Insights:

* **Job losses related to human health and social work**. Any time a policy affects household spending, for example by forcing consumer to buy more expensive equipment, there is likely going to be a significant amount of job loss in the human health and social work category, (ISIC 86T88), which represents, primarily, health care spending. This is because health care spending is a shockingly large share of US household spending, and changes in household income result in changes to spending on health care (everything is reduced proportionally). Education is similarly affected, because it is a large proportion of household spend.
* **Job losses can be smoothed with subsidies**. To the extent a policy forces consumers to purchase more expensive equipment, the impact on income and subsequent job losses can be mitigated somewhat by subsidies that bring the new tech in line with the prices of the tech it’s replacing. Nice to see our subsidy policies now have an impact on an important set of metrics when they may not do much on emissions.
* **Induced jobs drive impact significantly.** Often, the sign on induced jobs is positive while the signs on direct and indirect are negative. This is somewhat confusing, but could be correct. For example, consider a case where there are three industries, two with a low wage rate 1/3 of the third industry (let’s say 250k/job and 750k/job). A $500k impact on all the lower wage rate industries and a $1.5 million impact on the high wage industry would do the following: cut jobs in the lower wage industries by a total of 6 (3 + 3), but increase wages in the high wage industry by 2 for a net loss of 4 jobs. However, the induced jobs would be positive, because the sum of the cash flows to households would be $500k. In other words, the respending by the higher earners outweighs the reduction in spending by the lower earners, even though the direct job change is negative. The induced effects are also either all positive or all negative because the cash flows to consumers is summed before being fed into the IO matrix.

Policies:

* **Afforestation and reforestation:** Working as designed. The logic here is that the agriculture and forestry sector would see a growth in jobs as required to undertake the policies, paid for by industry/government to the extent each owns forest land.
* **Clean electricity standard:** compared this to the modeling from LBNL. We come out about 50% lower but after doing investigating this is because our model is more holistic than LBNL, in that we look at the downside to the utility industry from lost fuel sales, for example, which takes a big bite out of the increase in jobs. When I drilled down just to direct construction jobs from solar and wind, our numbers are actually quite close to LBNL’s. Some of the difference also comes down to the fact that we have lower capital costs for wind and solar than the LBNL report, and with the IO model, those costs now make a big difference on jobs, because the change in jobs is directly tied to the change in spend. I looked at modifying the settings for changes that affect exports to 1, which is the setting the LBNL modeling assumes (that all unused fuel in the power sector is used elsewhere or exported, and when matching this assumption, our jobs numbers go up to >500,000, closely matching LBNL’s data. I also cross-referenced AEO’s findings in their (weak) clean electricity standard policy, and nearly all of the reduction in natural gas consumption results in lower domestic gas production, which suggest our current settings are correct and that the LBNL data is overstating job gains.
* **Building electrification:** 10-20k increase in direct and indirect jobs, because electric equipment is more expensive and because increased electricity demand leads to higher electricity prices which leads people to purchase more efficient equipment, which is more expensive. Huge induced benefits from the large fuel savings that accrue to electrified buildings from efficiency improvement.
* **Building EE:** Large increase in direct jobs because higher EE equipment is more expensive than lower EE equipment, which increases direct spending to construction and input industries. Decrease in indirect jobs, presumably from decreases in fuel consumption and power plant construction. Huge increase in induced jobs from household savings.
* **Industrial facility retirement:** Has employment impacts because there is a cost associated with efficiency improvements. Not so sure this should be the case. There is little to no cost of shutting an industrial facility earlier. Perhaps we should revisit this.
* **Early retirement of coal power plants**. Creates net jobs in the near term from the construction costs associated with decommissioning the power plants. Over time results in job losses from lost employment at the facilities (the other industries sector receives less revenue, meaning it has less money to spend on labor, and the induced impacts from that change on lower labor spending flow through to jobs).
* **Material efficiency**. Something is wrong here; it’s creating jobs. Industry revenue should plummet (their costs do too). After portioning, the change in industry revenue is less than the change in industry expenditures, which is a positive cash flow to industry and causes jobs to be created. Something is wrong.
* **ZEV Mandate**: Causes a large decrease in jobs due in part to the higher upfront price of EVs causing a decrease in household spending on other things and also due in large part to the loss of vehicle maintenance jobs. Can be somewhat offset with a subsidy for EVs
* **Building Electrification**: Large increase in jobs due to construction and actually finding net savings on fuel spend due to higher efficiency of electrified equipment and rising gas costs over time.
* **Building EE**: Large increase in jobs due to construction and fuel savings causing increased domestic saving elsewhere
* **CCS:** Large increase in jobs because although industries are harmed by installing and running CCS, lots of labor required to do so, resulting in a large increase in household income and spending.
* **Carbon tax with 100% household dividend**: Direct and indirect losses from changes in spending but massive, massive induced effects through the reallocation of revenue to households. At $300/ton, causes a 1.5% increase in GDP attributable to the household respending; otherwise it would be a decrease
* **Cement clinker substitution**: Increase in jobs because the increased spend in industry is partially redirected to labor, which in turn offsets losses to industry by employing more people. This raises the question of whether ***we should assign process emissions costs to certain entities, i.e. should we make assumptions about the share of industrial process emissions spending that goes to labor vs materials when we have the data to do so?***
* **CHP:** Job losses because increased cost to industry means job losses to households, means less money to respend, even though the fuel savings more than offset the capital costs. We may want to look into this a bit more; this result surprised me.
* **Contractor training and education:** Net job increases, which makes sense. Discontinuity in a single year because of an avoided power plant from lower electricity demand. This is non-trivially affecting electricity prices, which is why this shows up. However, hard to trace the underlying cause here. Might be worth exploring to see if there is a bug.
* **Demand response:** Creates jobs. Some discontinuities, likely from changes in power sector.

TO-DO

* Jeff to add file for assigning industry policy costs to ISIC codes
* Jeff to add file for assigning vehicle charger costs to ISIC codes
* Jeff to explore issue with material efficiency policy and missing partitioning for industry expenses.