NASEM Committee on Carbon Utilization Infrastructure, Markets, Research and Development

Session: CO2-Derived Products

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March 1, 2022

CO_2 Derived Products Session – Key Messages

1. Although the right thing to do, CO_2 utilization potential in chemicals is dwarfed by CO2 emissions from fossil fuel energy sources
   - Examples are global urea production (150 MM tons/yr); global polymer production ~370 MM tons/yr…….but global fossil fuel consumption 15 **billion** tons/yr

2. Many attractive targets of CO_2 utilization require chemical reduction (e.g. methanol) or energy to drive endothermic reaction (dry methane reforming or electrochemistry) to make CO
   - Only viable if renewable energy used for these process and for reactant production (e.g. H_2)

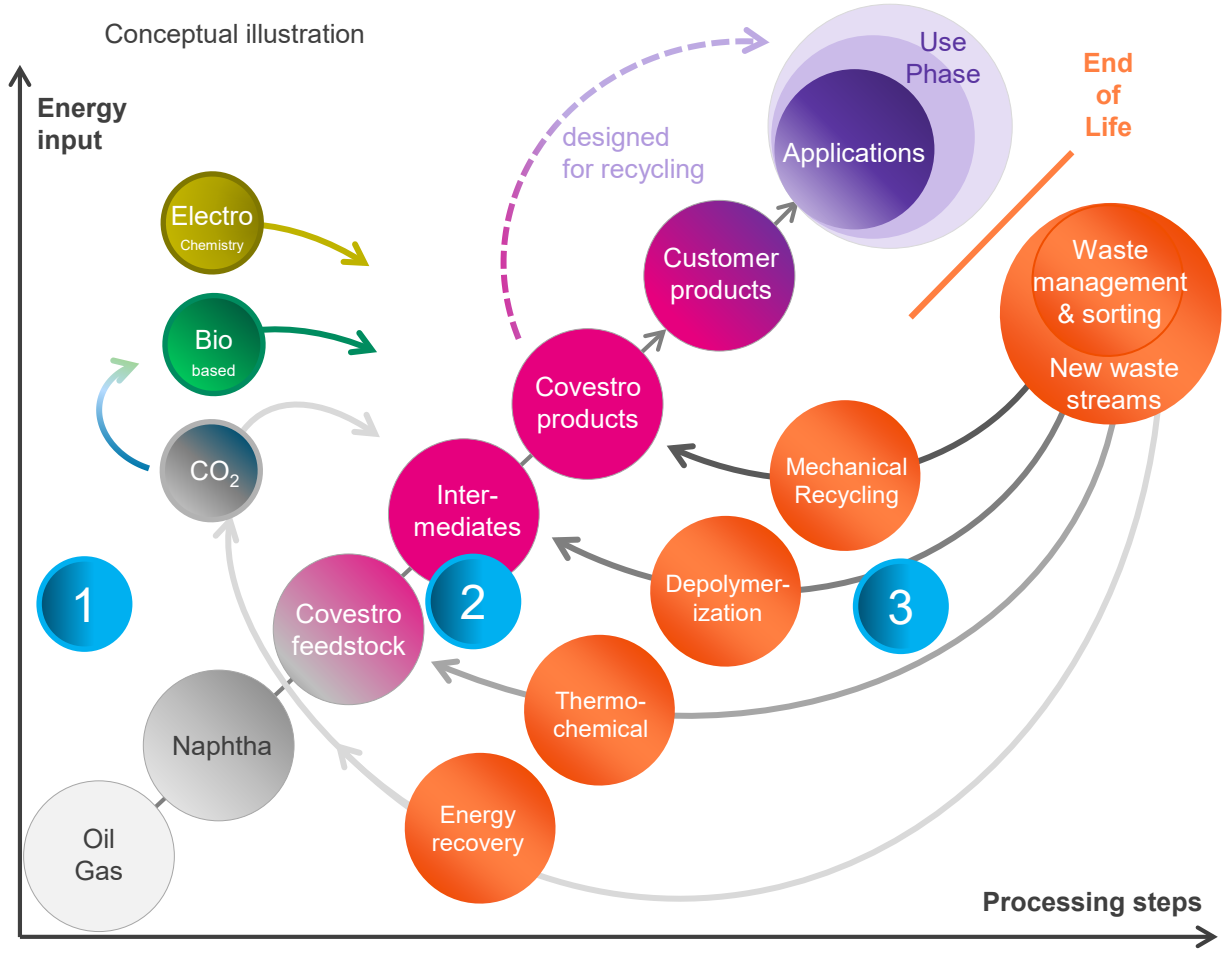
3. Mass balance approach to account for CO_2 or renewable content developing rapidly
   - Need consensus on standards (subject of recent NIST whitepaper)

4. Increased availability of alternative raw materials and energies at competitive prices occurring
   - Global efforts not only on plant based, but increasingly recycled plastic-based feedstocks

5. Cost comparisons should include total social and economic cost of fossil fuel extraction and CO_2 emissions
   - Difficult to achieve cost parity of new technology without accounting for real cost of incumbent

Closing material and carbon loops for a circular economy

What options is Covestro considering for our products



Covestro approach to circularity

1. Renewable energy & efficiency

2. Alternative raw materials

3. Innovative recycling for end-of-life solutions