BỘ CÔNG THƯƠNG

EMBASSY OF DENMARK

Danish Energy Agency

VIETNAMESE INDUSTRIAL POTENTIAL FOR ENERGY AND EMISSION REDUCTIONS

Vietnam – Denmark
Energy Partnership programme (DEPP3)

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Vets | Energy

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ABBREVIATIONS

DEU	: Designated Energy User
EE	: Energy Efficiency
ES	: Energy Savings
NDC	: Nationally Determined Contribution
GHG	: Greenhouse gas
GDP	: Tổng sản phẩm nội địa
RE	: Renewable Energy
PP	: Nhựa PP
PE	: Nhựa PE
MOIT	: Ministry of Industry and Trade
TFEC	: Total final energy consumption
TOE	: Tấn dầu quy đổi
VNEEP3	: National Energy Efficiency Program Period 2019-2030
VSD	: Variable Speed Drive
FDI	: Đầu tư trực tiếp nước ngoài
FTA	: Hiệp định thương mại tự do
WTO	: Tổ chức Thương mại Thế giới

FResumé

Viet Nam has quite a comprehensive policy on the promotion of energy efficiency (EE) and energy savings (ES), particularly with regard to large energy intensive industries. However, recent reviews of the impact of the law and policies have shown that there still remains a potential for improving energy efficiency in the industrial sector.

Development Engagement 3 (DE3) focuses on the possibilities to improve the low carbon development in the industrial sector in order to further contribute to reducing Viet Nam's energy consumption and CO_2 emissions. The work of the DE3 will furthermore be carried out with a focus on its contribution to the achievement of:

- The obligations in the Nationally Determined Contribution (NDC) of Viet Nam to the Paris Agreement.
- The goals in the national energy development strategy until 2030 (Resolution 55),
- Other relevant strategic EE and ES targets of Viet Nam,
- The specific and relevant goals and targets within EE and ES in VNEEP3.

In that context, the focus of Output 3 in 2021 is to initiate the development of cross-cutting EE technology catalogue for industries and technical guideline for the plastic industry subsector and ensure that it covers a specific need for information and guidance in this specific Vietnamese industrial sector. Hereto the aim is that any developed technical catalogues and guidelines are disseminated, and their application status is assessed at provincial level.

This report is part of the assessment of the industrial structure in Viet Nam report. It includes assessing the current status of energy use, GHG emissions, technology status, estimating energy conservation potential, and reducing GHG emissions and national impact analysis compared with national goals and policies.

This report focuses on analysing the energy savings potential and GHG emission reduction in the Vietnamese industry. It plays an important in the direction of the technology catalogue.

In the scope of the task, the consulting team conducts research, synthesizes and references the available reports and research results. Data sources are fully and unambiguously cited.

1 ENERGY CONSUMPTION AND RELATED GHG EMISSIONS

1.1 ENERGY CONSUMPTION

1.1.1 SUMMARY OF THE PRESENT INDUSTRIAL ENERGY CONSUMPTION

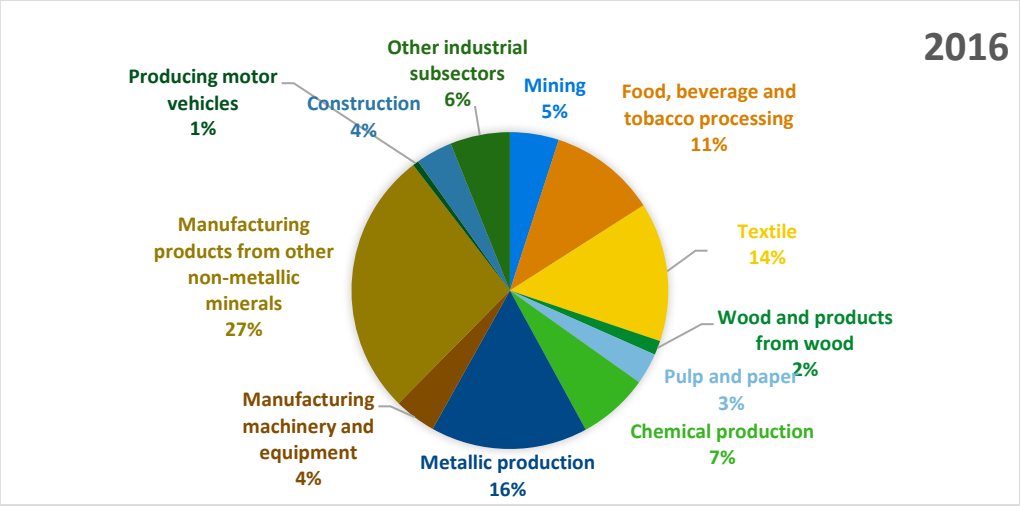
In the period 2016-2020, the total final energy consumption (TFEC) in industry increased from 20,715 KTOE in 2016 to 35,057 KTOE in 2020 with an average growth rate of about 17% per year. Contributing to that increase is typically the production of non-metallic mineral products. Energy consumption of this subsector accounts for the highest proportion of energy consumption and increases rapidly over the years (27.15% in 2016 and 35.87% in 2020). Followed by the metal manufacturing, textile manufacturing, food, and beverage processing sub-sectors also increased but did not increase much. Therefore, the energy share of these sub-sectors is to decrease. Detailed data in Table 1 and Figure 1.

