# FVI – Infrastructure Repurposing (Restructuring) Score

This guide uses your uploaded CSV plus recommended open datasets to compute implementable submetrics and a composite score for infrastructure repurposing.

## What you provided (CSV)

• global_coal_plant_tracker_data (2).csv — columns detected: plant_name, unit_name, plant_unit_name, owner, parent_company.

→ To compute restructuring metrics, we enrich with public datasets for capacity, COD year, coordinates, status, grid, and resource quality.

## External datasets to join (field mapping)

• Global Coal Plant Tracker (GEM): plant/unit attributes incl. Country/Area, status, first year (COD), capacity (MW), net generation (GWh/yr), coordinates.

• Global Power Plant Database (WRI): plant-level capacity (MW), fuel, latitude/longitude, country.

• Global Solar Atlas (World Bank/ESMAP): country/coordinate-level GHI / PVOUT (kWh/kWp), used for PV suitability.

• Global Wind Atlas (DTU/World Bank): mean wind speed/power density by location, used for wind suitability.

• Global Transmission Network / GridFinder (World Bank/ESMAP): transmission & distribution line locations; substation proximity proxy.

• Optional: Global Gas Infrastructure Tracker (GEM): pipelines/LNG proximity for coal→gas conversion feasibility.

## Proposed submetrics & formulas (all normalized 0–100, higher = easier to repurpose)

### IR1 — Decommissioning Readiness (Age & Status)

Inputs: COD_year, status (operating/retired/announced), Typical_Lifetime_years (e.g., 40).

Formula:

• `Age = Year_ref − COD_year`

• `Readiness_raw = (Age / Typical_Lifetime_years)`

• `IR1 = 100 × min(1, max(0, Readiness_raw)) (older ⇒ closer to retirement ⇒ easier to repurpose)`

### IR2 — Grid Interconnection Advantage

Inputs: Plant coordinates; nearest HV line distance (km); substation presence.

Formula:

• `Dist_to_HV_km = distance(plant_point, nearest_transmission_line)`

• `IR2 = 100 × (1 − min(Dist_to_HV_km / D_max, 1)) (closer grid ⇒ higher score)`

Parameter: D_max (e.g., 50 km).

### IR3 — PV Repowering Suitability

Inputs: GHI or PVOUT at plant/country; site area proxy Area_est_km² = k_area × Capacity_GW; PV land-use k_pv (km² per GW).

Formula:

• `PV_Cap_possible_GW = Area_est_km² / k_pv`

• `IR3 = 100 × percentile_rank( PVOUT × PV_Cap_possible_GW )`

Typical parameters: k_area≈3.0 km²/GW (brownfield footprint proxy), k_pv≈3.5 km²/GW (utility PV).

IR4 — Wind Repowering Suitability

Inputs: Mean wind speed/power density at plant/country; site area proxy Area_est_km²; wind capacity density k_wind≈3 MW/km².

Formula:

- `Wind_Cap_possible_GW = (Area_est_km² × k_wind) / 1000`
- `IR4 = 100 × percentile_rank( WindResource × Wind_Cap_possible_GW )`

IR5 — Brownfield Reuse Factor

Inputs: Existing interconnection (binary=1), rail/road/water access proxies (binary weights), brownfield contamination flag (–).

Formula:

- `ReuseScore = w_grid*1 + w_rail*Rail + w_water*Water − w_contam*Contam`
- `IR5 = 100 × ReuseScore / (w_grid + w_rail + w_water)`

Where Rail/Water/Contam are 0/1 from manual table if not available yet.

IR6 — Fuel■Switch Feasibility (Optional)

Inputs: Distance to nearest gas pipeline or LNG terminal; boiler retrofit class.

Formula:

- `Dist_to_gas_km = distance(plant_point, nearest_gas_asset)`
- `IR6 = 100 × (1 − min(Dist_to_gas_km / G_max, 1)) × RetrofitFlag`

G_max e.g., 200 km; RetrofitFlag∈{0,1}.

## Composite assembly

Normalize IR1–IR6 to 0–100 and compute weighted average. Suggested weights: IR1 20%, IR2 20%, IR3 20%, IR4 15%, IR5 15%, IR6 10% (if used).

Country■level scores: capacity■weight plant scores within each country.

## Minimal implementation steps

1) Join your CSV to GCPT/GPPD by plant_name (and country) to get capacity, coordinates, COD_year, status.

2) Build Area_est_km² = k_area × Capacity_GW per plant.

3) Use Global Solar/Wind Atlas to fetch PVOUT and wind speed by country (or sample at coordinates).

4) Compute distances to nearest grid line and gas asset using global transmission and gas infra datasets.

5) Calculate IR1–IR6; normalize and aggregate.