

Chapter 3 Natural Resources

Section 1 Mineral and Earth & Rock Resources

I . Energy physical flow accounts

Energy physical flow accounts use physical units to measure quantity; they use a supply and use table to present the circumstances of energy flows. They include the natural input flows for energy exploited or collected from the environment and injected into the economy; product flows produced within the economy, for purposes of energy supply and utilization (such as fuels, power generation and the supply of thermal energy to third parties); and the flows of energy residues back into the environment, etc. Furthermore, their carry into accounts are, in principle, consistent with the Supply and Use Identity; i.e., the total input flows for all types of energy should equal their overall usage flows.

Considering that part of the electricity generated from hydro power, solar-photovoltaic and wind power, pumped-storage hydroelectricity, thermal power, cogeneration, and nuclear power has been integrated into the power grid (documented in transferring and transformation) to provide consumption by various domestic sectors, it is impossible to separate the natural input energy from energy products. As a result, the supply and use table below does not include the distribution of electricity integrated into the power grid.

(I) Energy for natural inputs

Energy for natural inputs refers to that it is obtained from the environment and enter the economic production process or is directly used in products as physical inputs. This includes the inputs of natural resources (such as minerals and energy), the inputs of renewable energy, and other natural inputs.

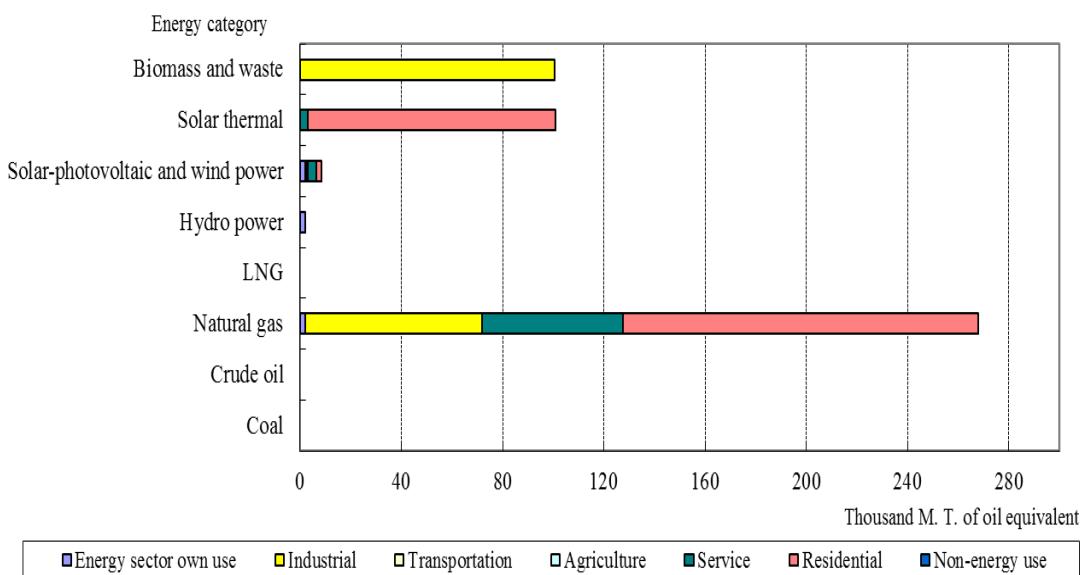
In 2016, the amount of natural input energy flows obtained from Taiwan's environment amounted to 2,635 thousand metric tons of oil equivalent. Biomass and waste were the most prominent with 1,482 thousand metric tons of oil equivalent, 56.3% of the total; nearly 93% were transformed into the input quantity for power. The input of renewable energy trailed with 888 thousand metric tons of oil equivalent, 33.7% of the total; most of it was also transformed into input quantities for power. Minerals and energy resources only amounted to 265 thousand metric tons of oil equivalent, 10.0% of the total; this primarily provided domestic natural gas usage, with consumption coming from energy sector own use, industry, services, and residences.

Table 1.3.1.1 Supply and use table for natural inputs, 2016

Unit: thousand M. T. of oil equivalent

| | Total supply | | | Total use | | | | |
|---------------------|-------------------------|----------------------------|--------------|----------------------|--------|---|---------------|---------------------|
| | From Taiwan environment | Transfers & transformation | Final supply | Domestic consumption | Export | International marine bunkers & civil aviation | Stock changes | Energy residue loss |
| Total | 2,635 | 2,164 | 471 | 480 | — | — | -11 | — |
| Minerals and energy | 265 | 8 | 256 | 268 | — | — | -11 | — |
| Renewable energy | 888 | 776 | 112 | 112 | — | — | — | 0 |
| Biomass & waste | 1,482 | 1,379 | 103 | 101 | — | — | 0 | — |
| | | | | | | | | 2 |

Figure 1.3.1.1 Domestic consumption for natural inputs, 2016



(II) Energy products

Energy products refer to products produced by economic units for use as energy sources, and they can be divided into primary energy and secondary energy (including fuels, electric energy, and thermal energy).

