

1. Download meteorological data (put it in ./Meteorological_Data/)

- WR_{High}
 - 100-meter wind speed and direction from [WindToolkit](https://developer.nrel.gov/docs/wind/wind-toolkit/wtk-download/) <https://developer.nrel.gov/docs/wind/wind-toolkit/wtk-download/>
 - GHI, DHI, DNI, and near-surface wind speed, temperature, dew-point temperature, pressure from National Solar Radiation Database <https://nsrdb.nrel.gov/data-viewer>
- WR_{Low}
 - 100-meter wind speed, direction, surface downwelling shortwave flux, direct solar radiation at surface from ERA5 <https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview>

2. Generate capacity factors (run in ./preprocess_vRE/; data in ./CF_Data/)

3. minCost optimization (run ./minCost/):

```
python Main_multi.py WR_name if_wake if_landuse Opreswind Opresolar 0
maximumratio_of_natural_gas num_yr ensemble_member_id
```

4. maxAEP (run after minCost optimization in ./maxAEP/)

```
python step1_resources.py WR if_wake if_landuse OpReswind OpResolar 0 ratio_of_natural_gas num_yr
member_id
python step2_cost.py WR if_wake if_landuse OpReswind OpResolar 0 ratio_of_natural_gas num_yr
member_id
```

5. Out-of-planning-period test (run after minCost/maxAEP in ./testing_fixedstrg and/or ./testing_newstrg)

```
python Main.py WR if_wake if_landuse OpReswind OpResolar 0 ratio_of_natural_gas num_yr member_id
case_name
```

Example (using the data of 2007 provided):

- Go to ./minCost/ and run “python Main_multi.py WR_{High} 0 0 0.06 0.14 0 0 1 1”, which run minCost optimization with $OpRes_{wind}=0.06^\circ$, $OpRes_{solar}=0.14^\circ$ at vRE penetration level of 100% using WR_{High} data without consider wake or land-use restriction for single-year of 2007 (num_yr=1, ensemble_member_id=1) You will get:
 - locations and built capacity of solar:
onshoresolar_sublyrs_ens1_ng_0_cc_0_wake_0_landr_0_wind-onshore0.06_solar-UPV0.14_WRHigh_solar-UPV_locations.csv
 - locations and built capacity of wind:
onshoresolar_sublyrs_ens1_ng_0_cc_0_wake_0_landr_0_wind-onshore0.06_solar-UPV0.14_WRHigh_wind-onshore_locations.csv
 - hourly data of electricity supply and demand:
onshoresolar_sublyrs_ens1_ng_0_cc_0_wake_0_landr_0_wind-onshore0.06_solar-UPV0.14_WRHigh_Load.csv
 - statistics in *onshoresolar_WRHigh_General_Results.csv*
- Go to ./maxAEP/ and run “python step1_resources.py WR_{High} 0 0 0.06 0.14 0 0 1 1” and then “python step2_cost.py WR_{High} 0 0 0.06 0.14 0 0 1 1”