Coal Conversion and CO_2 Utilization

China Coal Research Institute

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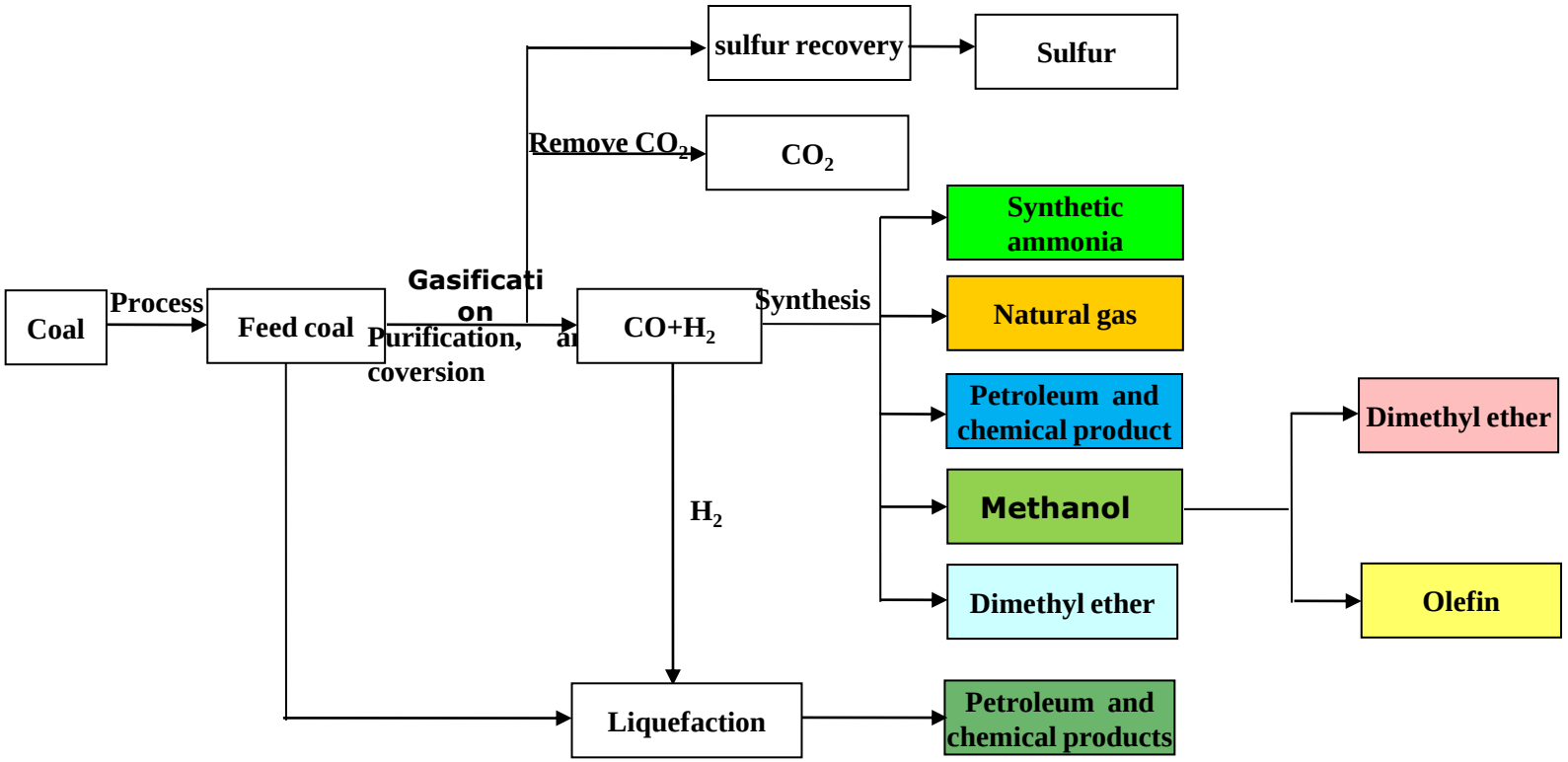
Agenda

- Coal Conversion Technologies and CO_2 Emissions
- Approaches for CO2 Emissions Reduction and Utilization through Coal Conversion
- Demonstration Projects of Coal Conversion and CO_2 Utilization demonstration projects