In 2016, energy products, from both import and transformation output, reached 206,013 thousand metric tons of oil equivalent. Secondary energy reached 103,776 thousand metric tons of oil equivalent, 50.4% of the total; about 73% of this came from output after transformation, and around 46% went to domestic consumption. Primary energy amounted to 102,237 thousand metric tons of oil equivalent and accounted for 49.6% of the total, 99% of which was imported and primarily input into coke ovens, petroleum refineries, and electricity.

Table 1.3.1.2 Supply and use table for energy products, 2016

Unit: thousand M. T. of oil equivalent

| | Total supply | | | | Total use | | | | | |
|------------------|--------------|-----------------------|----------------------------|--------------|----------------------|--------|---|---------------|---------------------|-------------------------|
| | From import | Transformation output | Transfers & transformation | Final supply | Domestic consumption | Export | International marine bunkers & civil aviation | Stock changes | Energy residue loss | Statistical Discrepancy |
| Total | 129,224 | 76,788 | 127,331 | 78,681 | 57,251 | 17,345 | 4,043 | 435 | 140 | -533 |
| Primary energy | 101,205 | 1,032 | 91,691 | 10,545 | 10,012 | 1 | — | 744 | 63 | -275 |
| Secondary energy | 28,019 | 75,757 | 35,640 | 68,136 | 47,238 | 17,344 | 4,043 | -309 | 77 | -258 |

Figure 1.3.1.2 Domestic consumption for primary energy, 2016

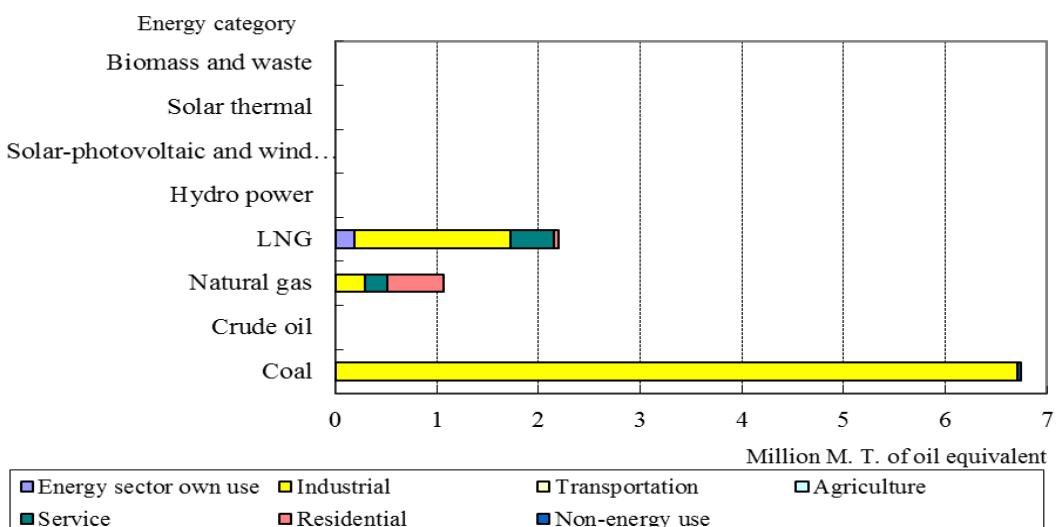
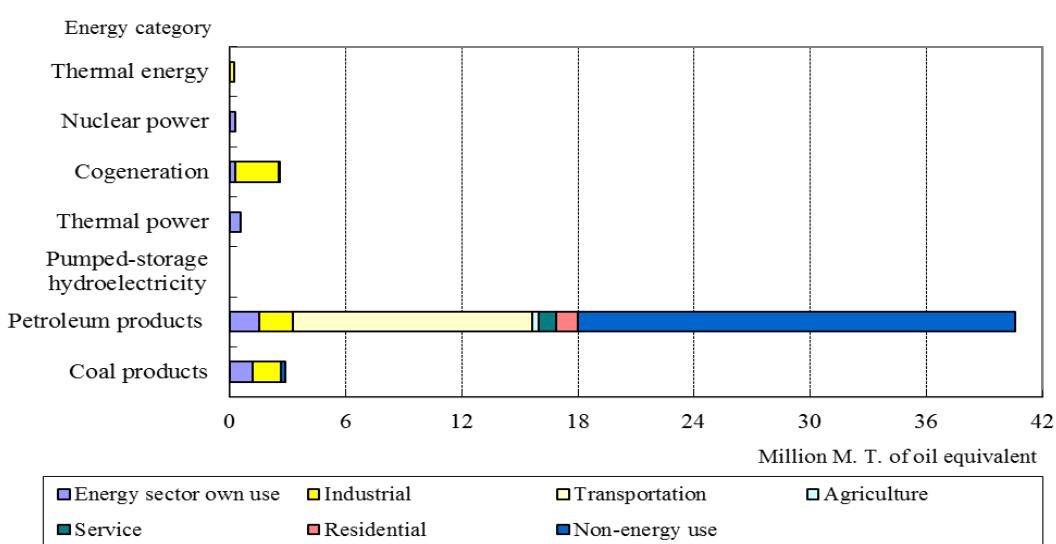


