# User Input

* Feedstock to Commodity Buildout: year to year resource buildout specified by user.
* Commodity to Use Buildout: year to year: User can specify the proportion of how much of each commodity’s use case (i.e., transportation= 0.4 vs. industrial process= 0.6). Each category proportions should sum to 1.

# Water Use Calculation (hydrogen for now)

Output Metric: Two metrics for water use. Consumption (loss or incorporated in the product) vs. withdrawal (diverted from the water source)

acre-feet consumed by year per feedstock & commodity (I.e., 10 acre-feet for producing hydrogen using solar). Nidhi will use the output in Tableau so long table with different feedstock and commodity category by year may work. Check with Nidhi on the output structure.

Previously “CATF Dashboard A 11.29.23.xlsx file “UserMade\_Scenario” tab column A to X is used for Tableau.

* Water consumption: “Feedstock to Commodity Buildout” inputs (i.e., 100 ton hydrogen per year) x “F2C Water” column F “Value” (i.e., 1 acre-feet per ton hydrogen) = 100 acre-feet per year
* Water withdrawal: Same as above

# Land Use Calculation (for solar (hydrogen and grid) and wind for now)

Output Metric: Two metrics for land use. Land impacted (within the fence/or leased area. Some of area can be co-located with other activities) vs. Land consumed (directly occupied by arrays or turbine)

Acres by year per feedstock & commodity

Notes:

\*New land is needed only when we build more resources. If the resource production stays the same from the previous year, there will be no new land needed.

* Land Impacted: If resource(t)-resource(t-1)>0, “Feedstock to Commodity Buildout” inputs differences from the previous year (i.e., 100 additional ton of hydrogen from last year) x “F2C Land” column G “Value” (i.e., 2 acres per hydrogen ton) = 200 acres
* Land Consumed: same as above

# Job Calculation (for solar (hydrogen and grid) and wind for now)

Output Metric: Six metrics (4 by education and skill level, 1 for total, 2 for upper bound)

Jobs by year per feedstock & commodity

Notes:

\*Solar and wind jobs are temporary jobs meaning new jobs are created when we build new resources (because our data is based on the rapid expansion period and solar/wind projects are construction heavy.). If the resource production stays the same from last year, there will be no new jobs created.

\*Operation and Maintenance related jobs will sustain throughout the periods (i.e., hydrogen production, renewable jet fuel production, etc)

\*Hydrogen using electrolysis with solar power will have two types of jobs: temporary jobs for solar construction and permanent jobs for hydrogen production facility operation.

\*Hydrogen using Natural Gas SMR will have permanent jobs for hydrogen production facility operation (unless we have data for SMR plant construction jobs)

* Jobs: If resource(t)-resource(t-1)>0, “Feedstock to Commodity Buildout” inputs differences from the previous year (i.e., 100 additional MW of solar from last year) x “F2C Jobs” column F “Value” (i.e., 0.5 jobs per MW) = 50 jobs
* For lower bound: sum of jobs from above
* For upper bound: multiply the factor to the lower bound.

# Avoided carbon emissions

Output Metric: Avoided carbon emissions (tCO2e per year)

1. Calculate avoided carbon intensity (tCO2e per unit of energy) by
   1. In general, C2U CI (displaced carbon) minus F2C CI (carbon released from the process)
   2. C2U CI can be calculated using the weighted average of different use case for the same commodity. Some CI varies each year (i.e., grid electricity will be getting cleaner every year due to the state’s policy and legal targets (RPS).)
      1. Weights come from user input from the “Commodity to Use Buildout” tab (i.e., Natural gas can be used for Surface Transport Fuel (STF) or Pipeline gas. User will specify 20% for STF and 80% for pipeline gas)
      2. “C2U CI” tab has different carbon intensities for each use case (i.e., pipeline gas and STF is 0 gCO2e/MJ because it doesn’t reduce any carbon emissions from the baseline)
      3. Useful output adjustments (for electricity, MWh can be replaced with MWh. For ground transportation, useful output may differ by fuel-vehicle technology. For example, battery electric vehicle displacing internal combustion vehicle can be compared for the useful output which is miles travelled by the vehicle per unit of energy of fuel (miles/MJ)[[1]](#footnote-2)

CARB Low Carbon Fuel Standard (LCFS) estimates carbon intensity adjusted for Energy Economy Ratio (EER). EER is 2.5 for H2 fuel cell vehicles, relative to gasoline, and 3.4 for electric vehicles, relative to gasoline.

* + 1. Weighted average will be using those two inputs: 0\*20%+0\*80% =0 gCO2e/MJ
  1. F2C CI is on the column I “Natural Value”) with the unit of gCO2e per MJ.
  2. Subtracting b-c will calculate the avoided CI in gCO2e per MJ

1. Multiply 1 (avoided CI) with the resource buildout will give us “tCO2e per year” with some unit conversion. Resource buildout is in the natural unit (ton of H2) while the avoided CI is in gCO2e per MJ. We need unit conversion of MJ H2 to ton H2, gCO2e to ton CO2e. Conversion factors can be found in ……TBD

1. <https://ww2.arb.ca.gov/sites/default/files/2020-09/lcfsguidance_20-04.pdf> [↑](#footnote-ref-2)