

FVI Necessity Score (Core) – Implementable Formulas Using Available Data

Using only the four files you provided, this guide defines precise fields, filters, and formulas for the Necessity composites in your FVI sheet. Where a target variable is missing, I provide a minimal proxy that is internally consistent.

Datasets detected

- Population dependent on coal.xlsx — likely includes a 'Static % (latest)' column per country (coal dependency of population).
- Electricity generated by coal.xlsx — WDI-style panel with columns: Country Name/Code, Series Name, Year columns (1990–2024).
- Coal Consumption by Countries (Year Wise).xlsx — OWID-style long table: Entity, Year, Coal consumption - TWh.
- Necessity Energy Fulfillment.xlsx — 'Meta Data' sheet; use for consistent definitions/units.

Global conventions

- Choose a scoring year (e.g., 2023) and use that across all calculations.
- Use ISO-3 country codes; standardize country names across files.
- When a % is stored as percent points, divide by 100 to get a fraction before multiplication.

NECESSITY 1 — Population Reliant on Coal-Generated Electricity

Goal: Share of population living in countries where coal is a primary electricity source, or directly the % of population dependent on coal where provided.

Datasets & fields

- Population dependent on coal.xlsx → fields: Country, Static % (latest). If available: Population (latest).
- Electricity generated by coal.xlsx → if 'Static %' missing, derive coal share of generation from this panel (Series Name should identify coal electricity).

Formulas (math)

- If Static % exists: $NecPop[c] = StaticPct[c]$ (percent points).
- Else derive: $NecPop[c] = 100 \times CoalGen_MWh[c] / TotalGen_MWh[c]$ (requires TotalGen if present; else proxy with coal electricity vs all electricity indicators available).

Aggregation

- Global population-weighted necessity: $NecPop_global = 100 \times \sum_c (NecPop[c] / 100 \times Population[c]) / \sum_c Population[c]$.

NECESSITY 2 — Coal Share of Electricity Production

Goal: Degree to which coal is needed in the current electricity mix.

Datasets & fields

- Electricity generated by coal.xlsx → fields: Country Name, (Year columns) for coal-generated electricity.
- If file contains only coal MWh (no total), compute *relative reliance rank* using coal MWh per capita or coal MWh growth.

Formulas (math)

- If TotalGen available: $CoalShareElec[c] = 100 \times CoalGen[c] / TotalGen[c]$.
- If TotalGen not available: $CoalRelianceIndex[c] = 100 \times CoalGen[c] / median(CoalGen[peers])$.

Normalization

- Rank or min–max CoalShareElec (or CoalRelianceIndex) to 0–100 where higher = more necessity.

NECESSITY 3 — Final■Energy Dependence on Coal (Consumption)

Goal: Reliance on coal in final energy consumption.

Dataset & fields

- Coal Consumption by Countries (Year Wise).xlsx → fields: Entity (Country), Year, Coal consumption - TWh.

Formulas (math)

- $NecConsAbs[c] = CoalConsumption_TWh[c]$.
- If population (or GDP) is available (e.g., from the Meta Data or WDI you already uploaded earlier): $NecCons_pc[c] = CoalConsumption_TWh[c] / Population[c]$.

Scoring

- Normalize NecConsAbs or NecCons_pc to 0–100 (higher = more necessity).

NECESSITY 4 — Substitutability Gap (Proxy)

Goal: How hard it is to replace coal without disrupting energy services.

Datasets & fields

- Electricity generated by coal.xlsx → coal electricity over time.
- Coal Consumption by Countries (Year Wise).xlsx → consumption trend.

Formulas (math)

- $CoalTrend[c] = slope(CoalConsumption_TWh[c, t] \text{ over last } N \text{ years })$.
- $SubstiGap[c] = \alpha \times CoalShareElec[c] + \beta \times \max(0, CoalTrend[c])$.

Typical $\alpha=0.7$, $\beta=0.3$; set $\beta=0$ if you lack stable trend windows.

NECESSITY 5 — Population at Risk from Under■Supply (Proxy)

Goal: If coal supply drops quickly, what population would be affected.

Datasets & fields

- Population dependent on coal.xlsx → Static % (latest), Population (if available).

Formulas (math)

- $PopAtRisk[c] = (StaticPct[c]/100) \times Population[c]$.
- If Population absent, use $PopAtRiskIdx[c] = StaticPct[c]$.

Composite assembly

- Normalize each submetric to 0–100 (higher = more necessity). Winsorize 1st/99th percentile. Suggested weights: Pop reliant 30%, Coal share of electricity 25%, Final■energy dependence 20%, Substitutability gap 15%, Population at risk 10%.
- Provide a 'Config' tab for the chosen year and α, β weights. Keep country → ISO3 mapping in a canonical table.