Table 1: Energy consumption in the industrial sub-sectors in the period 2016-2020

Unit: KTOE

Subsector	2016	2017	2018	2019	2020
Mining	1,034	1,116	1,352	1,358	1,459
Food, beverage and tobacco processing	2,272	2,450	2,699	3,079	3,071
Textile	2,943	3,019	3,867	4,176	4,226
Wood and products from wood	302	350	405	441	435
Pulp and paper	663	843	1,402	1,507	1,599
Chemical production	1,498	1,352	1,874	2,049	2,212
Metallic production	3,324	3,523	3,758	3,905	4,050
Manufacturing machinery and equipment	890	1 129	1,223	1,239	1,226
Manufacturing products from other non-metallic minerals	5,625	6,251	8,516	9,731	12,576
Producing motor vehicles	126	146	153	166	160
Construction	775	644	646	637	586
Other industrial subsectors	1,263	1,468	1,879	2,396	3,458
Total	**20,715**	**22,291**	**27,774**	**30,685**	**35,057**

(source: GSO)



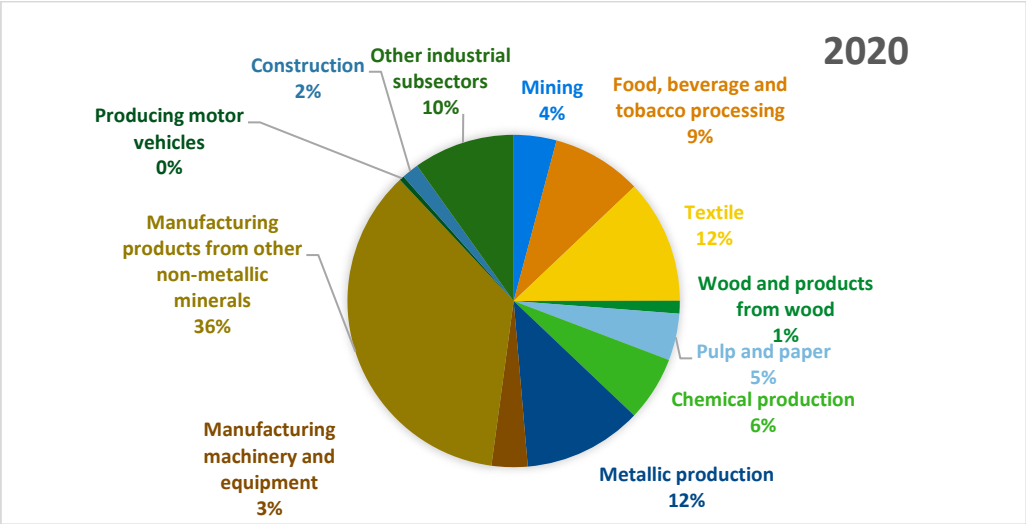


Figure 1: Energy consumption by sub-sector in 2016 and 2020

1.1.2 FORECAST OF THE INDUSTRIAL ENERGY CONSUMPTION IN 2030

Based on the Vietnam Energy Outlook 2019 the total final energy consumption (TFEC) in Vietnam will increase about four times in the period 2017-2050, from 64.500 KTOE in 2017 to about 121.800 KTOE in 2030 and 238.850 KTOE in 2050 in the RE target scenario. In this scenario[1], TFEC will increase by 6.6%/year in 2020-2030 and 4.4%/year in 2020-2050. In 2020-2030, industrial sector has the highest growth rates of 7.0%/year in RE target scenario, the industrial sector accounts for about half of TFEC, increasing to 53.7% of TFEC by 2030 and then reducing to 47.9% of TFEC by 2050.

