**Flowchart and Workflow**

**Step 1: Power System Modeling**

The analysis begins with a **bottom-up cost-optimization model**, which identifies the cost-optimal configuration of the power sector across the examined scenarios. This model also calculates the implications of power system development on resource use, the environment, human health, and biodiversity.

**Step 2: Macroeconomic Modeling**

The results from the power system model are passed to a **macroeconomic recursive-dynamic Computable General Equilibrium (RD-CGE) model**, which simulates the functioning of the wider economy and the behavior of its agents (see Subsection 3.2.2). This model evaluates the macroeconomic impacts of changes in the power system.

**Step 3: Multicriteria Decision Analysis**

Outputs from the models feed into a **multicriteria decision analysis (MCDA) framework**, which uses a hybrid **AHP–TOPSIS** approach:

* **Criteria** are quantified based on model outputs.
* **Weights** are derived using the AHP method.
* **TOPSIS** is then applied to evaluate the overall performance of strategies, providing relative closeness scores to the ideal solution.

**Running the Cost Optimization Model**

1. To run the model (version [**OSeMosys\_2015\_08\_27.txt**](http://www.osemosys.org/uploads/1/8/5/0/18504136/osemosys_2015_08_27.txt)) execute **RunSimulation.exe** (right click, and then run as administrator).
2. The model requires the **GLPK solver**, which is free to install and use.
3. After execution, results are stored as .csv files in the **results/** folder.

**Post-Processing of Results**

1. Results were consolidated in **results.xlsx**, which contains post-processed outputs for all examined scenarios.
2. Each worksheet corresponds to one indicator analyzed in this study (later used as a criterion in MCDA).
   * Example: the worksheet **ET\_Cost\_of\_ELCgen\_InvestmentCos** calculates power generation costs based on technology capacity investments, and fixed and variable operational costs derived from the model.
3. Indicators such as **land use impacts** (e.g., see worksheet *land\_req\_appl*) are calculated by combining model-derived capacities with coefficients provided in Appendix A. They can also derived directly from the model as separate .csv outputs.
4. For each indicator, results across the full-time horizon (e.g., 2023–2050) are aggregated into cumulative totals. These totals represent the **performance of each strategy** on that indicator.

**Construction of the Payoff Table**

* The cumulative performances across indicators are compiled into a **payoff table**, located in **multicriteria\_results.xlsx** (worksheet **w/s Visualization\_v2**).
* **Weights** for the criteria are calculated based on the AHP method in the worksheet **Weight\_scenarios** of the same file.
  + Users define pairwise comparisons between criteria using **linguistic values**.
  + Weights are then automatically calculated based on the **AHP method**.
  + Alternatively, users may manually assign weights, provided they sum to 1. To exclude a criterion, a weight of 0 must be assigned to that criterion.

**Application of TOPSIS**

Based on the payoff table and the assigned weights:

1. The **TOPSIS method** is applied (as implemented in the Excel formulas).
2. Results are expressed as **relative closeness (D)** to the ideal solution, where values closer to 1 indicate better performance.
3. By defining various sets of weights, users can apply a sensitivity analysis of results against various policy mixes.