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# Appendices

## Appendix 1 – ERIA–Frozen Scenario

### Appendix 1.1: ERIA–Frozen Scenario – Ammonia

#### Appendix 1.1.1. ASEAN-8 Ammonia Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Demand/Consumption</b>	<b>1,511,206</b>	<b>1,833,763</b>	<b>2,182,618</b>	<b>2,491,191</b>	<b>2,843,388</b>	<b>3,245,380</b>	<b>3,710,350</b>	<b>4,227,894</b>
Indonesia	1,052,120	1,270,759	1,421,651	1,622,640	1,852,045	2,113,882	2,412,738	2,753,845
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	312,133	356,262	406,629	464,117	529,733	604,625
Viet Nam	258,210	258,210	287,023	327,601	373,917	426,780	487,117	555,985
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	26,673	30,444	34,748	39,661	45,268	51,668
Brunei	0	0	135,138	154,243	176,050	200,939	235,494	261,772

Source: Authors.

#### Appendix 1.1.2. ASEAN-8 Ammonia Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Production Volumes</b>	<b>1,511,818</b>	<b>1,834,291</b>	<b>2,144,340</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>
Indonesia	1,052,732	1,271,287	1,333,800	1,504,800	1,504,800	1,504,800	1,504,800	1,504,800
Thailand	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-
Malaysia	176,347	280,799	353,970	564,300	564,300	564,300	564,300	564,300
Viet Nam	258,210	258,210	283,860	283,860	283,860	283,860	283,860	283,860
Philippines	-	-	-	-	-	-	-	-
Myanmar	24,529	23,995	47,880	47,880	47,880	47,880	47,880	47,880
Brunei	0	0	124,830	124,830	124,830	124,830	124,830	124,830

Source: Authors.

### Appendix 1.1.3. ASEAN-8 Ammonia Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Merchant Supply (Offtake)</b>	<b>-612</b>	<b>-528</b>	<b>49,177</b>	<b>-46,457</b>	<b>279,631</b>	<b>651,820</b>	<b>1,076,628</b>	<b>1,561,495</b>
Indonesia	-612	-528	87,851	117,840	347,245	609,082	907,938	1,249,045
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	-41,837	-208,038	-157,671	-100,183	-34,567	40,325
Viet Nam	0	0	3,163	43,741	90,057	142,920	203,257	272,125
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	-21,207	-17,436	-13,132	-8,219	-2,612	3,788
Brunei	0	0	10,308	29,413	51,220	76,109	110,664	136,942

Source: Authors.

### Appendix 1.2 : ERIA–Frozen Scenario – Ammonia

#### Appendix 1.2.1. ASEAN-8 Refineries' Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Demand/Consumption</b>	<b>1,157,234</b>	<b>1,167,870</b>	<b>1,546,092</b>	<b>1,931,152</b>	<b>2,142,621</b>	<b>2,377,245</b>	<b>2,637,562</b>	<b>2,926,385</b>
Indonesia	260,682	279,447	359,951	528,877	586,791	651,047	722,339	801,438
Thailand	281,532	301,799	313,638	363,592	403,407	447,582	496,593	550,972
Singapore	191,563	205,354	312,211	361,938	401,572	445,546	494,334	548,466
Malaysia	311,917	261,701	349,607	405,290	449,671	498,912	553,544	614,160
Viet Nam	53,088	56,910	70,687	81,945	90,918	100,874	111,920	124,176
Philippines	19,982	21,421	33,672	39,035	43,309	48,051	53,313	59,151
Myanmar	36,146	38,748	92,809	126,065	139,870	155,186	172,179	191,034
Brunei	2,323	2,490	13,517	24,409	27,082	30,048	33,338	36,989

Source: Authors.

**Appendix 1.2.2. ASEAN-8 Refineries' Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Production Volumes</b>	<b>976,792</b>	<b>974,439</b>	<b>1,282,387</b>	<b>1,594,511</b>	<b>1,595,163</b>	<b>1,595,343</b>	<b>1,595,343</b>	<b>1,595,343</b>
Indonesia	281,650	301,925	388,904	571,418	571,418	571,418	571,418	571,418
Thailand	202,019	216,562	225,057	301,663	301,663	301,663	301,663	301,663
Singapore	120,839	129,538	196,944	212,357	212,357	212,357	212,357	212,357
Malaysia	295,038	243,606	325,435	338,342	338,342	338,342	338,342	338,342
Viet Nam	16,913	18,131	22,520	21,584	21,584	21,584	21,584	21,584
Philippines	32,346	34,674	54,505	58,770	58,770	58,770	58,770	58,770
Myanmar	27,421	29,395	65,725	84,422	84,422	84,422	84,422	84,422
Brunei	567	608	3,298	5,956	6,608	6,788	6,788	6,788

Source: Authors.

**Appendix 1.2.3. ASEAN-8 Refineries' Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Merchant Supply (Offtake)</b>	<b>180,442</b>	<b>193,432</b>	<b>263,705</b>	<b>336,642</b>	<b>547,458</b>	<b>781,902</b>	<b>1,042,219</b>	<b>1,331,041</b>
Indonesia	-20,968	-22,477	-28,953	-42,540	15,374	79,629	150,921	230,020
Thailand	79,513	85,237	88,581	61,929	101,744	145,919	194,930	249,309
Singapore	70,725	75,816	115,268	149,582	189,215	233,189	281,978	336,109
Malaysia	16,879	18,094	24,172	66,948	111,329	160,570	215,202	275,818
Viet Nam	36,175	38,779	48,167	60,361	69,334	79,290	90,336	102,592
Philippines	-12,364	-13,254	-20,833	-19,736	-15,461	-10,719	-5,457	381
Myanmar	8,725	9,353	27,084	41,644	55,448	70,764	87,758	106,612
Brunei	1,756	1,882	10,219	18,453	20,474	23,260	26,550	30,201

Source: Authors.