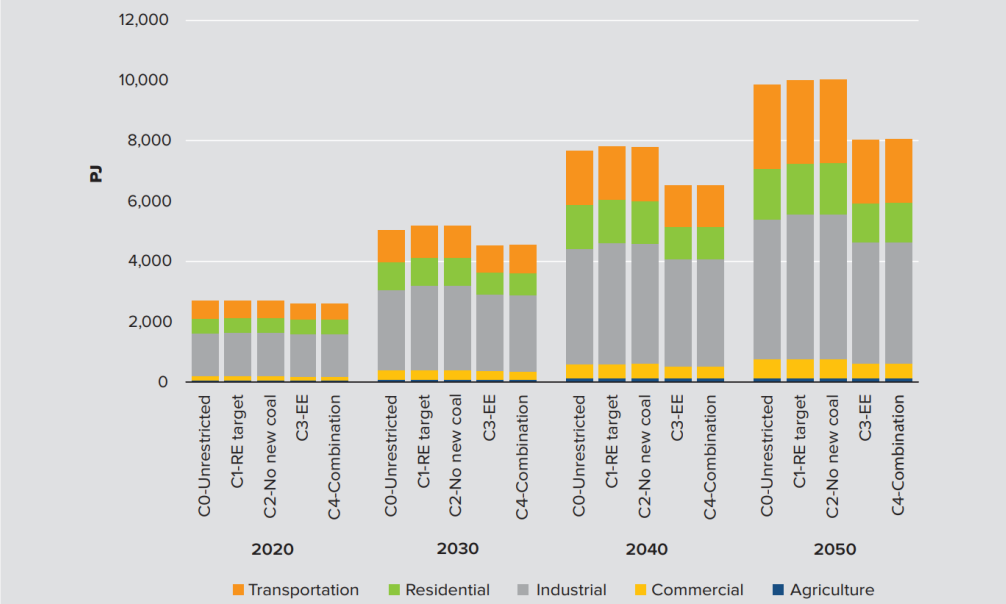


Figure 1: Forecast of total final energy consumption (TFEC) by sector in the analyzed scenarios for the period 2020-2050

The forecast for the period 2020-2030 shows that the commercial and industrial sectors is expected to have the highest growth rates of 7.4% per year and 7.0% per year, respectively. For the whole period of 2020-2050, the transportation industry is expected to have the highest growth rate, at 5.1%/year. In Scenario C1 of the Renewable Energy (RE) Target, the industry accounts for about half of the TFEC, increasing to 54% of the TFEC by 2030 and then falling to 48% of the TFEC by 2050. By 2030, the transportation sector will account for 20% of the TFEC, while the civil sector accounts for 18%, the commercial sector 6% and agriculture 2% of the TFEC.

[1] According to the Vietnam Energy Outlook Report 2019, there are 5 scenarios analyzed and compared:
- C0 – Unrestricted: A theoretical scenario not taking policy constraints into account, such as RE targets, restriction on coal-fired generation, successful EE penetration
- C1 – RE target: A scenario where RE power sector targets in the REDS are fulfilled, without EE penetration
- C2 – No new coal: C1 scenario with the addition of the constraint of no investments in new coal power plants after 2025
- C3 – Energy efficiency: C1 scenario with the addition of least-cost EE technology penetration rate of 50% in 2030 and 100% in 2050
- C4 – The most ambitious scenario combining the three scenarios C1, C2 and C3

It can be seen that, regardless of the forecast scenario, Vietnam's industry is still the largest proportion of TFEC. The change ultimate energy demand of the industry will have a major impact on TFEC. Therefore, energy efficiency activities focus on the industry.

