Fossil liquid fuels: production capacity of CTL and feedstock shares

In 2006 the total coal-to-liquid (CTL) production capacity in South Africa was approximately 125,000 barrels of oil equivalent[1] (BOE) per day, or roughly 246 petajoules (PJ) per annum. Of the total output, 93% is used for liquid fuels.[2]

Level 1

Level 1 assumes that existing CTL capacity is maintained until 2050 and that investment leads to new installed capacity of 40,000 barrels per day by 2030. This increases doubles the current CTL capacity.

Level 2

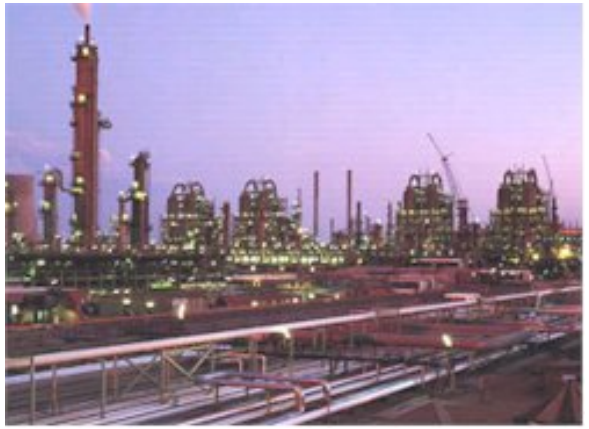
Level 2 assumes that existing CTL capacity is maintained until 2050, and that a new CTL plant with capacity of an additional 80,000 BOE per day is installed by 2020.

Level 3

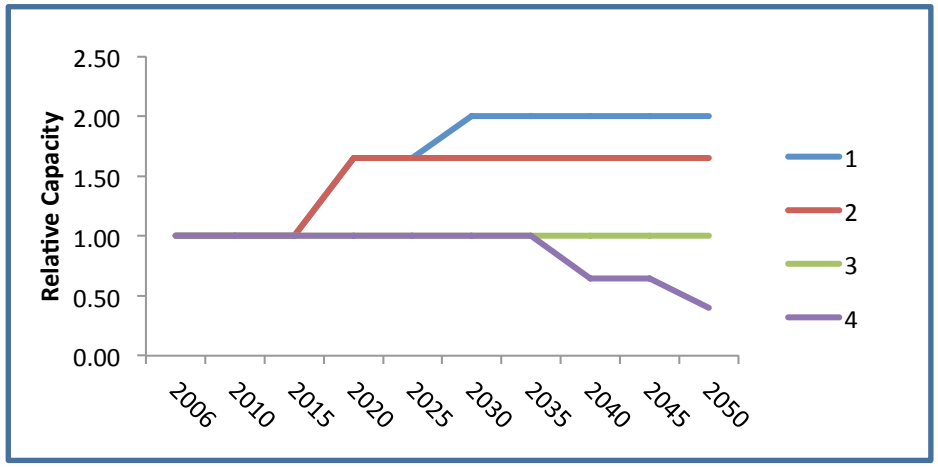
Level 3 assumes that retired CTL plants and equipment are refurbished or replaced so that the existing CTL capacity is maintained until 2050.

Level 4

Level 4 assumes that no new CTL plants are built and existing facilities are retired at the end of their predicted lifespan[3]. Capacity falls from 125 000 BOE per day now to 80 000 BOE per day in 2040 and to 50 000 BOE per day by 2050.



CTL facility at Secunda.
Source: www.scienceinafrica.co.za



CTL capacity (in PJ) for Levels 1 to 4

[1] Where a BOE = 5.7 GigaJoules (IEA)
[2] Energy Research Centre. 2013. Assumptions and Methodologies in the South African Times (SATIM) energy model. Available: http://www.erc.uct.ac.za/Research/otherdocs/satim/sAtiM%20Methodology%20v1.0.pdf Accessed 20 March 2014..
[3] Adapted from (Wuppertal Institute for Climate, Environment and Energy, 2012)

Fossil liquid fuels: CTL feedstock and CCS

Coal to gas material share

The share of feedstock used for CTL is predominantly coal, but natural gas can also be used. The coal to gas material share Lever can be used to increase the share of gas as feedstock for CTL production.

Level 1

Level 1 assumes that coal is used as nearly all the feedstock for CTL production and that this remains at 97% from now to 2050.

Level 2

Level 2 assumes that the material use of gas as feedstock for CTL production increases to reach a maximum share of around 20% by 2050.

