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| **Insights US** | **Insights Virginia** |
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| **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. |  |
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| **Policies**: | **Policies** |
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| **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. | This looks very weird. Most sectors and total jobs decrease in step downs. There’s a very weird spike around 2043 and then it declines again.  Steps down in weird increments – something is wrong |
| **Ban New Power Plants** | NA – no change |
| **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. | This is different than the US and looks really weird. Total jobs spike significantly and then drop. Largest decrease in construction jobs. Electricity, gas, water, electrical equipment, and mining jobs increase. |
| **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. | Moderate fluctuations in job growth through 2030’s and then large spike in total jobs between 2035 and 2050. Largest growth is in direct job creation in construction jobs. Indirect job creation is primarily in “human health and social work”, “accommodation and food services”, and “other business services.” Decrease in “Electricity, gas, water supply, sewerage, waste and remediation.” – ok |
| **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. | Large increase in jobs. Looks fairly similar to US results. Results look more linear. Largest increases are in induced jobs – “human health”, “accommodation”, “other business sector.” Most sectors show job increases, except for “construction” and “electricity, gas, water.”  – overall, looks ok |
| **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 | Large increase in total jobs (50,000 by 2050). Largest increases in human health, accommodation, other business which are induced jobs due to additional household income. – looks ok |
| **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?*** | Cement clinker substitution – everything is zero, assume this policy is turned off |
| **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. | Cogeneration. Total jobs initially spikes and then declines by 3,000 jobs by 2050. Biggest declines are in induced jobs (human health, accommodation, other business). Large increase in construction jobs and electricity, gas, water. Still some up and down steps but overall – looks ok |
| **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. | Looks similar to the US jobs. Total increase in jobs but overall increase looks moderate than US growth. Largest increases are in “construction” jobs and associated induced jobs through additional household spending (human health, accommodation, other business). Weird, large dip in 2035 and additional moderate ups and downs. Decrease in electricity, gas, water jobs. – looks weird overall but trends make sense |
| **Cropland management** | NA |
| **Demand response:** Creates jobs. Some discontinuities, likely from changes in power sector. | Large, immediate increase in total job growth (total growth about 2,000 jobs). Some moderate up and down spikes in total jobs and by sector jobs. Largest growth in induced jobs (health, accommodation, other business). Very modest decrease in electricity, gas, water jobs. – Some spikes but overall trends look ok. |
| **Distributed solar** | Huge, weird spikes in jobs although overall trend is decrease. Construction and electrical equipment look perfectly correlated and opposite (electrical equipment jobs increase, construction declines). Induced jobs spike up and down. “Other transport equipment” shows some negative spikes. – looks weird |
| **District Heat CHP** | Overall very small changes in jobs. Total job decrease is like less than 300 jobs lost by late 2040s. Spikes look weird but changes are pretty small. |
| **District Heat fuel switching** | Lots of up and down spikes in jobs but all under 1200 total job increases. Construction jobs decrease and induced jobs increase. Total jobs increase and stabilize around 800 total additional jobs by 2050. |
| **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. | Large spike to up to 1200 new jobs in the first 10 years and then trend downward and lots of weird spikes in total jobs. Drop to about -500 jobs by 2050. Human health and social work and accommodation decrease the most. Construction and Electricity increase the most. – something is wrong |
| **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). | Immediate, giant spike in total jobs up to 60,000 additional total jobs. Then it fluctuates up and down significantly. Large spike in “construction.” Large spikes in other sectors as well – “human health and social work,” “other business sector services,” “accommodation and food services.” Decline in “electricity, gas, water” jobs. – something is wrong |
| **Electrification and Hydrogen** | Looks normal! Total jobs increase by about 18,000 by 2050. Looks relatively linear and smooth. Induced jobs increase and construction and chemicals and pharmaceutical products decrease. |
| **End Existing Subsidies** | Total decrease in jobs with some small spikes up and down. Job changes are pretty moderate (total less than 800 jobs lost). Construction jobs decrease the most and electricity, gas, water increases. |
| **EV Charger Deployment** | Looks pretty different than US. |
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| **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. | Similar to US, there is significant job growth (70,000) additional jobs by 2050. All sectors show job growth or stay constant except for electricity, gas, water which declines about 10,000 jobs by 2050. Curves look smooth and linear. – 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 | Causes a large, immediate decrease in total jobs (about 15,000). Sectors look okay. There are some small spikes in most sectors and total job growth reflects some spikes up and down. Total jobs decrease by about 25,000 by 2050 with the largest decreases in “human health and social work,” “accommodation and food service,” “other business sector activities”, and “wholesale retail trade; repair of motor vehicles.” Decrease in jobs seem to be due to decrease in household spending due to decrease in motor vehicle jobs. – looks ok, although still spikes up and down |
| **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. | Giant spike and then big dip in total jobs – something is wrong |
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