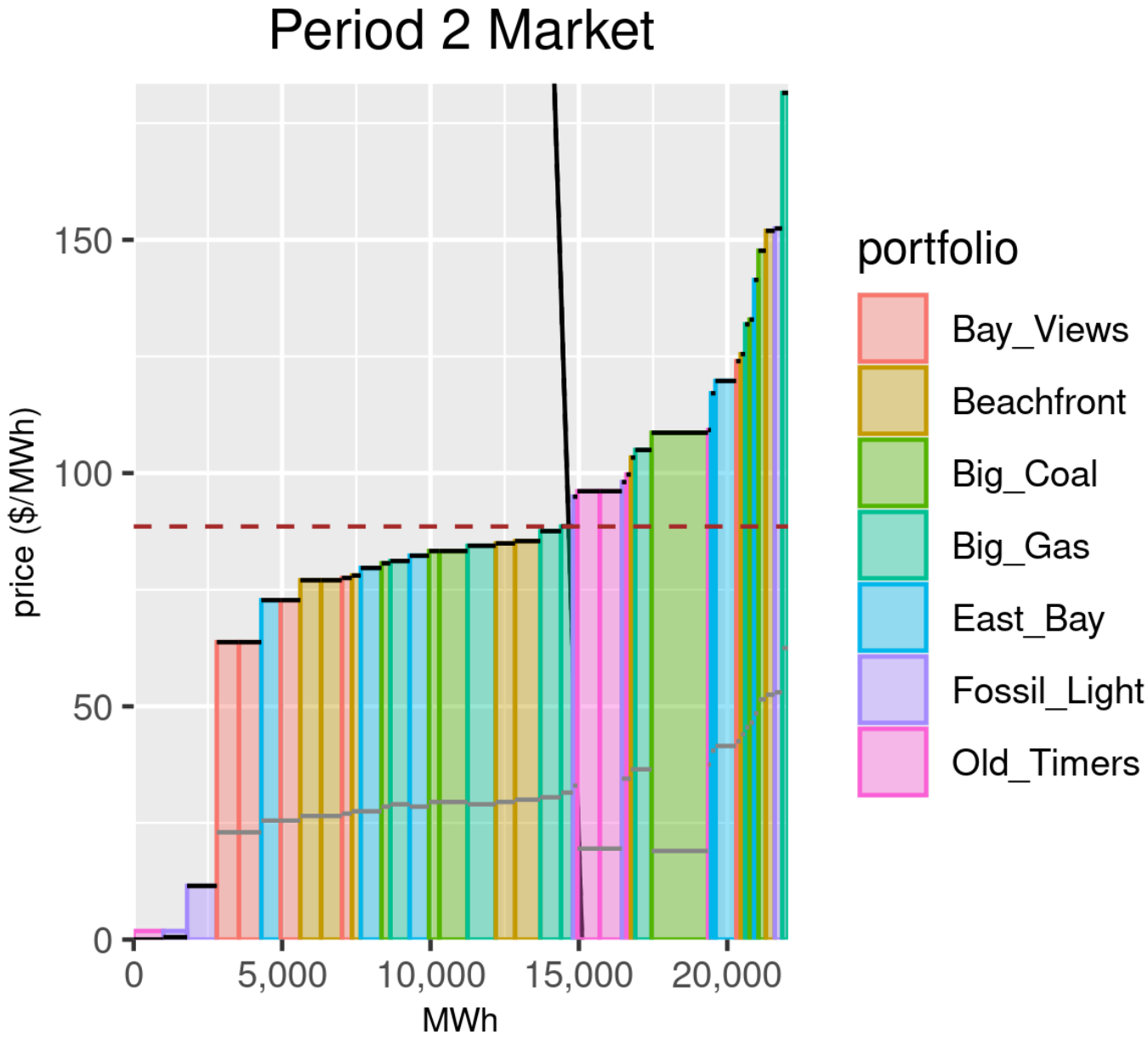
In markets with heterogeneous externalities, can reorder production to make it cleaner



This leads to <u>allocative inefficiency</u>: not just the wrong quantity consumed, but the wrong firms supplying Q*

In the simulated carbon tax game, I recomputed game 1 with a $163/ton carbon tax

- Can see that the bids change, but the *ordering* also changes



Market price: $88.55
Note: black marginal cost line assumes carbon price of $163
Note: grey marginal cost line assumes carbon price of $0

Comparison between baseline and tax games

	scenario	price	output	profits	co2
	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	baseline	36.9	67352	927065	20903
2	carbon tax	101.	64984	2141265.	18472

Comparison between baseline and tax games

	scenario	period	price	output	profits	co2
	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	baseline	1	27.5	11086	60448.	3150
2	carbon tax	1	83.3	10903	238196.	2445
3	baseline	2	29.5	15107	85698.	4471
4	carbon tax	2	88.6	14665	306929.	3731
5	baseline	3	53	21755	549272.	7264
6	carbon tax	3	126.	20549	964692.	6568
7	baseline	4	37.5	19404	231648.	6018
8	carbon tax	4	109.	18867	631448.	5728

Why are firms so against a carbon tax?