GHG emissions related to the energy consumption

1.1.3 SUMMARY OF THE PRESENT INDUSTRIAL GHG EMISSION

Total CO2 emission related to the energy consumption in the industrial subsector for the period 2016-2020 as the table below:

Table 1: Total CO2 emission by fuel consumption in the industrial subsector from 2016 to 2020

Unit: Mil ton CO2

Subsector	2016	2017	2018	2019	2020
Mining	7,19	7,80	9,29	9,03	9,47
Food, beverage, and tobacco processing	14,99	15,78	17,48	19,12	19,05
Textile	13,07	13,80	17,53	19,28	19,78
Wood and products from wood	2,80	3,25	3,80	4,16	4,11
Pulp and paper	3,05	3,42	5,04	5,52	6,43
Chemical production	3,61	3,33	4,98	5,88	7,33
Metallic production	15,05	16,82	19,56	20,25	21,55
Manufacturing machinery and equipment	7,92	9,89	10,80	10,93	10,79
Manufacturing products from other non-metallic minerals	27,31	30,12	40,12	45,37	56,83
Producing motor vehicles	0,71	0,78	0,86	0,96	0,91
Construction	3,70	3,32	3,31	3,21	3,08
Other industrial subsectors	9,86	11,18	13,51	17,84	26,42
Total	109,26	119,51	146,27	161,55	185,73

The data showed the increasing trend of CO2 emission. From 2016 to 2020 the CO2 emission has increased nearly two times due to the development of the industry.

1.1.4 FORECAST OF THE GHG EMISSION FROM THE INDUSTRIAL IN 2030

According to the draft of the National Energy Development Plan for the period 2021-2030, vision to 2050, the forecast of the CO2 emissions for different scenarios is shown in figure 3:

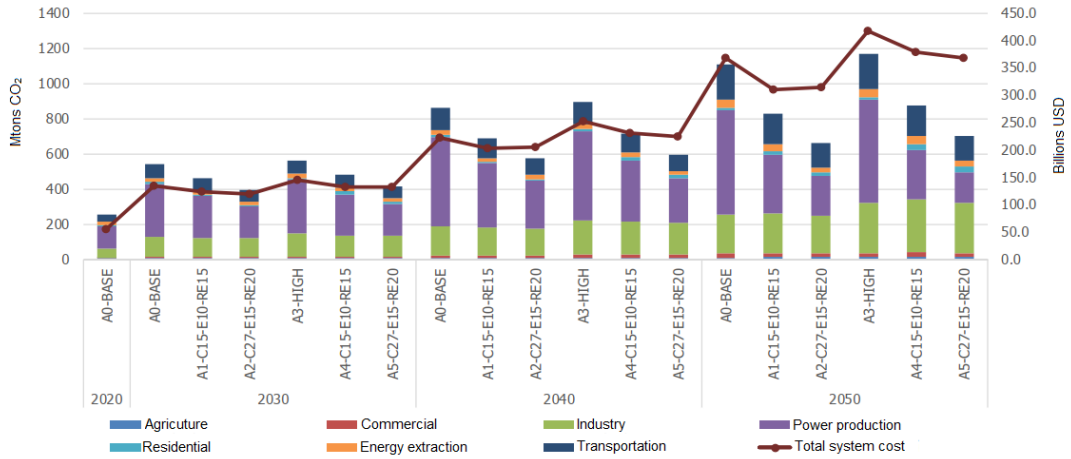


Figure 2: Forecast of the CO2 emissions according to different scenarios in the National Energy Development Plan for the period 2021-2030, vision to 2050

Accordingly, the studied scenarios are:

Table 3: Energy master plan development scenarios of the National Energy Development Plan for the period 2021-2030, vision to 2050

No.	Scenario	Detail
1	**A0 Base Reference Scenario**	Average GDP growth rate + Low energy efficiency. Also seen as the scenario without planning
2	**A1 Average Target Base Scenario**	Baseline growth rate + Renewable energy share (15%) + GHG emission reduction target (15%) + Average energy conservation level (8%) + External costs (CO2, SOx, NOx)
3	**A2 High Target Base Scenario**	Baseline growth rate + Renewable energy share (20%) + High GHG emission reduction target (27%) + High energy conservation level (12%) + External costs (CO2, SOx, NOx)
4	**A3 High Reference Scenario**	High GDP growth rate + Low energy conservation level
5	**A4 Medium Target High Scenario**	High growth rate + Renewable energy share (15%) + Average GHG emission reduction target (15%) + Average energy conservation level (8%) + External costs (CO2, SOx, NOx)
6	**A5 High Goal High Scenario**	Baseline growth rate+ Renewable energy share (20%) + High GHG emission reduction target (27%) + High energy conservation level (12%) + External costs (CO2, SOx, NOx)