Figure 1.3.1.3 Domestic consumption for secondary energy, 2016



(III) Energy residues

Energy residues primarily refer to losses incurred during production processes such as access, distribution, storage, and transferring. Taiwan's energy residues primarily come from the losses incurred during the transferring of liquefied petroleum gas (as a part of primary energy), as well as the losses incurred during the storage process for coal products (as part of secondary energy). In 2016, the losses amounted to 140 thousand metric tons of oil equivalent, accounting for 0.07% of the total supply of energy products.

II . Physical asset accounts

The asset accounts for mineral and earth & rock resources primarily present the annual amount of extraction and reserves of non-metallic mineral resources, energy mineral resources, and earth & rock resources. Even though Taiwan is not well-endowed in terms of mineral production, mineral and earth & rock resources are nonetheless important to economic development. We need to fully understand our underground wealth in mineral and earth & rock resources in order to effectively plan to utilize and preserve them.

(I) Non-metallic mineral resources

Within non-metallic mineral resources, those with economic value for development are primarily marble, serpentine, limestone, and dolomite. As of the end of 2016, marble reserves were estimated to be around 9.44 billion metric tons, making them the mineral resource the most abundantly in reserve in Taiwan. The marble has wide-ranging applications such as in construction materials, handicrafts, steel refining, cement, glass, paper-making, calcium carbide, lime, chemical/industrial raw materials, etc. Serpentine reserves were estimated to be around 0.4 billion metric tons. The serpentine is primarily used in the steel industry, in addition to being used as a construction material. Limestone reserves were estimated to be around 0.13 billion metric tons. The limestone is primarily used as a raw material for the production of cement. Dolomite reserves were estimated to be around 0.34 billion metric tons. The dolomite is often used in the steel industry and in ceramics.

In 2016, the amount extracted of these four non-metallic mineral resources aggregated 16,044 thousand metric tons, down 11.8% from 2015. The marble accounted for 99% of the total, at 15,918 thousand metric tons. Besides, the serpentine, limestone and dolomite reached 102 thousand, 1 thousand, and 22 thousand metric tons, respectively.

Table 1.3.1.3 Physical asset accounts for non-metallic minerals, 2016

| | Unit: thousand M. T. | | | | |
|----------------|----------------------|-----------|------------|-----------|----------|
| | Total | Marble | Serpentine | Limestone | Dolomite |
| Opening stocks | 10,328,111 | 9,456,138 | 399,399 | 133,876 | 338,698 |
| Extraction | 16,044 | 15,918 | 102 | 1 | 22 |
| Other changes | — | — | — | — | — |
| Closing stocks | 10,312,068 | 9,440,220 | 399,297 | 133,874 | 338,676 |

Note: "Other changes" include re-estimated resource reserves and the discovery of new lodes.

Table 1.3.1.4 Extraction of non-metallic minerals

| | Unit: thousand M. T. | | | | |
|------|----------------------|--------|------------|-----------|----------|
| | Total | Marble | Serpentine | Limestone | Dolomite |
| 2012 | 23,040 | 22,926 | 61 | 6 | 47 |
| 2013 | 22,338 | 22,197 | 94 | 9 | 38 |
| 2014 | 20,781 | 20,591 | 138 | 30 | 22 |
| 2015 | 18,193 | 18,035 | 134 | 1 | 22 |
| 2016 | 16,044 | 15,918 | 102 | 1 | 22 |