## Appendix 1.3: ERIA–Frozen Scenario – Methanol

### Appendix 1.3.1. ASEAN-8 Methanol Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Demand/Consumption</b>	<b>367,000</b>	<b>509,000</b>	<b>538,000</b>	<b>572,000</b>	<b>598,000</b>	<b>618,000</b>	<b>635,000</b>	<b>650,000</b>
Indonesia	79,000	157,000	158,000	173,000	184,000	193,000	200,000	207,000
Thailand	83,000	99,000	105,000	109,000	112,000	114,000	116,000	118,000
Singapore	65,000	63,000	72,000	73,000	74,000	75,000	75,000	76,000
Malaysia	112,000	139,000	149,000	160,000	168,000	174,000	180,000	184,000
Viet Nam	13,000	37,000	37,000	40,000	42,000	44,000	46,000	47,000
Philippines	15,000	14,000	17,000	17,000	18,000	18,000	18,000	18,000
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 1.3.2. ASEAN-8 Methanol Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Production Volumes</b>	<b>355,300</b>	<b>339,300</b>	<b>399,700</b>	<b>434,300</b>	<b>491,400</b>	<b>556,000</b>	<b>629,100</b>	<b>711,600</b>
Indonesia	82,500	82,500	93,300	105,600	119,500	135,200	153,000	173,000
Thailand	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-
Malaysia	182,500	166,500	188,400	213,100	241,100	272,800	308,700	349,200
Viet Nam	-	-	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-
Myanmar	-	-	-	-	-	-	-	-
Brunei	90,300	90,300	118,000	115,600	130,800	148,000	167,400	189,400

Source: Authors.

**Appendix 1.3.3. ASEAN-8 Methanol Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Merchant Supply (Offtake)</b>	<b>11,700</b>	<b>169,700</b>	<b>138,300</b>	<b>137,700</b>	<b>106,600</b>	<b>62,000</b>	<b>5,900</b>	<b>-61,600</b>
Indonesia	-3,500	74,500	64,700	67,400	64,500	57,800	47,000	34,000
Thailand	83,000	99,000	105,000	109,000	112,000	114,000	116,000	118,000
Singapore	65,000	63,000	72,000	73,000	74,000	75,000	75,000	76,000
Malaysia	-70,500	-27,500	-39,400	-53,100	-73,100	-98,800	-128,700	-165,200
Viet Nam	13,000	37,000	37,000	40,000	42,000	44,000	46,000	47,000
Philippines	15,000	14,000	17,000	17,000	18,000	18,000	18,000	18,000
Myanmar	0	0	0	0	0	0	0	0
Brunei	-90,300	-90,300	-118,000	-115,600	-130,800	-148,000	-167,400	-189,400

Source: Authors.

**Appendix 1.4: ERIA–Frozen Scenario – Iron and Steel****Appendix 1.4.1. ASEAN-8 Iron and Steel Industry's Hydrogen Demand/Consumption**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Demand/Consumption</b>	<b>59,006</b>	<b>24,648</b>	<b>29,211</b>	<b>43,816</b>	<b>43,816</b>	<b>43,816</b>	<b>43,816</b>	<b>102,238</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	29,211	43,816	43,816	43,816	43,816	43,816
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 1.4.2. ASEAN-8 Iron and Steel Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 1.4.3. ASEAN-8 Steel Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Steel Merchant Supply (Offtake)</b>	<b>59,006</b>	<b>24,648</b>	<b>29,211</b>	<b>43,816</b>	<b>43,816</b>	<b>43,816</b>	<b>43,816</b>	<b>102,238</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	29,211	43,816	43,816	43,816	43,816	43,816
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 1.5: ERIA–Frozen Scenario – Chemical and Other**

Using IHS 2020–2021 aggregate estimates.

**Appendix 1.5.1. ASEAN-8 Chemical and other Industry's Hydrogen Demand/Consumption**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical and Other Demand/Consumption</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,339	50,339	58,641	68,311	79,577	92,700
Thailand	27,161	28,726	28,669	31,380	36,555	42,584	49,607	57,787
Singapore	15,950	17,005	23,975	25,921	30,195	35,175	40,976	47,733
Malaysia	34,653	30,385	37,545	41,488	48,330	56,300	65,585	76,401
Viet Nam	4,420	4,713	5,428	5,869	6,836	7,964	9,277	10,807
Philippines	5,385	5,509	7,171	8,137	9,479	11,042	12,863	14,984
Myanmar	3,010	3,209	7,127	9,028	10,517	12,252	14,272	16,626
Brunei	193	206	1,038	1,748	2,036	2,372	2,763	3,219

Source: Authors.

**Appendix 1.5.2. ASEAN-8 Chemical and other Industry's Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 1.5.3. Chemical and Other Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Merchant Supply (Offtake)</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,339	50,339	58,641	68,311	79,577	92,700
Thailand	27,161	28,726	28,669	31,380	36,555	42,584	49,607	57,787
Singapore	15,950	17,005	23,975	25,921	30,195	35,175	40,976	47,733
Malaysia	34,653	30,385	37,545	41,488	48,330	56,300	65,585	76,401
Viet Nam	4,420	4,713	5,428	5,869	6,836	7,964	9,277	10,807
Philippines	5,385	5,509	7,171	8,137	9,479	11,042	12,863	14,984
Myanmar	3,010	3,209	7,127	9,028	10,517	12,252	14,272	16,626
Brunei	193	206	1,038	1,748	2,036	2,372	2,763	3,219

Source: Authors.