Comparison across firms

	scenario	portfolio	output	profits	co2
	<chr>	<chr>	<dbl>	<dbl>	<dbl>
1	baseline	Bay_Views	10150	106315	2767
2	carbon tax	Bay_Views	10150	312394	2767
3	baseline	Beachfront	10620	92875	3537
4	carbon tax	Beachfront	11699	243142.	3809
5	baseline	Big_Coal	12038	168500	5734
6	carbon tax	Big_Coal	9370	131183.	3813
7	baseline	Big_Gas	8250	87200	2905
8	carbon tax	Big_Gas	9715	189007.	3371
9	baseline	East_Bay	7885	72850	2632
10	carbon tax	East_Bay	8850	175800	2910
11	baseline	Fossil_Light	7955	187800	324
12	carbon tax	Fossil_Light	7800	658687	230
13	baseline	Old_Timers	10454	211525	3004
14	carbon tax	Old_Timers	7400	431052.	1572

This exercise is inherently **short-run.**

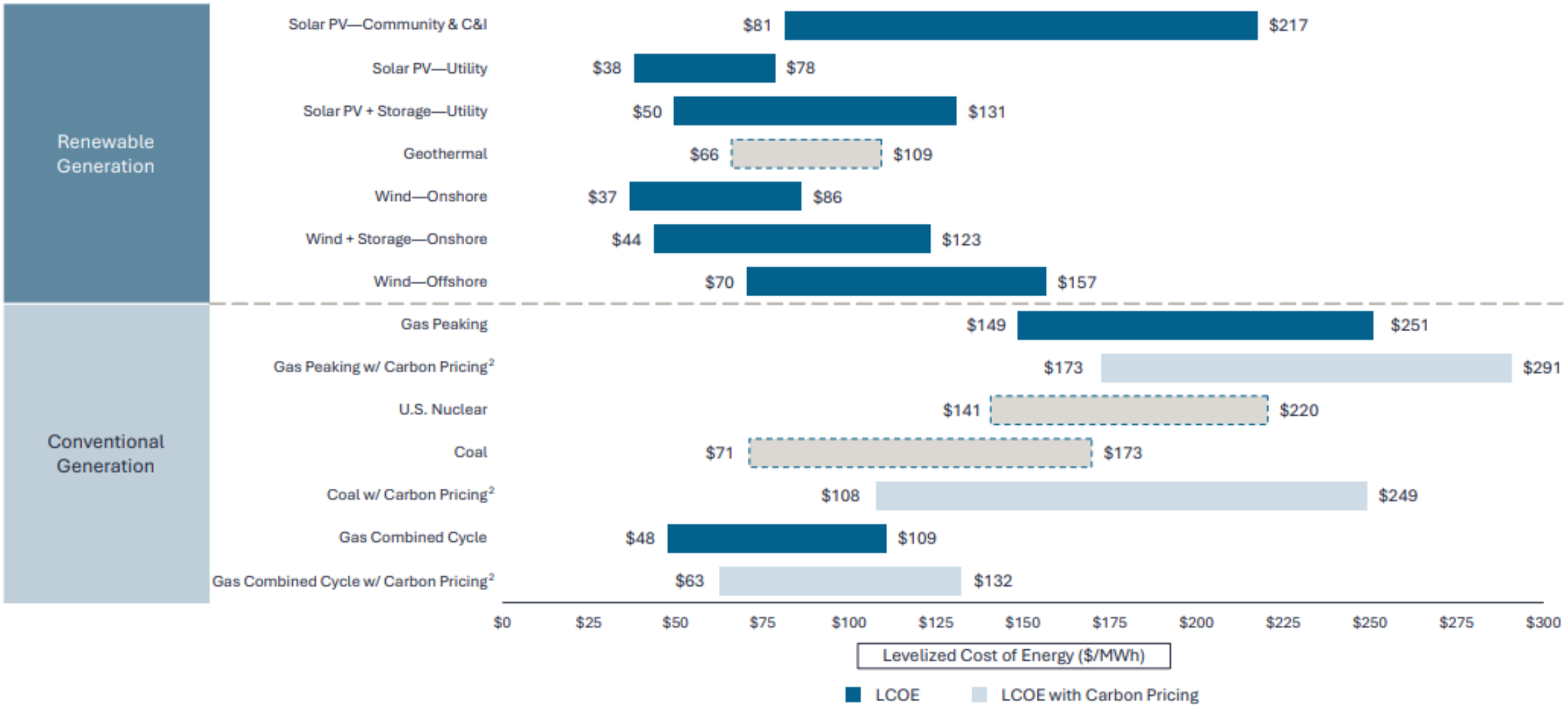
What will change in the long-run?
(under a carbon tax vs the baseline)

LCOE again

- How does a carbon tax effect LCOE of renewables?
- How does it effect the LCOE of fossil plants?

Levelized Cost of Energy Comparison—Sensitivity to Carbon Pricing

Carbon pricing is one avenue for policymakers to address carbon emissions; a carbon price range of $40 – $60/Ton[1] of carbon would increase the LCOE for certain conventional generation technologies, as indicated below



Will this increase renewable entry? Why?

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	scenario	price	output	profits	co2
	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	baseline	36.9	67352	927065	20903
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