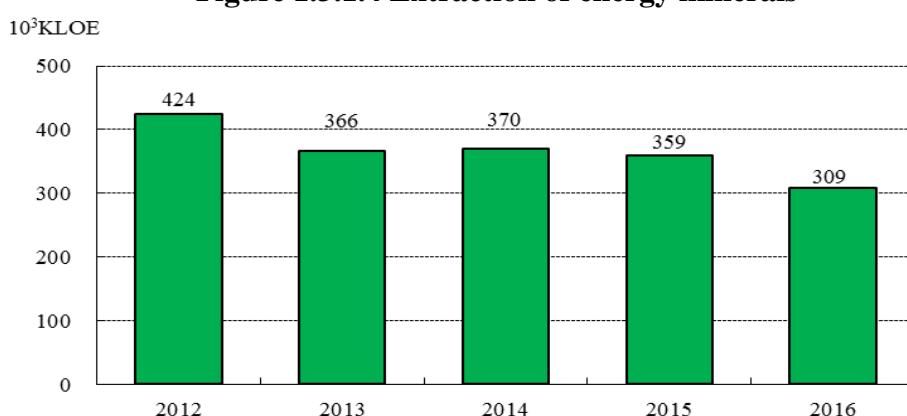
(II) Energy mineral resources

Taiwan has limited reserves in energy mineral resources. As of the end of 2016, condensed oil and natural gas reserves were estimated at 4,081 thousand kiloliters of oil equivalent, down 5.8% from the end of 2015. The amount extracted for the year reached 309 thousand kiloliters of oil equivalent, down 13.9% from 2015.

Table 1.3.1.5 Physical asset accounts for energy minerals, 2016

| | Natural gas & condensed oil (Thousand kiloliters of oil equivalent) |
|----------------|--|
| Opening stocks | 4,334 |
| Extraction | 309 |
| Other changes | 57 |
| Closing stocks | 4,081 |

Figure 1.3.1.4 Extraction of energy minerals



(III) Earth and rock resources

Earth and rock resources are indispensable basic raw materials for all public construction & architectural construction projects. As of the end of 2016, reserves of earth and rock resources were estimated at 3.98 billion cubic meters. They, in coastal regions and marines, totaled 2.33 billion cubic meters, 58.4% of the total, and they, on the land, amounted to 1.64 billion cubic meters, 41.3% of the total. Besides, they, in rivers and lakes, totaled 0.01 billion cubic meters, only 0.3% of the total.

In 2016, the amount extracted of earth & rocks, in rivers and lakes, reached 24,691 thousand cubic meters, down 31.2% from 2015, and they, on the land, amounted to 1,944 thousand cubic meters, up 13.6%. Besides, they, in coastal regions and marines, totaled 15 thousand cubic meters, up 110%. The total amount extracted of earth & rock resources amounted to 26,650 thousand cubic meters, for a decrease of 29.2%.

Table 1.3.1.6 Physical asset accounts for earth and rock resources, 2016

| | Total | In rivers and lakes | On the land | In coastal regions and marines | Unit: thousand cubic meters |
|----------------|-----------|---------------------|-------------|--------------------------------|-----------------------------|
| Opening stocks | 3,978,829 | 7,401 | 1,644,940 | 2,326,488 | |
| Extraction | 26,650 | 24,691 | 1,944 | 15 | |
| Other changes | 30,493 | 28,780 | 1,713 | — | |
| Closing stocks | 3,982,672 | 11,489 | 1,644,710 | 2,326,473 | |

Table 1.3.1.7 Extraction of earth and rock resources

| | Total | In rivers and lakes | On the land | In coastal regions and marines | Unit: thousand cubic meters |
|------|--------|---------------------|-------------|--------------------------------|-----------------------------|
| 2012 | 49,531 | 47,326 | 2,176 | 29 | |
| 2013 | 39,902 | 38,530 | 1,358 | 14 | |
| 2014 | 39,001 | 37,022 | 1,965 | 15 | |
| 2015 | 37,623 | 35,905 | 1,711 | 7 | |
| 2016 | 26,650 | 24,691 | 1,944 | 15 | |

III. Depletion accounts

Depletion accounts primarily present the status of the depletion which is the volume of use of the minerals and earth & rocks, non-renewable resources. Currently, these accounts are estimated using the net price method. In 2016, the total depletion value of mineral and earth & rock resources reached NTD 2.90 billion, down 48.8% from 2015. Within it, the energy minerals were the highest, at NTD 1.71 billion (59.0% of the total), followed by earth & rock resources at NTD 0.94 billion (32.4% of the total). Non-metallic minerals reached NTD 0.25 billion (8.6% of the total). Compared with 2015, the depletion value of non-metallic minerals, energy minerals and earth & rock resources decreased by 34.5%, 55.5% and 34.8%, respectively; they were all due to a sharp decline in their amount extracted.

Figure 1.3.1.5 Depletion of mineral and earth & rock resources