In scenario A1[2], the energy supply-demand balance will be analysed in detail in the next section. For total annual CO2 emissions, scenario A1 has an emission level of 458 million tons in 2030 and 830 million tons in 2050. CO2 emissions by sectors (million tons of CO2) are shown as below:

Table 4: CO2 emissions by sector (million tons of CO2)

	2020	2030	2040	2050
Agriculture	4.9	7	9.4	12.3
Commerce	3.4	9.7	14.4	19.4
Industry	54.5	108.1	155,3	232.3
Power production	121.7	234.2	367.8	330.5
Civil	5.7	6.6	6.1	19.7
Exploiting energy	24.6	23	24.7	43
Transportation	38.6	70.2	110.6	172.8
Total	**253.4**	**458.6**	**688.4**	**830.1**

[2] Due to insufficient baseline data, all scenarios face difficult analysis. The consulting team conducted an analysis A1 scenario, which had specific data shown in draft of the National Energy System Plan for the period 2021-2030, vision to 2050.

2 POTENTIAL FOR SAVINGS IN ENERGY CONSUMPTION

2.1 STUDIES ON THE POTENTIAL FOR SAVINGS IN THE INDUSTRIAL ENERGY CONSUMPTION

2.2 ESTIMATION OF THE SAVING POTENTIAL IN SUB-SECTORS

According to DEUs reporting to MOIT, energy consumption by industry sub-sectors is shown in the figure below.

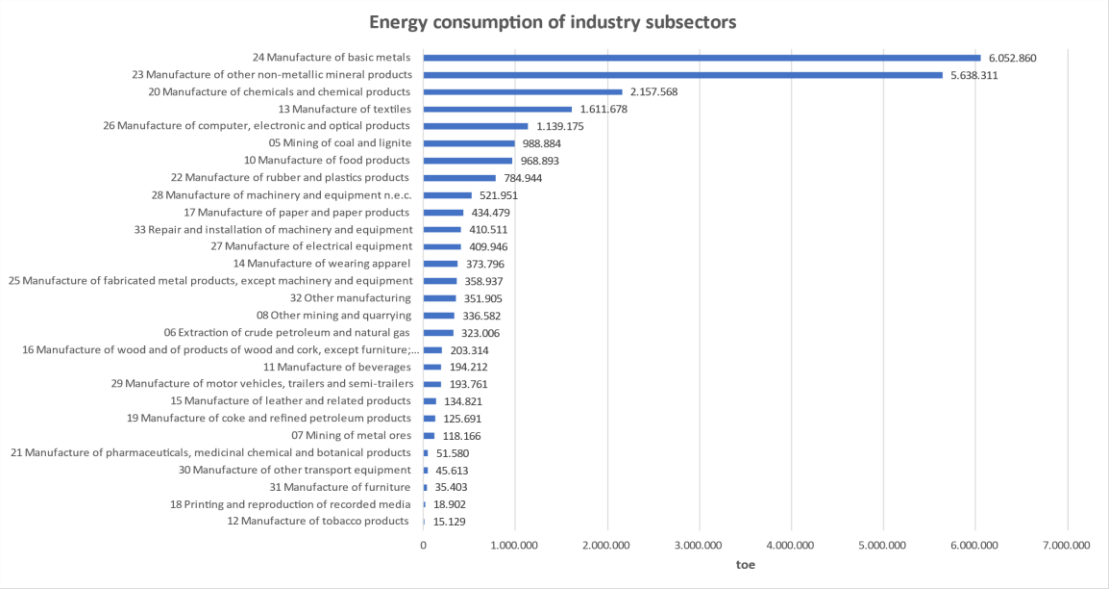


Figure 3: DEU energy consumption 2019 by industry subsector

(Resource: DEU reporting to MOIT)

From the figure, we can see that the sub-sectors of metal production, non-metallic minerals, and chemicals are those that consume the most energy. Sub-sectors such as textiles, electronics, mining, food, plastics are also the ones with high energy consumption levels.