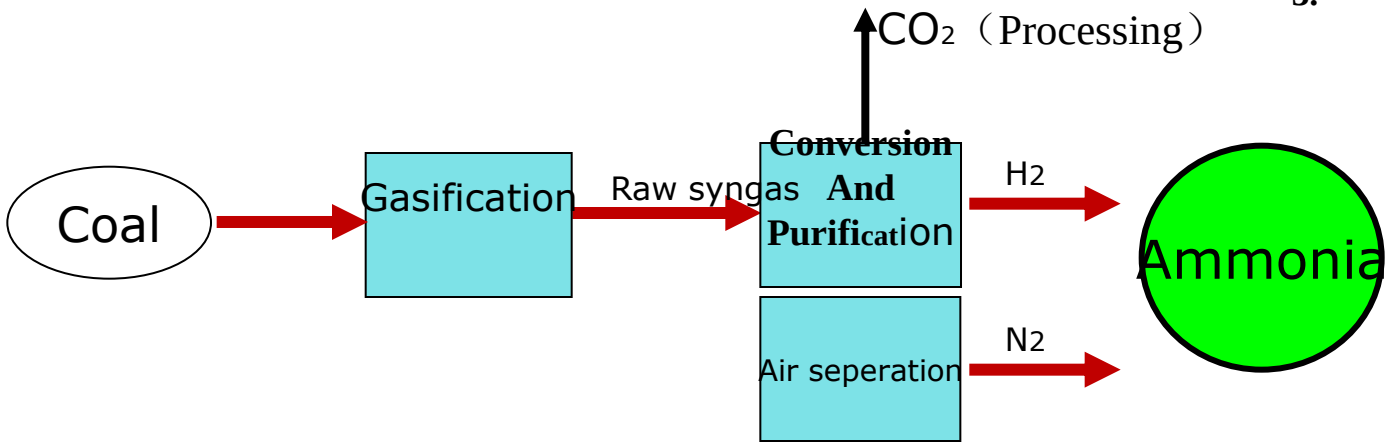
I. Coal Conversion Technology and CO2 Emissions



Routes of Coal Conversion

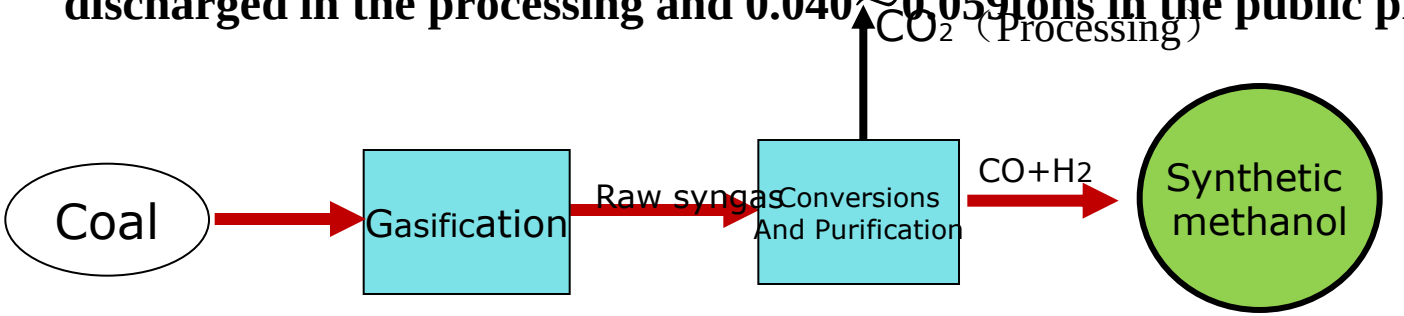
（1） Ammonia and Urea Production from Coal

- **The comprehensive coal consumption in ammonia production is 1.3～1.7 tons of standard coal equivalent per ton of NH_3， a level of below 1.5tce/tNH_3 can be achieved if technology permits.**
- **Volume of carbon dioxide emissions is about 2 ～3t/tNH_3.**



（2）Methanol Production from Coal

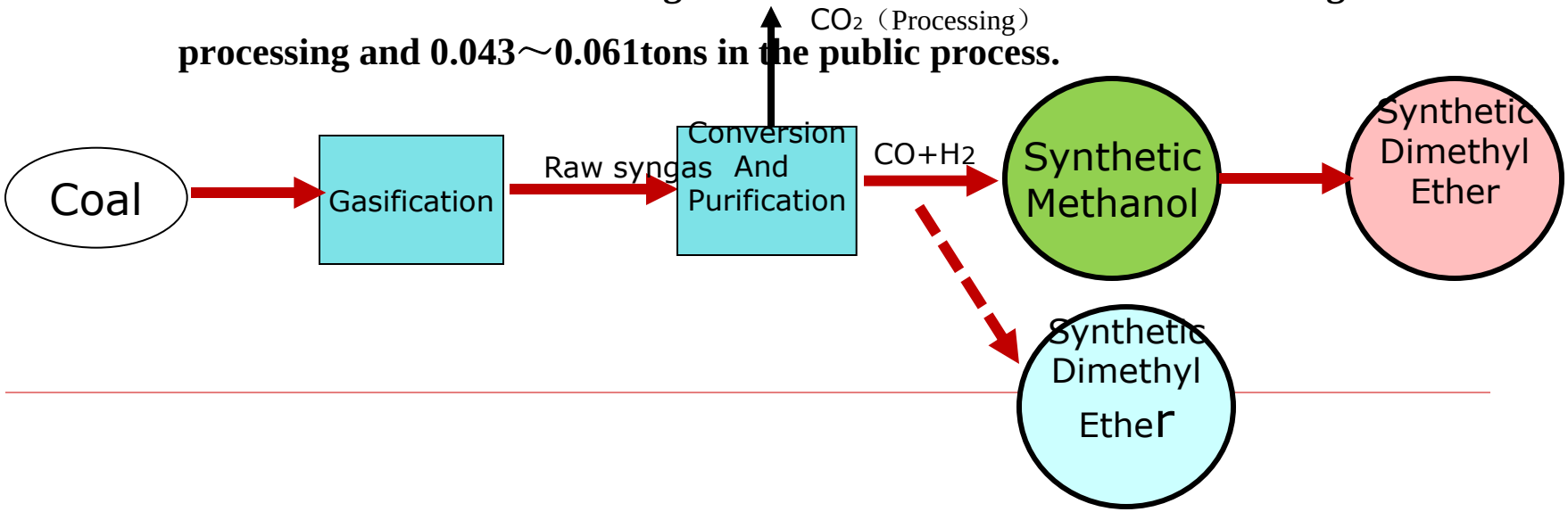
- **The comprehensive coal consumption in methanol production is 1.42～1.59 tons of standard coal equivalent per ton of methanol. Energy conversion efficiency can reach 43～48% , or even 50% in some large projects.**
- **CO_2 emissions are 2.37～3.52tons of carbon dioxide per ton of methanol(0.119～0.176t/GJ), among which 0.079～0.117tons are discharged in the processing and 0.040～0.059tons in the public process.**