## Appendix 2 – ERIA–STEPS

### Appendix 2.1: ERIA–STEPS – Ammonia

#### Appendix 2.1.1. ASEAN-8 Ammonia Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Demand/Consumption</b>	<b>1,511,206</b>	<b>1,833,763</b>	<b>2,088,857</b>	<b>2,237,150</b>	<b>2,605,518</b>	<b>3,034,656</b>	<b>3,534,519</b>	<b>4,116,690</b>
Indonesia	1,052,120	1,270,759	1,360,993	1,457,614	1,697,651	1,977,319	2,303,079	2,682,456
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	300,796	322,190	375,329	437,229	509,346	593,369
Viet Nam	258,210	258,210	276,540	296,140	344,812	401,498	467,523	544,427
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	25,698	27,521	32,047	37,318	43,457	50,606
Brunei	0	0	124,830	133,685	155,679	181,292	211,115	245,832

Source: Authors.



**Appendix 2.1.2. ASEAN-8 Ammonia Industry's Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Production Volumes</b>	<b>1,511,818</b>	<b>1,834,291</b>	<b>2,144,340</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>
Indonesia	1,052,732	1,271,287	1,333,800	1,504,800	1,504,800	1,504,800	1,504,800	1,504,800
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	353,970	564,300	564,300	564,300	564,300	564,300
Viet Nam	258,210	258,210	283,860	283,860	283,860	283,860	283,860	283,860
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	47,880	47,880	47,880	47,880	47,880	47,880
Brunei	0	0	124,830	124,830	124,830	124,830	124,830	124,830

Source: Authors.

**Appendix 2.1.3. ASEAN-8 Ammonia Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Merchant Supply (Offtake)</b>	<b>-612</b>	<b>-528</b>	<b>-33,301</b>	<b>-277,016</b>	<b>64,832</b>	<b>463,086</b>	<b>926,988</b>	<b>1,467,292</b>
Indonesia	-612	-528	27,193	-47,186	192,851	472,519	798,279	1,177,656
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	-53,174	-242,110	-188,971	-127,071	-54,954	29,069
Viet Nam	0	0	-7,320	12,280	60,952	117,638	183,663	260,567
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	-22,182	-20,359	-15,833	-10,562	-4,423	2,726
Brunei	0	0	0	8,855	30,849	56,462	86,285	121,002

Source: Authors.

## Appendix 2.2: ERIA–STEPS Scenario – Refinery

## Appendix 2.2.1. ASEAN-8 Refineries' Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Demand/Consumption</b>	<b>1,157,234</b>	<b>1,167,870</b>	<b>1,546,092</b>	<b>1,931,152</b>	<b>1,989,786</b>	<b>2,050,201</b>	<b>2,112,449</b>	<b>2,176,588</b>
Indonesia	260,682	279,447	359,951	528,877	544,935	561,481	578,528	596,094
Thailand	281,532	301,799	313,638	363,592	374,632	386,006	397,726	409,802
Singapore	191,563	205,354	312,211	361,938	372,928	384,251	395,917	407,938
Malaysia	311,917	261,701	349,607	405,290	417,596	430,275	443,339	456,800
Viet Nam	53,088	56,910	70,687	81,945	84,433	86,997	89,638	92,360
Philippines	19,982	21,421	33,672	39,035	40,220	41,441	42,699	43,996
Myanmar	36,146	38,748	92,809	126,065	129,893	133,837	137,900	142,087
Brunei	2,323	2,490	13,517	24,409	25,150	25,914	26,701	27,511

Source: Authors.

## Appendix 2.2.2. ASEAN-8 Refineries' Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Production Volumes</b>	<b>976,792</b>	<b>974,439</b>	<b>1,282,387</b>	<b>1,594,511</b>	<b>1,594,692</b>	<b>1,595,343</b>	<b>1,595,343</b>	<b>1,595,343</b>
Indonesia	281,650	301,925	388,904	571,418	571,418	571,418	571,418	571,418
Thailand	202,019	216,562	225,057	301,663	301,663	301,663	301,663	301,663
Singapore	120,839	129,538	196,944	212,357	212,357	212,357	212,357	212,357
Malaysia	295,038	243,606	325,435	338,342	338,342	338,342	338,342	338,342
Viet Nam	16,913	18,131	22,520	21,584	21,584	21,584	21,584	21,584
Philippines	32,346	34,674	54,505	58,770	58,770	58,770	58,770	58,770
Myanmar	27,421	29,395	65,725	84,422	84,422	84,422	84,422	84,422
Brunei	567	608	3,298	5,956	6,136	6,788	6,788	6,788

Source: Authors.

**Appendix 2.2.3. ASEAN-8 Refineries' Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Merchant Supply (Offtake)</b>	<b>180,442</b>	<b>193,432</b>	<b>263,705</b>	<b>336,642</b>	<b>395,095</b>	<b>454,857</b>	<b>517,106</b>	<b>581,245</b>
Indonesia	-20,968	-22,477	-28,953	-42,540	-26,483	-9,937	7,111	24,676
Thailand	79,513	85,237	88,581	61,929	72,969	84,343	96,063	108,139
Singapore	70,725	75,816	115,268	149,582	160,571	171,894	183,561	195,581
Malaysia	16,879	18,094	24,172	66,948	79,254	91,933	104,997	118,458
Viet Nam	36,175	38,779	48,167	60,361	62,849	65,413	68,054	70,776
Philippines	-12,364	-13,254	-20,833	-19,736	-18,551	-17,329	-16,071	-14,775
Myanmar	8,725	9,353	27,084	41,644	45,471	49,415	53,479	57,666
Brunei	1,756	1,882	10,219	18,453	19,014	19,126	19,913	20,723

Source: Authors.

