Cost of Setting Up 50 Tonne (~1 MW ~ 1850 Panels) Plasma Pyrolysis-Based Plant (50 tonnes at a time)

1. **Heating furnaces for Aluminium (Cylindrical)**
    - r=2 m, h = 7m
    - T>200°

    Volume = $\pi r^2 h$ = 8796.4 lit

    Furnaces Required = 3
    - Each furnace can hold up to 50 panels at a time.
    - So, in one hour → 1 furnace handles 100 panels/hour (2 shifts).
    - For 8 hours → 1 furnace handles 800 panels.

    Surface Area Calculation (S):

    $S=2\pi r^2+2\pi rh = 36\pi$ sqm

    Material Needed: SS 317 (works under high temperatures, corrosion resistant)

    Density = 8000kg/m^3

    Price = ₹500/\text{kg}

    Weight of Material Required:

    Weight=S × Thickness ×ρ

    Total Material Needed:10857×3 = 33000 kg

    33000×500

    Cost → 1.65 Cr

2. **Precision Cutters**
    - Capacity = 1–2 panels/min
    - 20–30KW, 120 panels/hour
    - For 8 hours = 960 panels/cutter
    - 3–4 cutters needed for efficient operation

- **Cost → 30 lakh each, so almost 1.2cr**

3. **Subcritical treatment in water**
   - r = 2, h=7
   - Distilled water (One batch will undergo treatment for 1 hour)
   - Furnace required = 6–7 furnaces
   - Material used is same = SS317
   - Cost → 10857×7×500
   - **Cost = 3.8 Cr**
4. **Crushers**
   - 500–1000 kg/hour
   - **Power = 30–50 kW**
   - For 8 hours = 5600 kg/crusher
   - **Required → 50000/5600 ≈ 9 crushers**
   - **Cost of 1 crusher = 1 Cr**
     [Hammer, PCB Series Type]

   Total Cost → 9 Cr

5. **Cooling tanks for Subcritical water**

   Qty → 3-4
   Each with a capacity to hold 50000 litres.
   Cost → (Assuming material is the same: SS 317)
   → 80577 × 10 × 3 × 500
   → **1.65 Cr**

6. **Plasma Reactor**

   r = 1 m, h = 5 m
   S = 2π × 1(6) = 12π

   Material used → **SS 317**

   For Inner Coating → **Hafnium Carbide** (Melting point = 4000°C)

   Price → Rupee 30000/Kg

   Density = 12200 kg/m^3

SS 317 Sheet:

$= 12 \times \pi \times 8000 \times 12 \times 10^{-3}$

= 3700 kg

= Price = **18.50 Lakhs (3700 * 500/kg)**

Hafnium Carbide inner coating (thickness = 2mm):

Surface Area:

$S=2\pi r(r+h) = 2\pi \times 1 \times (1+5) = 37.6$ sqm

Material Required:

$37.6 \times 12200 \times 2 \times 10^{-3} = 920$ kg

Considering wastage → 1000 kg

Price:

Rate = ₹40000/kg

Price = 40000*1000 = 4cr

Total = 4.18crore

7. **Cooling/Condensation Chamber for Metals:**

- **2 Chambers Required**
- Material: SS-317
- r=2, h=7
- **Price =** 10857 * 500 = 1.08 cr

8. **Turbine:**

- Turbine Cost → ₹50–70 lakh per MW
- Generator Cost → ₹30–50 lakh per MW

Total Setup for Turbine → 3–5 crore

Plasma Electrodes

- Tungsten electrodes (₹20000–30000 per kg)
- Required for any reactor → 5 to 10 kg
- Price → 300000

Auxiliary Systems

- Electrical systems + Transformers (to convert generated electricity into high voltage) + Cooling systems for plasma reactor; storage tanks for condensed metals, etc.
- **~2–3 crore**

Combustion chambers

- we need to include 3–4 → 2.17 Cr

Net total for setup = Almost 35 crores

Now if we assume for 100 tonne plant:

- We need to increase heating furnace (3 more)
- Subcritical tanks (2-3 more)
- Storage tanks for metals, cutters (4 more added), crushers (4 more added)
- **Plasma reactor still one is sufficient.**

Combustion chamber → 2 more = ₹1 Cr

Estimated cost now →
35 + 1.65 + 1.65 + 1.2 + 4 = 43.5 Cr

Other upgrades of auxiliary systems:
₹3-4 Cr

~50 Cr final

Now for 500 tonne plant:

Massive upgrade necessary:

- Heating furnace → 6 more → 5 Cr
- Subcritical tanks → 3-4 more → 3.6 Cr
- Combustion chambers → 3-4 more → 3.6 Cr

Crushers (either ↑ in number or ↑ the capacity; if ↑ in capacity, cost will also ↑ number) = 8-10 more crushers (10cr)

Cutters:
8-10 more → ₹3 Cr

Plasma reactor one more added – 4cr

Turbine one more added – 5cr

Auxiliary system upgrades – 6-7 cr

Total = 50 + 40 cr = approx. 90 cr

These are rough estimates only, the sizes and the quantity of the furnaces may vary depending on the capacity the plant operates, thus the final cost of setting up plant will vary. The entire aim of our above analysis is to prove that increasing the capacity of the plant, the cost per tonne decreases exponentially.