（3） Dimethyl Ether Production from Coal

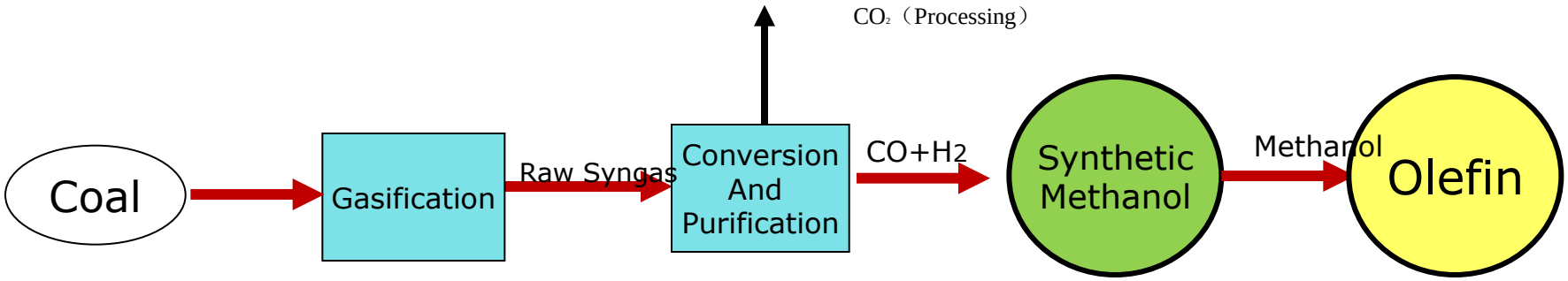
- **The comprehensive coal consumption here is 2.18~2.40 tons of standard coal equivalent per ton of dimethyl ether. Energy conversion efficiency can reach 41～45%.**

- **CO_2 emissions are 3.8～5.48tons of carbon dioxide per ton of dimethyl ether （or, 0.133～0.190t/GJ）， among which 0.090～0.129tons are discharged in the processing and 0.043～0.061tons in the public process.**



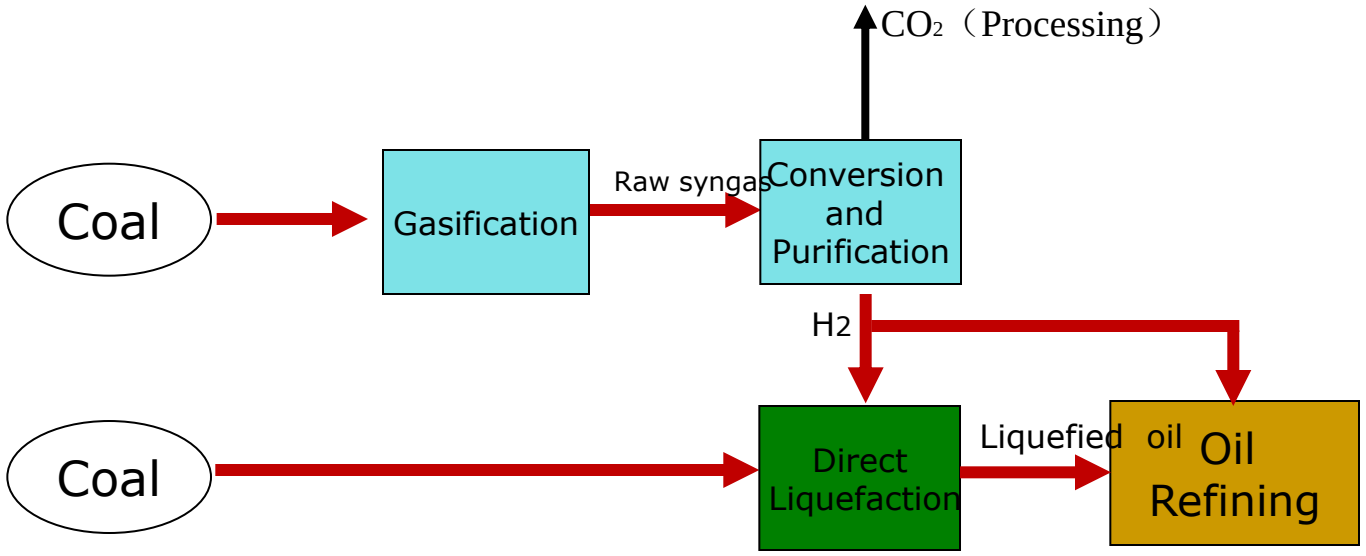
（4）Olefin Production from Coal

- **The comprehensive coal consumption is 4.28～5.20 tons of standard coal equivalent per ton of olefin.**
- **CO_2 emissions are 6.40～9.15tons of carbon dioxide per ton of olefin, among which 4.27～6.10tons are discharged in the processing and 2.13～3.05 tons in the public process.**