**Appendix 2.3: ERIA–Frozen Scenario – Methanol****Appendix 2.3.1. ASEAN-8 Methanol Industry's Hydrogen Demand/Consumption**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Demand/Consumption</b>	<b>367,000</b>	<b>509,000</b>	<b>538,208</b>	<b>572,034</b>	<b>597,513</b>	<b>617,955</b>	<b>635,031</b>	<b>649,694</b>
Indonesia	79,000	157,000	157,957	172,728	183,856	192,782	200,240	206,643
Thailand	83,000	99,000	104,564	108,591	111,624	114,058	116,091	117,836
Singapore	65,000	63,000	72,406	73,448	74,233	74,862	75,388	75,840
Malaysia	112,000	139,000	149,203	159,812	167,802	174,214	179,569	184,168
Viet Nam	13,000	37,000	36,909	40,090	42,486	44,409	46,015	47,394
Philippines	15,000	14,000	17,169	17,365	17,512	17,630	17,728	17,813
Myanmar	-	-	0	0	0	0	0	0
Brunei	-	-	-	-	-	-	-	-

Source: Authors.

### Appendix 2.3.2. ASEAN-8 Methanol Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Production Volumes</b>	<b>355,300</b>	<b>339,300</b>	<b>378,316</b>	<b>421,802</b>	<b>470,287</b>	<b>524,346</b>	<b>584,618</b>	<b>651,819</b>
Indonesia	82,500	82,500	91,983	102,556	114,345	127,489	142,143	158,482
Thailand	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-
Malaysia	182,500	166,500	185,639	206,978	230,769	257,295	286,871	319,846
Viet Nam	-	-	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-
Myanmar	-	-	-	-	-	-	-	-
Brunei	90,300	90,300	100,694	112,268	125,173	139,562	155,604	173,490

Source: Authors.

### Appendix 2.3.3. ASEAN-8 Methanol Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Merchant Supply (Offtake)</b>	<b>11,700</b>	<b>169,700</b>	<b>159,893</b>	<b>150,232</b>	<b>127,226</b>	<b>93,609</b>	<b>50,413</b>	<b>-2,124</b>
Indonesia	-3,500	74,500	65,974	70,172	69,511	65,293	58,097	48,161
Thailand	83,000	99,000	104,564	108,591	111,624	114,058	116,091	117,836
Singapore	65,000	63,000	72,406	73,448	74,233	74,862	75,388	75,840
Malaysia	-70,500	-27,500	-36,436	-47,166	-62,967	-83,081	-107,302	-135,678
Viet Nam	13,000	37,000	36,909	40,090	42,486	44,409	46,015	47,394
Philippines	15,000	14,000	17,169	17,365	17,512	17,630	17,728	17,813
Myanmar	0	0	0	0	0	0	0	0
Brunei	-90,300	-90,300	-100,694	-112,268	-125,173	-139,562	-155,604	-173,490

Source: Authors.

## Appendix 2.4: ERIA–STEPS – Iron and Steel

## Appendix 2.4.1. ASEAN-8 Iron and Steel Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Demand/Consumption</b>	<b>59,006</b>	<b>24,648</b>	<b>44,780</b>	<b>46,913</b>	<b>49,045</b>	<b>51,178</b>	<b>53,310</b>	<b>55,442</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	44,780	46,913	49,045	51,178	53,310	55,442
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

## Appendix 2.4.2. ASEAN-8 Iron and Steel Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 2.4.3. ASEAN-8 Steel Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Steel Merchant Supply (Offtake)</b>	<b>59,006</b>	<b>24,648</b>	<b>44,780</b>	<b>46,913</b>	<b>49,045</b>	<b>51,178</b>	<b>53,310</b>	<b>55,442</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	44,780	46,913	49,045	51,178	53,310	55,442
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 2.5: ERIA–STEPS – Chemical and Other

Using IHS 2020–2021 aggregate estimates.

#### Appendix 2.5.1. ASEAN-8 Chemical and Other Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical and Other Demand/Consumption</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,339	50,339	58,641	68,311	79,577	92,700
Thailand	27,161	28,726	28,669	31,380	36,555	42,584	49,607	57,787
Singapore	15,950	17,005	23,975	25,921	30,195	35,175	40,976	47,733
Malaysia	34,653	30,385	37,545	41,488	48,330	56,300	65,585	76,401
Viet Nam	4,420	4,713	5,428	5,869	6,836	7,964	9,277	10,807
Philippines	5,385	5,509	7,171	8,137	9,479	11,042	12,863	14,984
Myanmar	3,010	3,209	7,127	9,028	10,517	12,252	14,272	16,626
Brunei	193	206	1,038	1,748	2,036	2,372	2,763	3,219

Source: Authors.

**Appendix 2.5.2. ASEAN-8 Chemical and Other Industry's Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical and Other Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 2.5.3. ASEAN-8 Chemical and Other Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Merchant Supply (Offtake)</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,339	50,339	58,641	68,311	79,577	92,700
Thailand	27,161	28,726	28,669	31,380	36,555	42,584	49,607	57,787
Singapore	15,950	17,005	23,975	25,921	30,195	35,175	40,976	47,733
Malaysia	34,653	30,385	37,545	41,488	48,330	56,300	65,585	76,401
Viet Nam	4,420	4,713	5,428	5,869	6,836	7,964	9,277	10,807
Philippines	5,385	5,509	7,171	8,137	9,479	11,042	12,863	14,984
Myanmar	3,010	3,209	7,127	9,028	10,517	12,252	14,272	16,626
Brunei	193	206	1,038	1,748	2,036	2,372	2,763	3,219

Source: Authors.

## Appendix 3 – ERIA–LIKELY Scenario

### Appendix 3.1: ERIA–LIKELY Scenario – Ammonia

#### Appendix 3.1.1. ASEAN-8 Ammonia Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Demand\Consumption</b>	<b>1,511,206</b>	<b>1,833,763</b>	<b>2,070,152</b>	<b>2,196,013</b>	<b>2,736,397</b>	<b>3,409,939</b>	<b>4,249,348</b>	<b>5,295,336</b>
Indonesia	1,052,120	1,270,759	1,348,036	1,429,994	1,781,921	2,220,622	2,767,365	3,448,628
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	297,924	316,071	393,979	491,086	612,142	763,060
Viet Nam	258,210	258,210	273,908	290,534	361,891	450,798	561,581	699,627
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	25,454	27,000	33,635	41,903	52,204	65,039
Brunei	0	0	124,830	132,413	164,970	205,530	256,056	318,981

Source: Authors.