Carbon Capture and Storage (CCS)

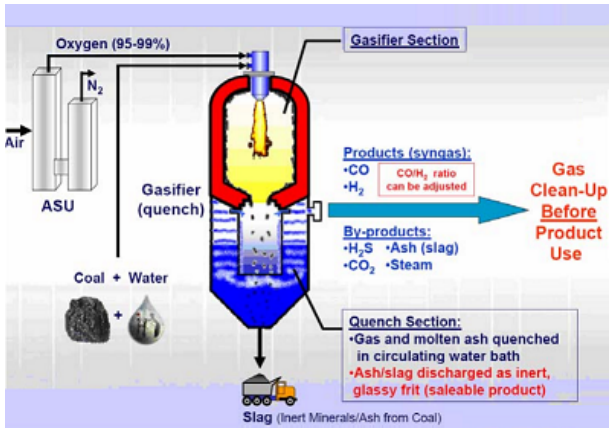
CTL production occurs via the Fischer-Tropsch process which requires the coal feedstock to undergo gasification. This results in a very concentrated source of CO_2 and makes a CTL facility an ideal site for CCS.

Level 1

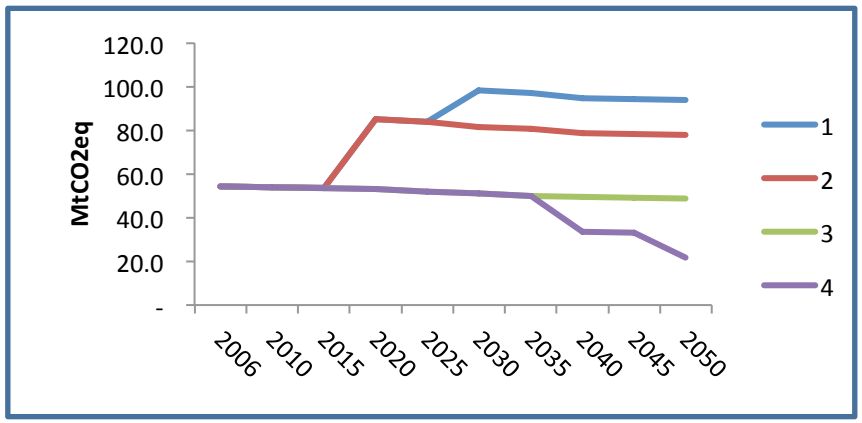
Level 1 assumes that CCS is not utilised.

Level 2

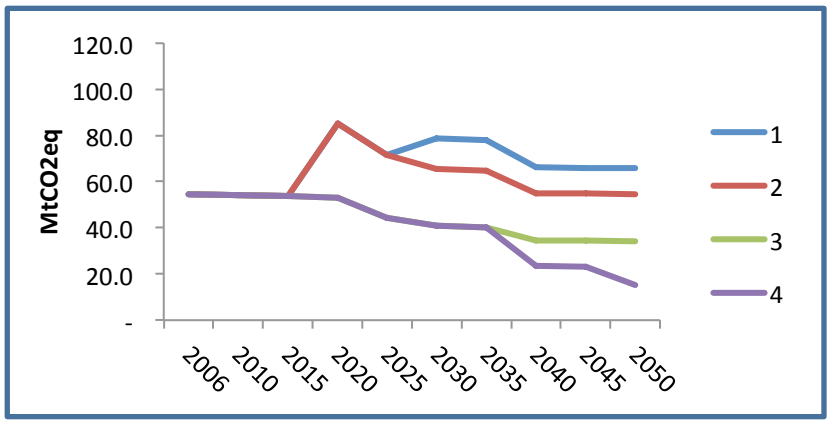
Level 2 assumes that in 2025, 25% of the estimated CO_2 production associated with the CTL process that is suitable for CCS is captured[3]. CTL-CCS expands such that by 2040, 50% of the estimated CO_2 production that is suitable for CCS is captured.[3]



Coal gasification process.
Source: Indiana Center for Coal Technology Research (2006)



CTL with no CCS. Assumes no increase in gas feedstock



CTL with CCS. Assumes no increase in gas feedstock

[1] Where a BOE = 5.7 GigaJoules (IEA)
[2] Energy Research Centre. 2013. Assumptions and Methodologies in the South African Times (SATIM) energy model. Available: http://www.erc.uct.ac.za/Research/otherdocs/satim/sAtiM%20Methodology%20v1.0.pdf Accessed 20 March 2014..
[3] Adapted from (Wuppertal Institute for Climate, Environment and Energy, 2012)

Fossil liquid fuels: production capacity of GTL

In 2006 the gas to liquid (GTL) production capacity in South Africa was approximately 45,000 barrels per day (bpd) or approximately 60 petajoules per annum[1]. By 2011 production had decreased to around 45 PJ/a due to declining gas production.

Level 1

Level 1 assumes that installation of GTL facilities increases capacity to double the existing capacity to 90,000 bpd by 2025, and to increase capacity by a further 45,000 bpd by 2035. Total GTL capacity quadruples from now to 2040 and is maintained to 2050.