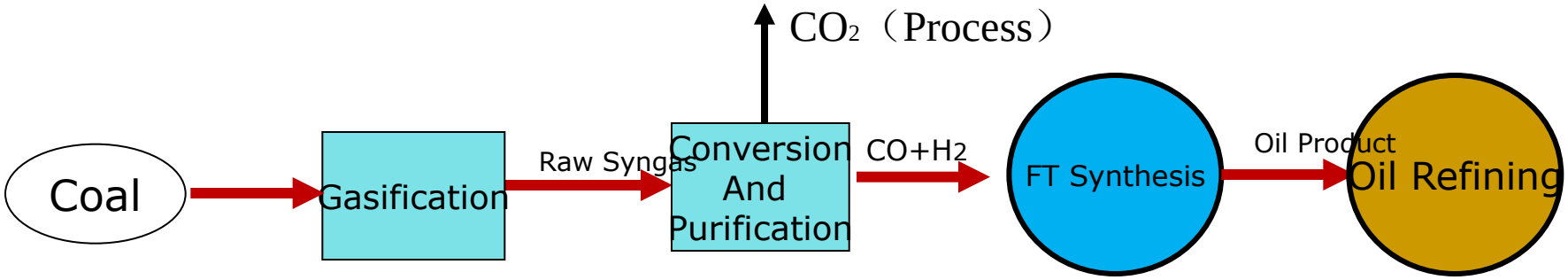
（5）Direct Liquefaction of Coal

- **The comprehensive coal consumption is 2.57～3.01 tons of standard coal equivalent per ton of coal in direct liquefaction of coal; energy conversion efficiency stands at 50～58%.**
- **CO_2 emissions are 4.14～6.85tons per ton of oil product (or, 0.096～0.157t/GJ), among which 0.067～0.110tons are discharged in the processing and 0.029～0.047 tons in the public process.**



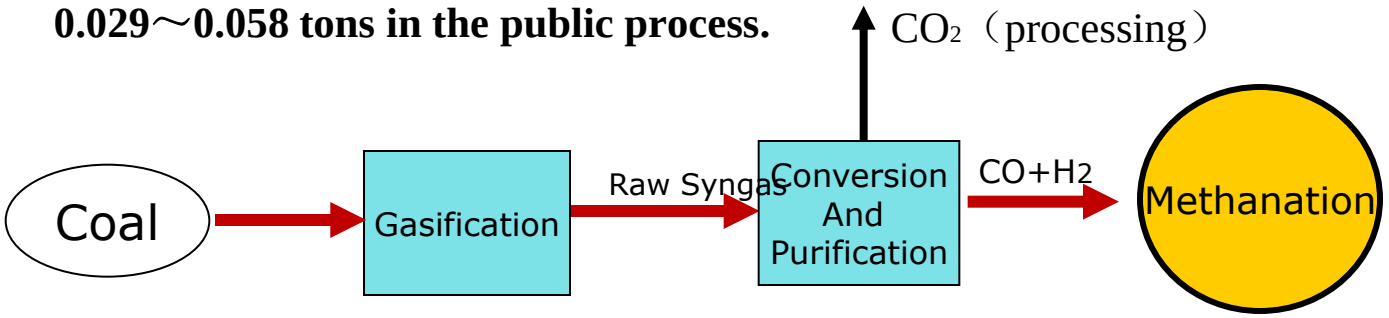
（6） Indirect Liquefaction of Coal

- **The comprehensive coal consumption is 3.24～3.87 tons of standard coal equivalent per ton of coal in indirect liquefaction of coal; energy conversion efficiency stands at 38～43%.**
- **CO_2 emissions are 5.52～8.49tons per ton of oil product (or, 0.128～0.197t/GJ), among which 0.085～0.131 tons are discharged in the processing and 0.043～0.066 tons in the public process.**



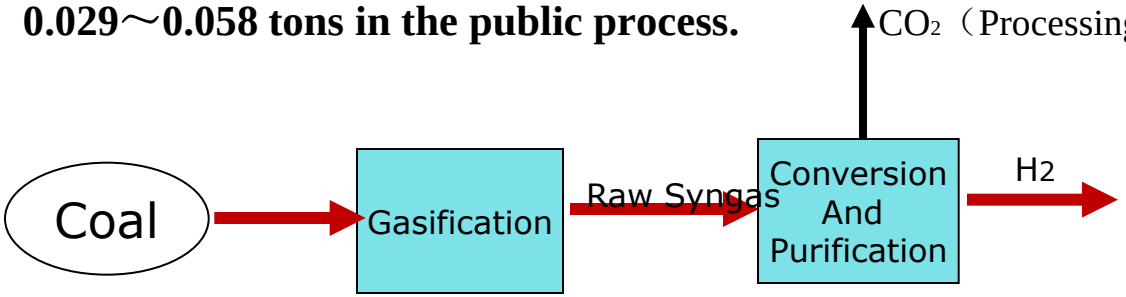
（7）Natural Gas from Coal

- **The comprehensive coal consumption is 1.97～2.25 tons of standard coal equivalent per cubic kilometers of natural gas; energy conversion efficiency stands at 55～63%.**
- **CO_2 emissions are 3.2～5 tons per cubic kilometers of natural gas (or, 0.086～0.145t/GJ), among 0.057～0.097 tons are discharged in the processing and 0.029～0.058 tons in the public process.**