#### Appendix 3.1.2. ASEAN-8 Ammonia Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Production Volumes</b>	<b>1,511,818</b>	<b>1,834,291</b>	<b>2,144,340</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>
Indonesia	1,052,732	1,271,287	1,333,800	1,504,800	1,504,800	1,504,800	1,504,800	1,504,800
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	353,970	564,300	564,300	564,300	564,300	564,300
Viet Nam	258,210	258,210	283,860	283,860	283,860	283,860	283,860	283,860
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	47,880	47,880	47,880	47,880	47,880	47,880
Brunei	0	0	124,830	124,830	124,830	124,830	124,830	124,830

Source: Authors.



**Appendix 3.1.3. ASEAN-8 Ammonia Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Merchant Supply (Offtake)</b>	<b>-612</b>	<b>-528</b>	<b>-51,762</b>	<b>-316,361</b>	<b>184,831</b>	<b>809,546</b>	<b>1,588,128</b>	<b>2,558,355</b>
Indonesia	-612	-528	14,236	-74,806	277,121	715,822	1,262,565	1,943,828
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	-56,046	-248,229	-170,321	-73,214	47,842	198,760
Viet Nam	0	0	-9,952	6,674	78,031	166,938	277,721	415,767
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	-22,426	-20,880	-14,245	-5,977	4,324	17,159
Brunei	0	0	0	7,583	40,140	80,700	131,226	194,151

Source: Authors.

**Appendix 3.2: ERIA–LIKELY Scenario - Refinery****Appendix 3.2.1. ASEAN-8 Refineries' Hydrogen Demand/Consumption**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Demand/Consumption</b>	<b>1,157,234</b>	<b>1,167,870</b>	<b>1,404,953</b>	<b>1,619,893</b>	<b>1,548,298</b>	<b>1,479,868</b>	<b>1,414,462</b>	<b>1,351,946</b>
Indonesia	260,682	279,447	326,336	454,577	434,486	415,283	396,929	379,385
Thailand	281,532	301,799	280,964	295,296	282,245	269,770	257,847	246,451
Singapore	191,563	205,354	283,054	297,493	284,344	271,777	259,765	248,284
Malaysia	311,917	261,701	318,126	334,354	319,576	305,452	291,952	279,048
Viet Nam	53,088	56,910	64,085	67,354	64,377	61,532	58,812	56,213
Philippines	19,982	21,421	30,527	32,084	30,666	29,311	28,015	26,777
Myanmar	36,146	38,748	88,614	115,803	110,685	105,793	101,117	96,648
Brunei	2,323	2,490	13,247	22,932	21,918	20,950	20,024	19,139

Source: Authors.

### Appendix 3.2.2. ASEAN-8 Refineries' Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Production Volumes</b>	<b>976,792</b>	<b>974,439</b>	<b>1,167,666</b>	<b>1,513,874</b>	<b>1,491,920</b>	<b>1,472,612</b>	<b>1,452,781</b>	<b>1,433,827</b>
Indonesia	281,650	301,925	352,585	491,141	469,434	448,686	428,856	409,901
Thailand	202,019	216,562	201,611	301,663	301,663	301,663	301,663	301,663
Singapore	120,839	129,538	178,551	212,357	212,357	212,357	212,357	212,357
Malaysia	295,038	243,606	296,131	338,342	338,342	338,342	338,342	338,342
Viet Nam	16,913	18,131	20,417	21,584	21,584	21,584	21,584	21,584
Philippines	32,346	34,674	49,415	58,770	58,770	58,770	58,770	58,770
Myanmar	27,421	29,395	65,725	84,422	84,422	84,422	84,422	84,422
Brunei	567	608	3,232	5,595	5,348	6,788	6,788	6,788

Source: Authors.

### Appendix 3.2.3. ASEAN-8 Refineries' Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Merchant Supply (Offtake)</b>	<b>180,442</b>	<b>193,432</b>	<b>237,288</b>	<b>106,019</b>	<b>56,379</b>	<b>7,256</b>	<b>-38,319</b>	<b>-81,881</b>
Indonesia	-20,968	-22,477	-26,249	-36,564	-34,948	-33,403	-31,927	-30,516
Thailand	79,513	85,237	79,353	-6,367	-19,418	-31,893	-43,816	-55,212
Singapore	70,725	75,816	104,503	85,136	71,988	59,420	47,409	35,928
Malaysia	16,879	18,094	21,996	-3,988	-18,766	-32,890	-46,390	-59,294
Viet Nam	36,175	38,779	43,669	45,770	42,793	39,948	37,228	34,629
Philippines	-12,364	-13,254	-18,888	-26,686	-28,104	-29,460	-30,755	-31,993
Myanmar	8,725	9,353	22,889	31,382	26,263	21,371	16,696	12,227
Brunei	1,756	1,882	10,015	17,337	16,571	14,162	13,236	12,351

Source: Authors.

## Appendix 3.3: ERIA–LIKELY Scenario – Methanol

## Appendix 3.3.1. ASEAN-8 Methanol Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Demand/Consumption</b>	<b>367,000</b>	<b>509,000</b>	<b>575,985</b>	<b>651,674</b>	<b>737,309</b>	<b>834,197</b>	<b>943,818</b>	<b>1,067,843</b>
Indonesia	79,000	157,000	177,695	201,046	227,465	257,356	291,175	329,437
Thailand	83,000	99,000	112,123	126,857	143,527	162,387	183,726	207,869
Singapore	65,000	63,000	71,433	80,820	91,441	103,457	117,052	132,434
Malaysia	112,000	139,000	156,924	177,545	200,876	227,273	257,138	290,928
Viet Nam	13,000	37,000	41,843	47,341	53,562	60,601	68,564	77,574
Philippines	15,000	14,000	15,727	17,794	20,132	22,777	25,771	29,157
Myanmar	-	-	239	271	306	347	392	444
Brunei	-	-	0	0	0	0	0	0

Source: Authors.

