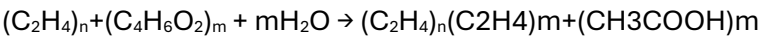


# Energetic and thermodynamic analysis for plasma pyrolysis:

## Reaction of EVA with Water

The reaction proceeds as follows:



Ethylene is recovered, and vinyl acetate breaks down into acetic acid.

## Material Breakdown for 1 MW Solar Panels

### Component Percentage (%) Mass (Kg)

Glass	76%	39368
Other Metals	11%	5180
Aluminium	8%	4144
EVA	8%	4144
PVF	2%	1036

## EVA Composition and Breakdown

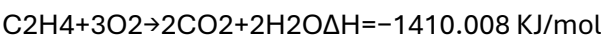
- EVA consists of:
  - 80% Ethylene (C<sub>2</sub>H<sub>4</sub>)
  - 20% Vinyl Acetate (C<sub>4</sub>H<sub>6</sub>O<sub>2</sub>)

Component	Percentage (%)	Mass (Kg)	Molar Mass (g/mol)	Moles
C <sub>2</sub> H <sub>4</sub>	80%	3315.2	28	118400
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	20%	828.8	86	963

- Vinyl acetate fully breaks down into acetic acid (CH<sub>3</sub>COOH), yielding 963 moles of acetic acid.

## Combustion Reactions and Energetics

### 1. Ethylene (C<sub>2</sub>H<sub>4</sub>) Combustion:



$$\text{Energy from } 118400 \text{ mol} = 118400 \times -1410.008 \text{ KJ} = -166.96 \text{ GJ}$$

**Total Energy Released:**

167 GJ

**Electricity Generated (Efficiency = 50 % considering that 20 % heat also lost while heating the water ):**

$167 - 20\% = 133.6$  , almost 134GJ

$133 * 0.5 = 67\text{GJ}$

### Energy Required for Plasma Pyrolysis

#### Argon Gas Ionization

Parameter	Value
Volume of Argon	2.12 m <sup>3</sup> (2120 L)
Moles (n)	87
Ionization Energy (731 KJ/mol)	63.59 MJ
Thermal Energy	16.27 MJ

**Total Energy (Argon)** 79.86 MJ

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#### Energy for Metal Vaporization

Metal	Mass (Kg)	Heat of Fusion (KJ/mol)	Heat of Vaporization (KJ/mol)	Total Energy (GJ)
Si	2072	50.2	383	35
Cu	518	13.26	300.4	0.862
Ag	15	23.5	254	0.454
Pb	23	4.77	179.5	0.150
Ti	22	14.15	425	3
Sn	14	7.03	296.1	0.100

#### Total Energy for Metals:

$(35 + 3 + 0.862 + 0.454 + 0.150 + 0.100)$  GJ  $\approx 39.57$  GJ

Energy for metals is calculated as:

[(From Room temperature (RT) to melting point(Tm) ]



$$m \cdot C_p(T_m - RT) + \text{Heat of fusion} + m \cdot C_p(T_b - T_m) + \text{heat of vaporization}$$

### Final Energy Requirements

Component	Energy (GJ)
Electricity generated	67GJ
Plasma Pyrolysis Energy (Required)	39.57
<b>Net Energy Available</b>	<b>27.43</b>

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Let me know if any further refinement is needed!