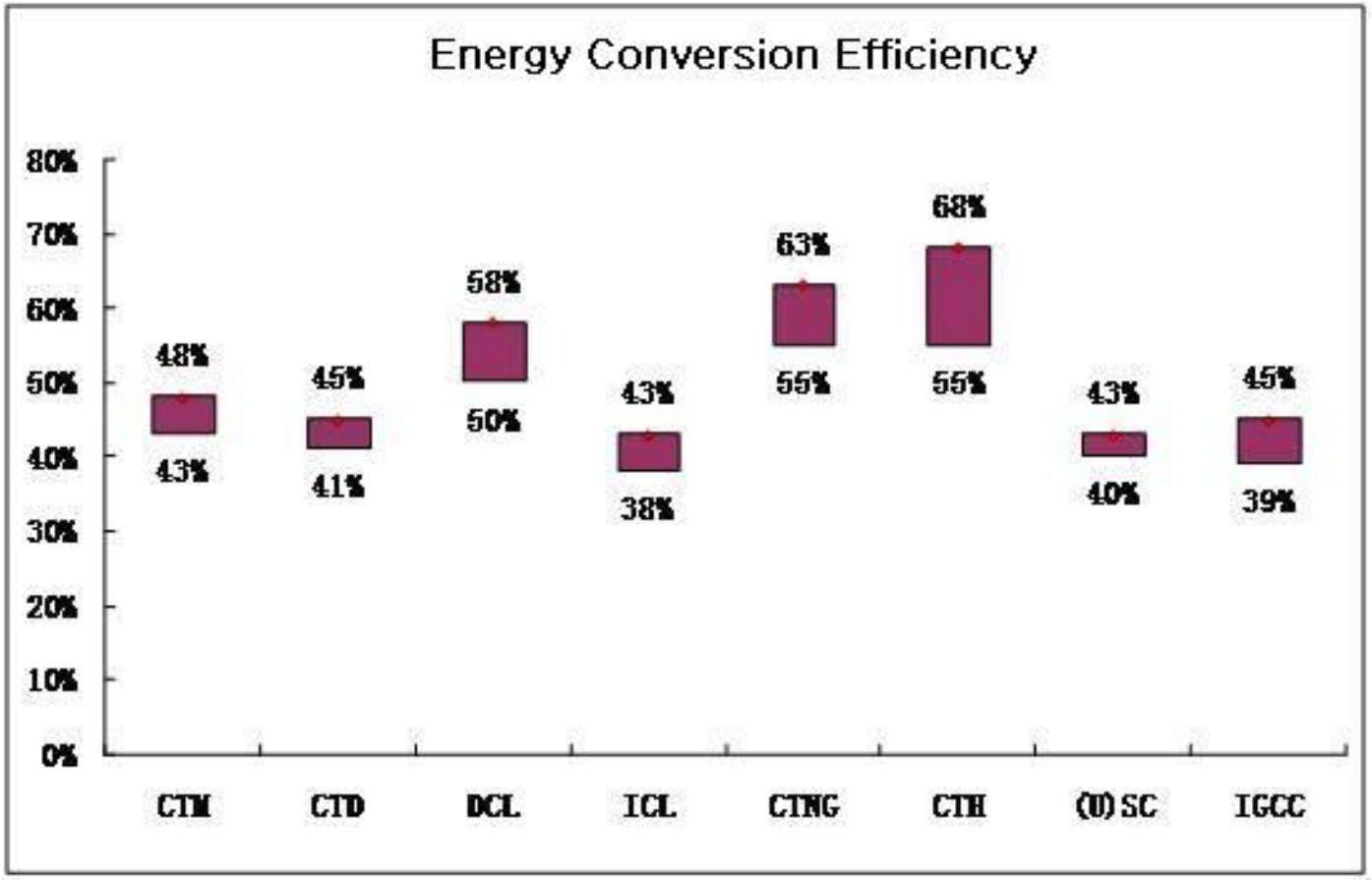


（8）Hydrogen Production from Coal

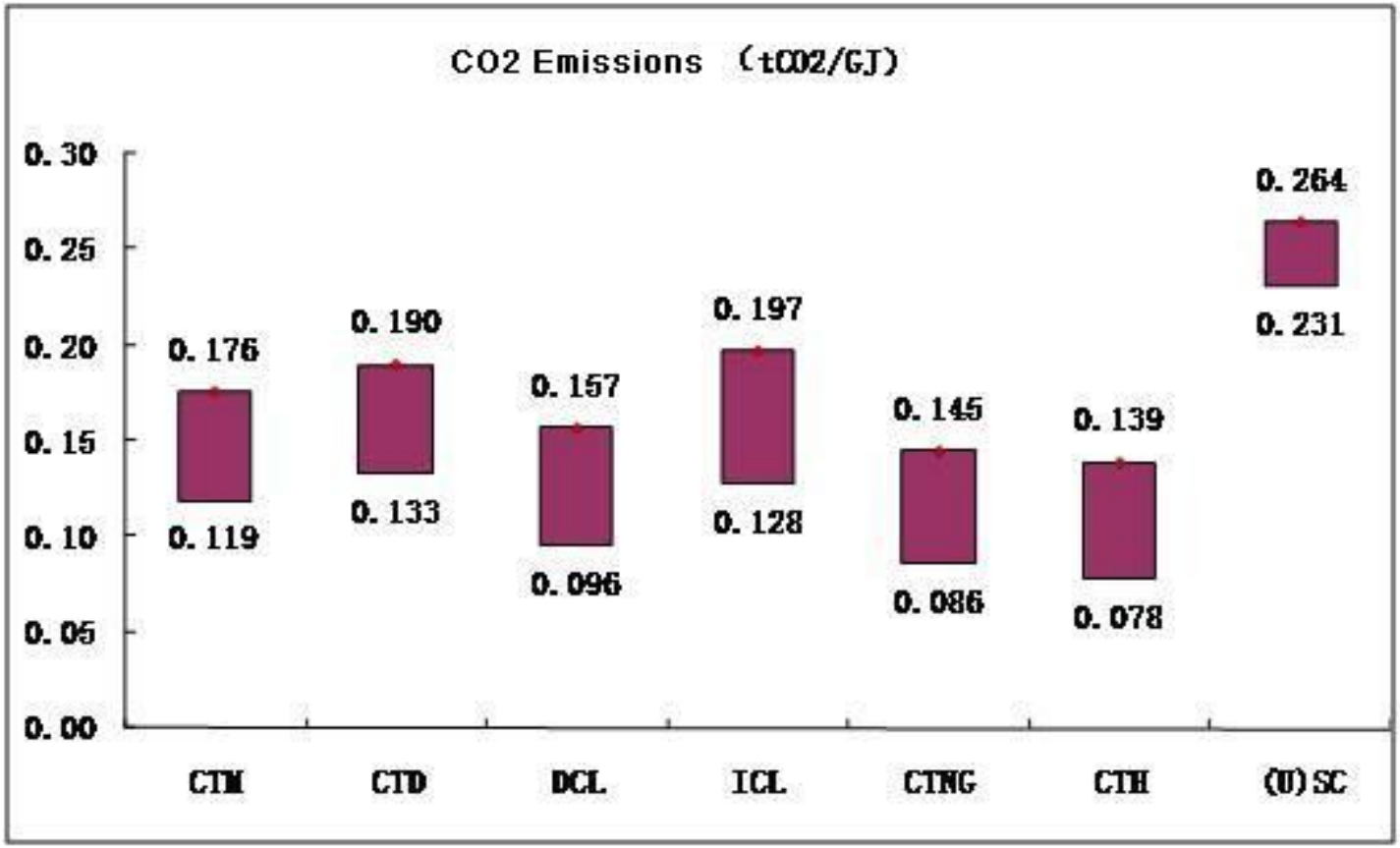
- **The comprehensive coal consumption is 0.64～0.79 tons of standard coal equivalent per cubic kilometers of hydrogen; energy conversion efficiency stands at 55～68％.**
- **CO_2 emissions are 1.02～1.82 tons per cubic kilometers of hydrogen (or, 0.078～0.139t/GJ),, among 0.057～0.097 tons are discharged in the processing and 0.029～0.058 tons in the public process.**