## Appendix 3.3.2. ASEAN-8 Methanol Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Production Volumes</b>	<b>355,300</b>	<b>339,300</b>	<b>383,901</b>	<b>434,349</b>	<b>491,426</b>	<b>556,003</b>	<b>629,066</b>	<b>711,731</b>
Indonesia	82,500	82,500	93,341	105,607	119,485	135,186	152,950	173,049
Thailand	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-
Malaysia	182,500	166,500	188,379	213,134	241,142	272,830	308,682	349,245
Viet Nam	-	-	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-
Myanmar	-	-	-	-	-	-	-	-
Brunei	90,300	90,300	102,180	115,608	130,799	147,988	167,434	189,437

Source: Authors.

### Appendix 3.3.3. ASEAN-8 Methanol Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Merchant Supply (Offtake)</b>	<b>11,700</b>	<b>169,700</b>	<b>192,084</b>	<b>217,325</b>	<b>245,883</b>	<b>278,194</b>	<b>314,751</b>	<b>356,112</b>
Indonesia	-3,500	74,500	84,354	95,439	107,980	122,170	138,224	156,388
Thailand	83,000	99,000	112,123	126,857	143,527	162,387	183,726	207,869
Singapore	65,000	63,000	71,433	80,820	91,441	103,457	117,052	132,434
Malaysia	-70,500	-27,500	-31,456	-35,589	-40,266	-45,557	-51,544	-58,317
Viet Nam	13,000	37,000	41,843	47,341	53,562	60,601	68,564	77,574
Philippines	15,000	14,000	15,727	17,794	20,132	22,777	25,771	29,157
Myanmar	0	0	239	271	306	347	392	444
Brunei	-90,300	-90,300	-102,180	-115,607	-130,799	-147,987	-167,434	-189,436

Source: Authors.

### Appendix 3.4: ERIA–LIKELY Scenario – Iron and Steel

#### Appendix 3.4.1. ASEAN-8 Iron and Steel Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Demand/Consumption</b>	<b>59,006</b>	<b>42,648</b>	<b>44,290</b>	<b>45,932</b>	<b>47,574</b>	<b>49,216</b>	<b>50,858</b>	<b>52,500</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	42,648	44,289.95	45,932	47,574	49,216	50,858	52,500
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 3.4.2. ASEAN-8 Iron and Steel Industry's Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 3.4.3. ASEAN-8 Steel Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Steel Merchant Supply (Offtake)</b>	<b>59,006</b>	<b>42,648</b>	<b>44,290</b>	<b>45,932</b>	<b>47,574</b>	<b>49,216</b>	<b>50,858</b>	<b>52,500</b>
Indonesia	2,921	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	42,648	44,290	45,932	47,574	49,216	50,858	52,500
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 3.5: ERIA–Likely Scenario – Chemical and other

Using IHS 2020–2021 aggregate estimates.

#### Appendix 3.5.1. ASEAN-8 Chemical and other Industry’s Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Demand/Consumption</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,275	51,273	59,729	69,579	81,054	94,420
Thailand	27,161	28,726	28,328	30,553	35,591	41,461	48,298	56,263
Singapore	15,950	17,005	23,919	25,399	29,588	34,467	40,151	46,773
Malaysia	34,653	30,385	37,581	41,009	47,772	55,650	64,828	75,519
Viet Nam	4,420	4,713	5,415	5,751	6,699	7,804	9,091	10,590
Philippines	5,385	5,509	7,165	8,080	9,413	10,965	12,774	14,880
Myanmar	3,010	3,209	7,488	9,887	11,518	13,417	15,630	18,207
Brunei	193	206	1,119	1,958	2,281	2,657	3,095	3,605

Source: Authors.

#### Appendix 3.5.2. ASEAN-8 Chemical and other Industry’s Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 3.5.3. ASEAN-8 Chemical and Other Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Merchant Supply (Offtake)</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,275	51,273	59,729	69,579	81,054	94,420
Thailand	27,161	28,726	28,328	30,553	35,591	41,461	48,298	56,263
Singapore	15,950	17,005	23,919	25,399	29,588	34,467	40,151	46,773
Malaysia	34,653	30,385	37,581	41,009	47,772	55,650	64,828	75,519
Viet Nam	4,420	4,713	5,415	5,751	6,699	7,804	9,091	10,590
Philippines	5,385	5,509	7,165	8,080	9,413	10,965	12,774	14,880
Myanmar	3,010	3,209	7,488	9,887	11,518	13,417	15,630	18,207
Brunei	193	206	1,119	1,958	2,281	2,657	3,095	3,605

Source: Authors.

## Appendix 4 – ERIA–APS

### Appendix 4.1: ERIA–APS – Ammonia

#### Appendix 4.1.1. ASEAN-8 Ammonia Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Demand/Consumption</b>	<b>1,511,206</b>	<b>1,833,763</b>	<b>2,074,107</b>	<b>2,204,679</b>	<b>3,004,786</b>	<b>4,095,570</b>	<b>5,582,470</b>	<b>7,609,082</b>
Indonesia	1,052,120	1,270,759	1,350,775	1,435,812	1,956,950	2,667,512	3,636,142	4,956,315
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	298,531	317,360	432,735	590,045	804,569	1,097,128
Viet Nam	258,210	258,210	274,465	291,715	397,373	541,342	737,532	1,004,903
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	25,506	27,110	36,935	50,324	68,569	93,430
Brunei	0	0	124,830	132,682	180,793	246,347	335,659	457,305

Source: Authors.