According to the report of National Energy Efficiency Programme for the period of 2019-2030, Specific Energy Consumption and energy saving potentials in sub-sectors are presented in the following table:

Table 2: Specific Energy consumption and Energy Savings Potential

Sector	Product	Savings potential (%)
Drinks	Beer	9-12
	Non-alcoholic beverages	4-9
Plastic	Consumer plastic	9-13
	Construction plastic	5-14
	Packaging	4-12
	Plastic bottle	5-14.5
	Plastic bag	11-17
Paper	Pulp	6.8
	Packaging	3.8
	Printing paper	4.4
	Toilet paper	3.8
Chemistry	Rubber SVR 10CV, 20CV	9.4-32.7
	Rubber SSVR 10, 20	9.8-32.7
	Fertilizer	1.4-5.4
	Water-based paint	20-30
Heavy industrial products	Finished steel	13
	Cement	14
	Textile yarn	14

According to the C3 Energy efficiency scenario of the Vietnam Energy Outlook 2019 report, the final industrial energy consumption will be reduced 8.9% in 2030 compared to the C1 RE target scenario.

According to this scenario, the major energy efficiency will be in the industrial sub-sectors as cement, iron & steel, textile, and food industry.

More than half of the energy savings is expected to be related to projects in heat processes (61%). Efficiency in machine drive is expected to contribute to 20.5% of the energy savings and facilities will contribute to 18.3%. In the period towards 2030, the sub-sectors with the largest potential for energy efficiency improvements in process heat will be cement, iron & steel, pulp and paper, food, and textile industry. In general – for all industrial sub-sectors – there is a potential for energy savings related to general energy and power consumption. E.g. there is a potential for efficient motors and Variable Speed Drive (VSD) applications, and efficient lighting such as LED.

The energy-saving potential by the industrial sub-sector is presented in the figure below:

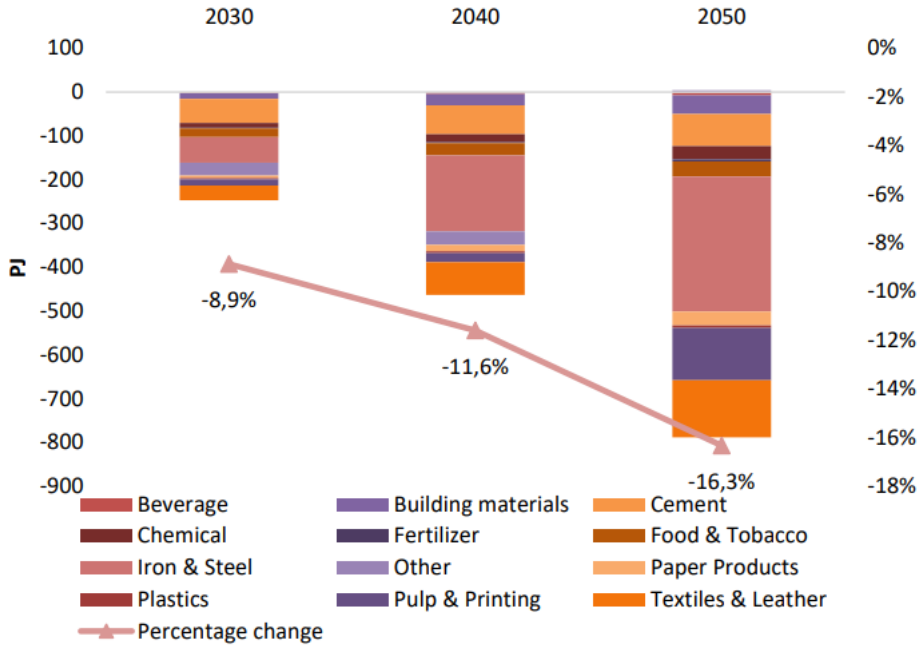


Figure 5: Potential for energy saving in sub-industries

The VNEEP3 sets a target for energy savings at 8-10% of the by the total national energy consumption in the period of 2019-2030. This target is quite ambitious, but the analysis above points out, that the target is completely achievable.

3 POTENTIAL FOR REDUCTION OF GHG EMISSIONS FROM THE INDUSTRY

The level of detail in the available data is not sufficient to carry out a detailed assessment of the potential for reduction of the GHG emissions in the industry. Thus, the assessment of the potential to reduce GHG emissions in industry is based on the draft National Energy Development Plan for the period 2021-2030, vision to 2050. Based on the different scenarios in the draft National Energy Development Plan for the period 2021-2030, vision to 2050, the CO2 emission from the industry will increase from 7.10% to 10.00% towards 2030 compared to 2020.