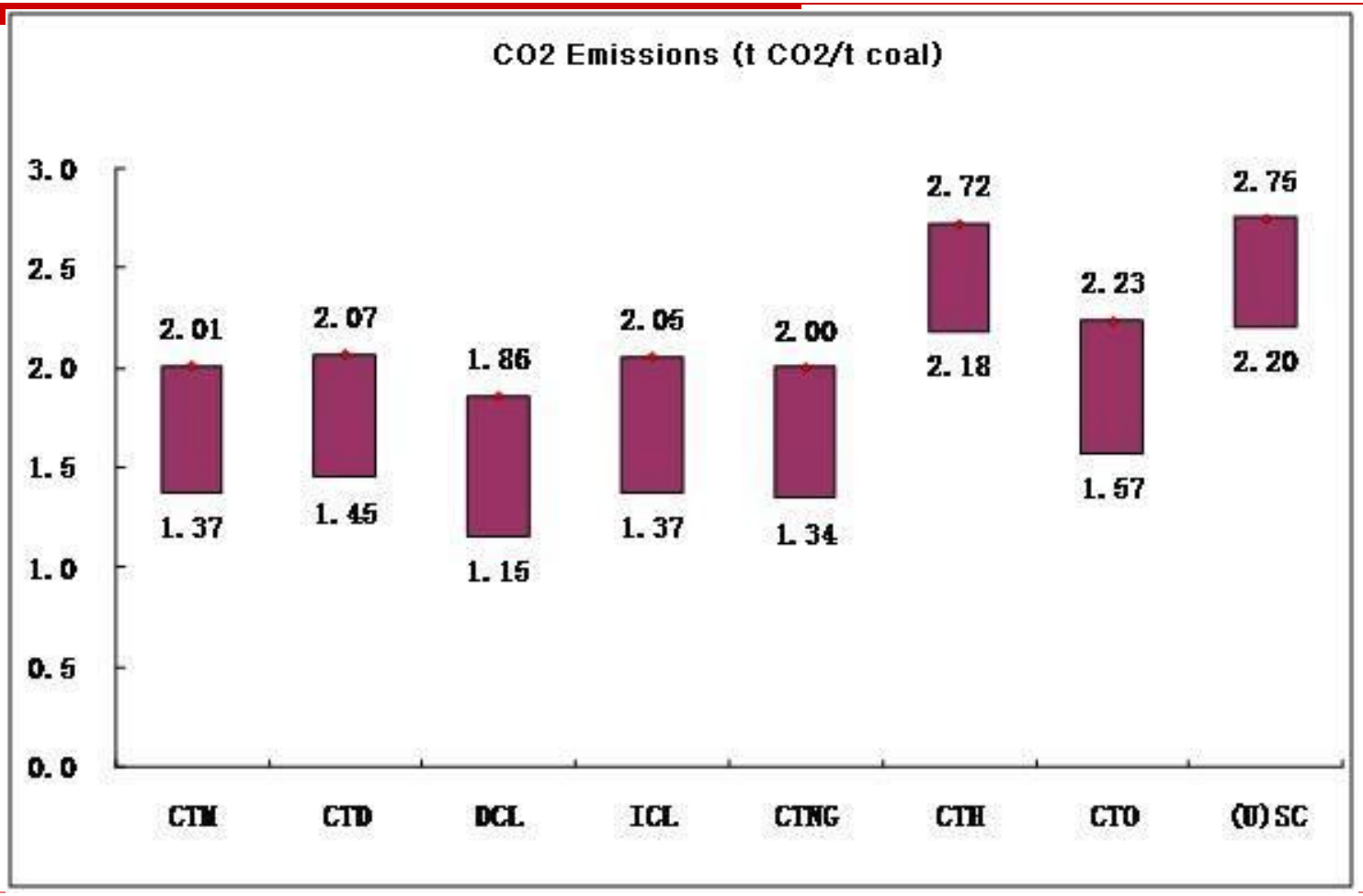
Energy Efficiencies of Conversion Technologies, %



Carbon Dioxide Emissions of Conversion Technologies, tCO_2/GJ



Carbon Dioxide Emissions of Conversion Technologies, tCO_2/t coal



II. Approaches for CO_2 Emissions Reduction and Utilization through Coal Conversion

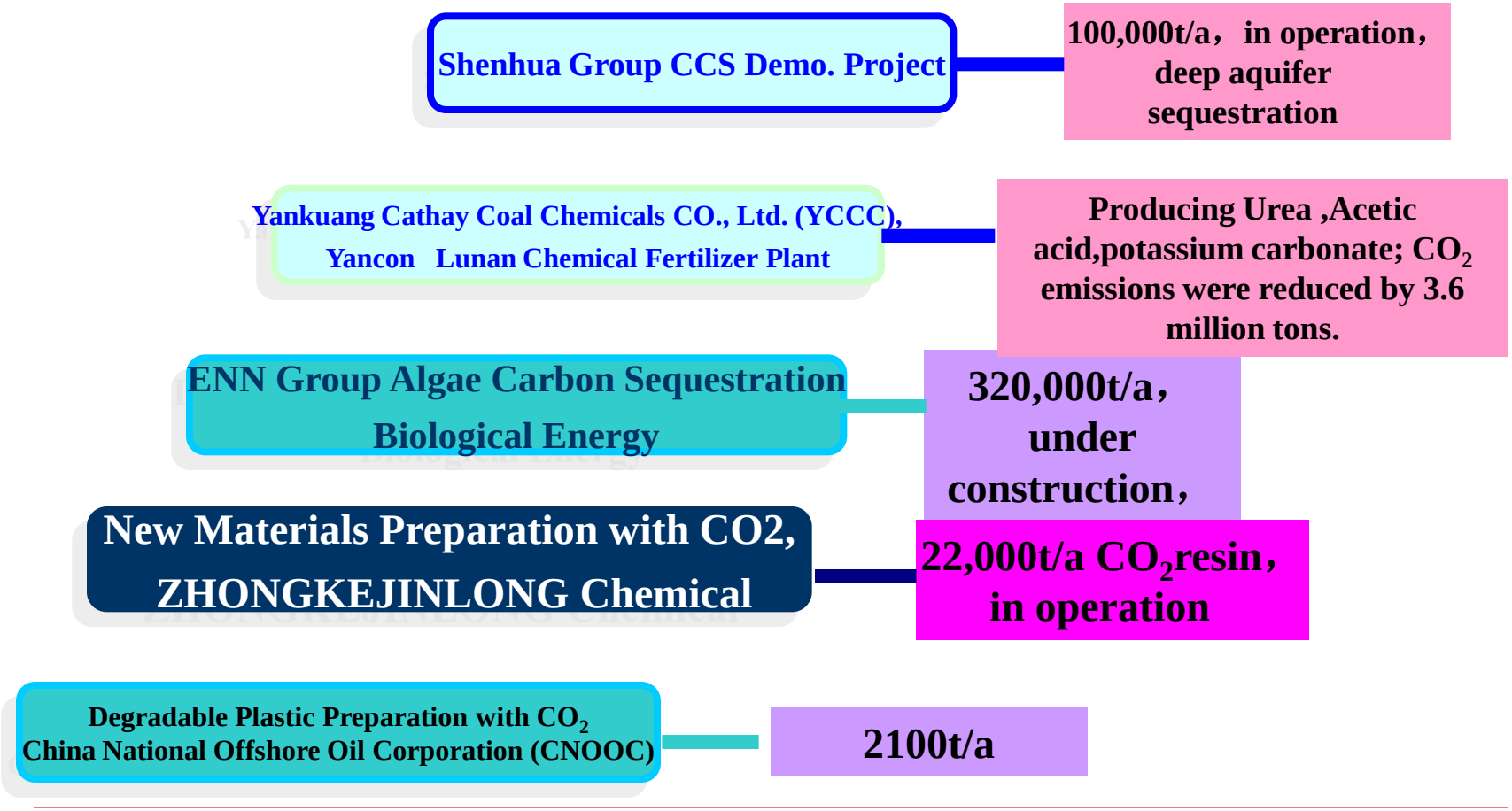
☐Approaches for CO_2 Emissions Reduction