### Appendix 4.1.2. ASEAN-8 Ammonia Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Production Volumes</b>	<b>1,511,818</b>	<b>1,834,291</b>	<b>2,144,340</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>	<b>2,525,670</b>
Indonesia	1,052,732	1,271,287	1,333,800	1,504,800	1,504,800	1,504,800	1,504,800	1,504,800
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	176,347	280,799	353,970	564,300	564,300	564,300	564,300	564,300
Viet Nam	258,210	258,210	283,860	283,860	283,860	283,860	283,860	283,860
Philippines	0	0	0	0	0	0	0	0
Myanmar	24,529	23,995	47,880	47,880	47,880	47,880	47,880	47,880
Brunei	0	0	124,830	124,830	124,830	124,830	124,830	124,830

Source: Authors.

### Appendix 4.1.3. ASEAN-8 Ammonia Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Ammonia Merchant Supply (Offtake)</b>	<b>-612</b>	<b>-528</b>	<b>-47,859</b>	<b>-308,073</b>	<b>434,098</b>	<b>1,445,939</b>	<b>2,825,283</b>	<b>4,705,386</b>
Indonesia	-612	-528	16,975	-68,988	452,150	1,162,712	2,131,342	3,451,515
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	-55,439	-246,940	-131,565	25,745	240,269	532,828
Viet Nam	0	0	-9,395	7,855	113,513	257,482	453,672	721,043
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	-22,374	-20,770	-10,945	2,444	20,689	45,550
Brunei	0	0	0	7,852	55,963	121,517	210,829	332,475

Source: Authors.



## Appendix 4.2: ERIA–APS – Refinery

## Appendix 4.2.1. ASEAN-8 Refineries' Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Demand/Consumption</b>	<b>1,157,234</b>	<b>1,167,870</b>	<b>1,474,139</b>	<b>1,768,653</b>	<b>1,590,582</b>	<b>1,430,440</b>	<b>1,286,421</b>	<b>1,156,902</b>
Indonesia	260,682	279,447	342,814	490,089	440,746	396,371	356,464	320,575
Thailand	281,532	301,799	296,981	327,891	294,878	265,189	238,490	214,478
Singapore	191,563	205,354	297,347	328,295	295,242	265,516	238,784	214,742
Malaysia	311,917	261,701	333,558	368,275	331,197	297,851	267,863	240,894
Viet Nam	53,088	56,910	67,321	74,328	66,845	60,115	54,062	48,619
Philippines	19,982	21,421	32,068	35,406	31,841	28,636	25,752	23,160
Myanmar	36,146	38,748	90,671	120,720	108,566	97,635	87,805	78,965
Brunei	2,323	2,490	13,379	23,649	21,268	19,127	17,201	15,469

Source: Authors.

## Appendix 4.2.2. ASEAN-8 Refineries' Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Production Volumes</b>	<b>976,792</b>	<b>974,439</b>	<b>1,223,902</b>	<b>1,552,418</b>	<b>1,498,525</b>	<b>1,452,179</b>	<b>1,409,062</b>	<b>1,370,286</b>
Indonesia	281,650	301,925	370,388	529,510	476,198	428,254	385,136	346,360
Thailand	202,019	216,562	213,104	301,663	301,663	301,663	301,663	301,663
Singapore	120,839	129,538	187,567	212,357	212,357	212,357	212,357	212,357
Malaysia	295,038	243,606	310,495	338,342	338,342	338,342	338,342	338,342
Viet Nam	16,913	18,131	21,447	21,584	21,584	21,584	21,584	21,584
Philippines	32,346	34,674	51,910	58,770	58,770	58,770	58,770	58,770
Myanmar	27,421	29,395	65,725	84,422	84,422	84,422	84,422	84,422
Brunei	567	608	3,264	5,770	5,189	6,788	6,788	6,788

Source: Authors.

### Appendix 4.2.3. ASEAN-8 Refineries' Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Refineries Merchant Supply (Offtake)</b>	<b>180,442</b>	<b>193,432</b>	<b>250,237</b>	<b>216,236</b>	<b>92,058</b>	<b>-21,739</b>	<b>-122,641</b>	<b>-213,384</b>
Indonesia	-20,968	-22,477	-27,574	-39,420	-35,452	-31,882	-28,672	-25,785
Thailand	79,513	85,237	83,876	26,228	-6,785	-36,474	-63,173	-87,185
Singapore	70,725	75,816	109,780	115,938	82,885	53,160	26,427	2,386
Malaysia	16,879	18,094	23,063	29,933	-7,145	-40,491	-70,479	-97,448
Viet Nam	36,175	38,779	45,874	52,744	45,261	38,531	32,478	27,035
Philippines	-12,364	-13,254	-19,841	-23,364	-26,929	-30,135	-33,018	-35,611
Myanmar	8,725	9,353	24,945	36,299	24,144	13,214	3,384	-5,457
Brunei	1,756	1,882	10,115	17,879	16,079	12,339	10,413	8,681

Source: Authors.

### Appendix 4.3: ERIA–APS – Methanol

#### Appendix 4.3.1. ASEAN-8 Methanol Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Demand/Consumption</b>	<b>367,000</b>	<b>509,000</b>	<b>665,356</b>	<b>869,593</b>	<b>1,136,523</b>	<b>1,485,391</b>	<b>1,941,346</b>	<b>2,537,262</b>
Indonesia	79,000	157,000	205,267	268,276	350,626	458,254	598,919	782,763
Thailand	83,000	99,000	129,520	169,277	221,239	289,150	377,908	493,910
Singapore	65,000	63,000	82,517	107,847	140,951	184,218	240,765	314,670
Malaysia	112,000	139,000	181,273	236,916	309,640	404,687	528,909	691,264
Viet Nam	13,000	37,000	48,335	63,172	82,563	107,907	141,030	184,320
Philippines	15,000	14,000	18,167	23,744	31,032	40,558	53,008	69,279
Myanmar	-	-	277	361	472	617	807	1,055
Brunei	-	-	0	0	0	0	0	1

Source: Authors.