Level 2

Level 2 assumes that GTL production capacity doubles to 90,000 bpd capacity by 2030. No further expansion occurs.

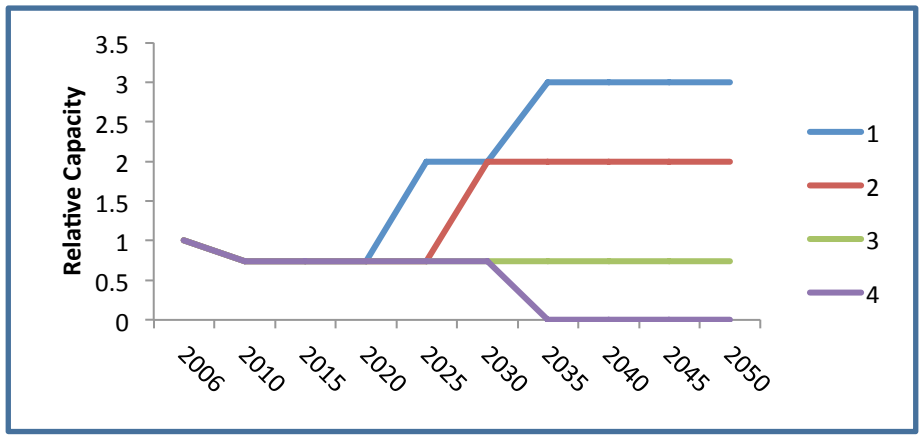
Level 3

Level 3 assumes that existing GTL capacity of 45,000 bpd is maintained until 2050.

Level 4

Level 4 assumes that the existing GTL plant production is maintained until 2030 after which it is steadily decommissioned by 2035.

A GTL facility in the Eastern Cape
Source: www.novaserve.co.za



GTL refinery capacity relative to the 2006 for Levels 1 to 4

[1] Energy Research Centre. 2013. Assumptions and Methodologies in the South African Times (SATIM) energy model. Available: http://www.erc.uct.ac.za/Research/otherdocs/satim/sAtiM%20Methodology%20v1.0.pdf Accessed 20 March 2014.

Fossil liquid fuels: production capacity of crude oil refineries

In 2006 South Africa's the crude oil refinery capacity was approximately 513,000 barrels per day (bpd), equivalent to approximately 1,000 petajoules per annum.[1]

Level 1

Level 1 assumes that dependency on crude oil products grows and that refining capacity is installed to reach 360,000 bpd by 2025 and that an additional plant with capacity of 180,000 bpd becomes operational by 2035. Crude oil capacity is thus doubled from now to 2035.

Level 2

Level 2 assumes that additional crude oil refining capacity of 360,000 bpd is commissioned and becomes operational by 2025. This expands capacity by around 70%. These refining plants are maintained and after 2025 there is no further expansion in capacity.

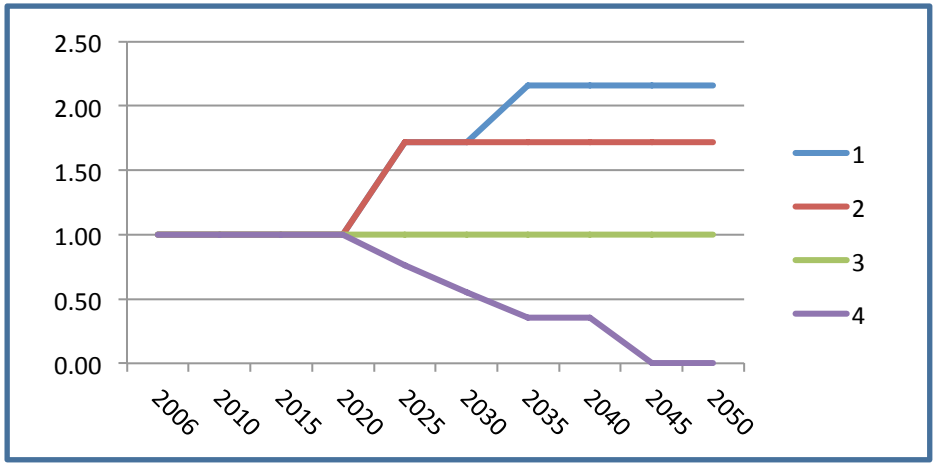
Level 3

Level 3 assumes that existing crude oil refining capacity is maintained and is not expanded from now until 2050.

Level 4

Level 4 assumes existing crude oil refineries are retired at the end of their expected lifespan and that by 2050 there are no crude oil refineries in the country.

Oil rigs extracting petroleum
Source: www.theguardian.com



Changes in crude oil refining capacity relative to now in Levels 1 to 4.

[1] Industrial Energy Balance (ERC,2006)