- **Choosing the right direction for product development**
- **Improving technology**
  - **Raising coal conversion efficiency**
  - **Raising the efficiency of catalysts**
  - **Improving the efficiency of pumps**
  - **Recycling waste heat**
  - **Rationalizing the process flow**
- **Developing coal poly-generation technology**

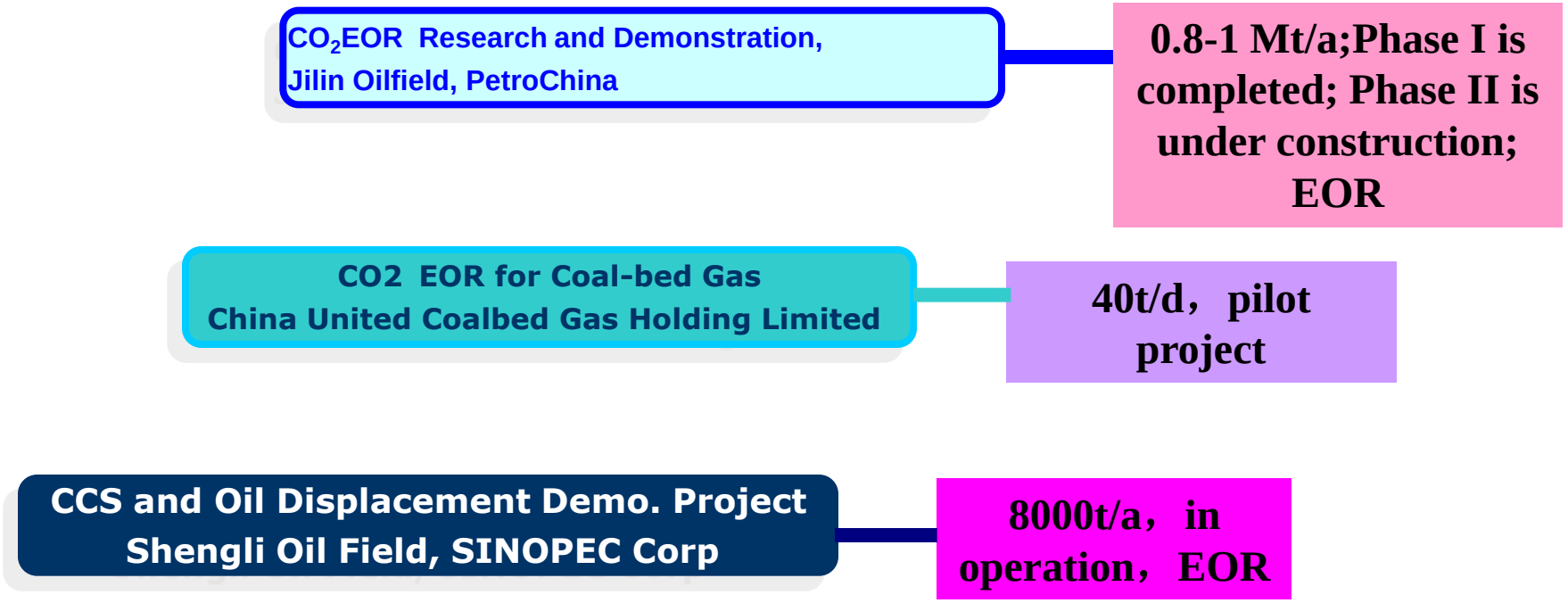
Approaches for CO_2 Utilization

- **Producing chemical products as raw materials**
  - **Since CO_2 produced in the coal chemical processing are of high concentration and high pressure, it's helpful for capture and utilization; Priority can be given to deploying capture and storage technologies in the coal chemical industry and IGCC power plants.**
  - **Producing urea while making coal-ammonia; emissions can be decreased to 0.71t/t.**
  - **Producing chemical products such as K_2CO_3, acetic acid**
  - **Underground fire extinguishing**
- **Raising oil-gas recovery**
  - **EOR, ECBM**

III. Demonstration Projects of CO_2 Utilization in Coal Conversion



☐Possibility of being used for EOR



Thank you!