Indirect co-firing consists of the combustion of producer gas from biomass/waste gasification in coal-fired furnaces or lime kilns. Gasification can be thus considered a method for biomass pre-processing.

**Advantages**
- High efficiency (economy of scale).
- Use of existing infrastructure.
- Relatively low additional capital investment.
- Reduction of CO₂ emissions.
- Fuel flexibility.
- **Possibility of keeping biomass ash separated from coal ash.**
- High co-firing ratios possible.
- No significant impact on the performance of boiler (capacity, stability and availability).
- **Less strict requirements in producer gas quality** (heating value, tar and particles content) as compared to other applications (e.g. gas turbines, engines).
- Better fuel flexibility than direct co-firing.

**Disadvantages/ challenges**
- Relatively high unit investment costs compared to direct co-firing (investment costs: 300-1100 €/kWₑ).
- Risk of fouling and hot corrosion due to Cl, S and alkalis (but lower compared to direct co-firing).

---

**Examples of commercial indirect co-firing plants**

<table>
<thead>
<tr>
<th>Plant</th>
<th>Biomass fuel</th>
<th>Type of gasifier</th>
<th>Producer gas cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amergas power plant, Geertruidenberg, The Netherlands</td>
<td>Waste wood (5% of total heat input to boiler)</td>
<td>Air-blown CFB, 83 MWₜₜ 840°C</td>
<td>Cooler + cyclone</td>
</tr>
<tr>
<td>Kymijärvi power plant, Lahti, Finland</td>
<td>Recycled energy fuel (REF), sawdust, bark, wood chips, wood wastes (15% of total boiler input fuel)</td>
<td>Air-blown CFB, 45-70 MWₜₜ 850-900°C</td>
<td>-</td>
</tr>
<tr>
<td>Metso Vaskiluodon Voima, Vaasa, Finland</td>
<td>Forest residues (chips)</td>
<td>CFB, 140 MWₜₜ</td>
<td>-</td>
</tr>
<tr>
<td>Electrabel Ruien power plant, Belgium</td>
<td>Wood chips, bark, hard and soft board residues</td>
<td>Atmospheric, air-blown CFB, 40-80 MWₜₜ</td>
<td>-</td>
</tr>
</tbody>
</table>

---

*Metso Vaskiluodon Voima, Finland (top). Amergas, The Netherlands (bottom).*