**Appendix 4.3.2. ASEAN-8 Methanol Industry's Hydrogen Production Volumes**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Production Volumes</b>	<b>355,300</b>	<b>339,300</b>	<b>443,468</b>	<b>579,595</b>	<b>757,507</b>	<b>990,032</b>	<b>1,293,932</b>	<b>1,691,117</b>
Indonesia	82,500	82,500	107,824	140,922	184,179	240,715	314,605	411,176
Thailand	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-
Malaysia	182,500	166,500	217,609	284,406	371,707	485,807	634,930	829,828
Viet Nam	-	-	-	-	-	-	-	-
Philippines	-	-	-	-	-	-	-	-
Myanmar	-	-	-	-	-	-	-	-
Brunei	90,300	90,300	118,035	154,267	201,621	263,510	344,397	450,113

Source: Authors.

**Appendix 4.3.3. ASEAN-8 Methanol Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Methanol Merchant Supply (Offtake)</b>	<b>11,700</b>	<b>169,700</b>	<b>221,888</b>	<b>289,998</b>	<b>379,016</b>	<b>495,359</b>	<b>647,415</b>	<b>846,145</b>
Indonesia	-3,500	74,500	97,443	127,354	166,446	217,539	284,314	371,587
Thailand	83,000	99,000	129,520	169,277	221,239	289,150	377,908	493,910
Singapore	65,000	63,000	82,517	107,847	140,951	184,218	240,765	314,670
Malaysia	-70,500	-27,500	-36,336	-47,490	-62,068	-81,120	-106,020	-138,564
Viet Nam	13,000	37,000	48,335	63,172	82,563	107,907	141,030	184,320
Philippines	15,000	14,000	18,167	23,744	31,032	40,558	53,008	69,279
Myanmar	0	0	277	361	472	617	807	1,055
Brunei	-90,300	-90,300	-118,035	-154,267	-201,620	-263,510	-344,397	-450,112

Source: Authors.

## Appendix 4.4: ERIA-APS – Iron and Steel

### Appendix 4.4.1. ASEAN-8 Iron and Steel Industry's Hydrogen Demand/Consumption

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Demand/Consumption</b>	<b>59,006</b>	<b>24,648</b>	<b>43,074</b>	<b>43,501</b>	<b>43,927</b>	<b>44,354</b>	<b>44,780</b>	<b>45,207</b>
Indonesia	2,921	0	0	0	0	0	0	58,422
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	43,074	43,501	43,927	44,354	44,780	45,207
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 4.4.2. ASEAN-8 Iron and Steel Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Iron and Steel Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 4.4.3. ASEAN-8 Steel Industry's Hydrogen Merchant Supply (Offtake)**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Steel Merchant Supply (Offtake)</b>	<b>59,006</b>	<b>24,648</b>	<b>43,074</b>	<b>43,501</b>	<b>43,927</b>	<b>44,354</b>	<b>44,780</b>	<b>45,207</b>
Indonesia	2,921	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	56,085	24,648	43,074	43,501	43,927	44,354	44,780	45,207
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

**Appendix 4.5: ERIA–APS – Chemical and other**

Using IHS 2020–2021 aggregate estimates.

**Appendix 4.5.1. ASEAN-8 Chemical and other Industry's Hydrogen Demand/Consumption**

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Demand/Consumption</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,308	50,786	59,161	68,918	80,283	93,523
Thailand	27,161	28,726	28,503	30,981	36,090	42,042	48,975	57,052
Singapore	15,950	17,005	23,948	25,672	29,905	34,837	40,582	47,274
Malaysia	34,653	30,385	37,562	41,261	48,065	55,992	65,225	75,982
Viet Nam	4,420	4,713	5,422	5,812	6,771	7,887	9,188	10,703
Philippines	5,385	5,509	7,168	8,110	9,447	11,005	12,820	14,934
Brunei	3,010	3,209	7,302	9,440	10,997	12,810	14,923	17,384
Myanmar	193	206	1,078	1,849	2,154	2,509	2,923	3,405

Source: Authors.

### Appendix 4.5.2. ASEAN-8 Chemical and other Industry's Hydrogen Production Volumes

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Production Volumes</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Indonesia	0	0	0	0	0	0	0	0
Thailand	0	0	0	0	0	0	0	0
Singapore	0	0	0	0	0	0	0	0
Malaysia	0	0	0	0	0	0	0	0
Viet Nam	0	0	0	0	0	0	0	0
Philippines	0	0	0	0	0	0	0	0
Myanmar	0	0	0	0	0	0	0	0
Brunei	0	0	0	0	0	0	0	0

Source: Authors.

### Appendix 4.5.3. ASEAN-8 Chemical and Other Industry's Hydrogen Merchant Supply (Offtake)

Unit: tons per annum

ERIA 2022–2023 Study	2015	2020	2025E	2030E	2035E	2040E	2045E	2050E
<b>ASEAN-8 Chemical &amp; other Merchant Supply (Offtake)</b>	<b>121,158</b>	<b>121,608</b>	<b>149,291</b>	<b>173,911</b>	<b>202,591</b>	<b>236,000</b>	<b>274,920</b>	<b>320,257</b>
Indonesia	30,387	31,855	38,308	50,786	59,161	68,918	80,283	93,523
Thailand	27,161	28,726	28,503	30,981	36,090	42,042	48,975	57,052
Singapore	15,950	17,005	23,948	25,672	29,905	34,837	40,582	47,274
Malaysia	34,653	30,385	37,562	41,261	48,065	55,992	65,225	75,982
Viet Nam	4,420	4,713	5,422	5,812	6,771	7,887	9,188	10,703
Philippines	5,385	5,509	7,168	8,110	9,447	11,005	12,820	14,934
Myanmar	3,010	3,209	7,302	9,440	10,997	12,810	14,923	17,384
Brunei	193	206	1,078	1,849	2,154	2,509	2,923	3,405

Source: Authors.