The growth rate of CO2 emissions according to the scenarios are shown in the following table:

Table 6: The rate of CO2 emissions increases according to the scenarios

	A0-BASE	A1-C15-E10-RE15	A2-C27-E15-RE20	A3-HIGH	A4-C15-E10-RE15	A5-C27-E15-RE20
Agriculture	3.10%	3.60%	3.90%	3.50%	4.10%	4.30%
Commerce	11.40%	11.00%	11.20%	12.20%	11.80%	12.00%
Industry	8.20%	7.10%	7.60%	10.00%	8.10%	8.50%
Power production	8.90%	6.80%	4.70%	9.20%	6.30%	4.20%
Civil	5.50%	1.40%	0.20%	6.10%	10.70%	9.00%
Exploiting energy	0.30%	-0.70%	-1.40%	0.40%	-0.60%	-3.10%
Transportation	6.50%	6.20%	5.40%	6.50%	6.20%	5.40%
Total CO2 emissions	7.70%	6.10%	5.00%	8.20%	6.40%	5.20%
Total system cost	9.60%	9.40%	9.60%	10.30%	10.30%	10.60%

For industry, the emission reduction potential can be assessed based on the difference in CO2 emission growth rate between scenario A0 and other scenarios. The calculation of emission reduction potential is done with CO2 emissions level in 2020, the results are shown in the following table:

Table 7: Potential of CO2 emissions reduction from the industry compared to A0 scenario.

Scenario	**A0**	**A1**		**A2**		**A3**		**A4**		**A5**	
Year	**CO_2 Emision (Mtons CO_2)**	**CO_2 Emision (Mtons CO_2)**	**Emission reduction rate**	**CO_2 Emision (Mtons CO_2)**	**Emission reduction rate**	**CO_2 Emision (Mtons CO_2)**	**Emission reduction rate**	**CO_2 Emision (Mtons CO_2)**	**Emission reduction rate**	**CO_2 Emision (Mtons CO_2)**	**Emission reduction rate**
2020	185,73	185,73	0.00%	185,73	0.00%	185,73	0.00%	185,73	0.00%	185,73	0.00%
2021	200,96	198,92	1.02%	199,85	0.55%	204,31	-1.66%	200,78	0.09%	201,52	-0.28%
2022	217,44	213,04	2.02%	215,04	1.11%	224,74	-3.35%	217,04	0.18%	218,65	-0.56%
2023	235,27	228,17	3.02%	231,38	1.65%	247,21	-5.07%	234,62	0.28%	237,23	-0.83%
2024	254,56	244,37	4.00%	248,96	2.20%	271,93	-6.82%	253,62	0.37%	257,40	-1.11%
2025	275,44	261,72	4.98%	267,89	2.74%	299,12	-8.60%	274,17	0.46%	279,28	-1.39%
2026	298,02	280,30	5.95%	288,24	3.28%	329,04	-10.41%	296,37	0.55%	303,02	-1.68%
2027	322,46	300,20	6.90%	310,15	3.82%	361,94	-12.24%	320,38	0.65%	328,77	-1.96%
2028	348,90	321,52	7.85%	333,72	4.35%	398,13	-14.11%	346,33	0.74%	356,72	-2.24%
2029	377,51	344,34	8.79%	359,09	4.88%	437,95	-16.01%	374,39	0.83%	387,04	-2.52%
2030	408,47	368,79	9.71%	386,38	5.41%	481,74	-17.94%	404,71	0.92%	419,94	-2.81%

Depending on the scenario the potential for reduction of the CO2 emission from the industry in 2030 compared to 2020 range between a reduction by 9.7% to an increase by 17.9%. It can be seen that the emission reduction potential of scenario A1, the RE scenario, is the largest, which is also the proposed option of the draft National Energy Development Plan for the period 2021-2030, vision to 2050 of Vietnam.

4 CONCLUSIONS

Energy savings potential in Vietnam's industries is very large. In the energy efficiency scenario, the application of technology plays an acritical on a large amount of energy savings and GHG emission reduction (VEO2019). The technical catalogue and the technical guideline will support the dissemination of energy efficiency technologies, new technologies and optimization of energy use in the industry.

APPENDIX – REFERENCES

[1] Vietnam Energy Outlook 2019;
[2] The draft of the National Energy System Plan for the period 2021-2030, vision to 2050;
[3] The report on the National Energy Efficiency Programme for the period of 2019-2030;
[4] The reports of DEUs to MOIT;