



VIETNAM OIL AND GAS GROUP

VIETNAM PETROLEUM INSTITUTE

CURRENT STATUS OF PVN's HYDROGEN PRODUCTION AND USES

Ho Chi Minh City, 6-8/7/2021





CONTENTS

01

**ENERGY TRANSITION AND
VIETNAM ENERGY OUTLOOK**

02

PVN'S DEMAND ON HYDROGEN

03

**CURRENT FEEDSTOCK AND
TECHNOLOGIES FOR HYDROGEN
PRODUCTION AT PVN'S PLANTS**

04

**SUSTAINABLE DEVELOPMENT
IN HYDROGEN FOR PVN**

05

**CONCLUSIONS AND
RECOMMENDATIONS**



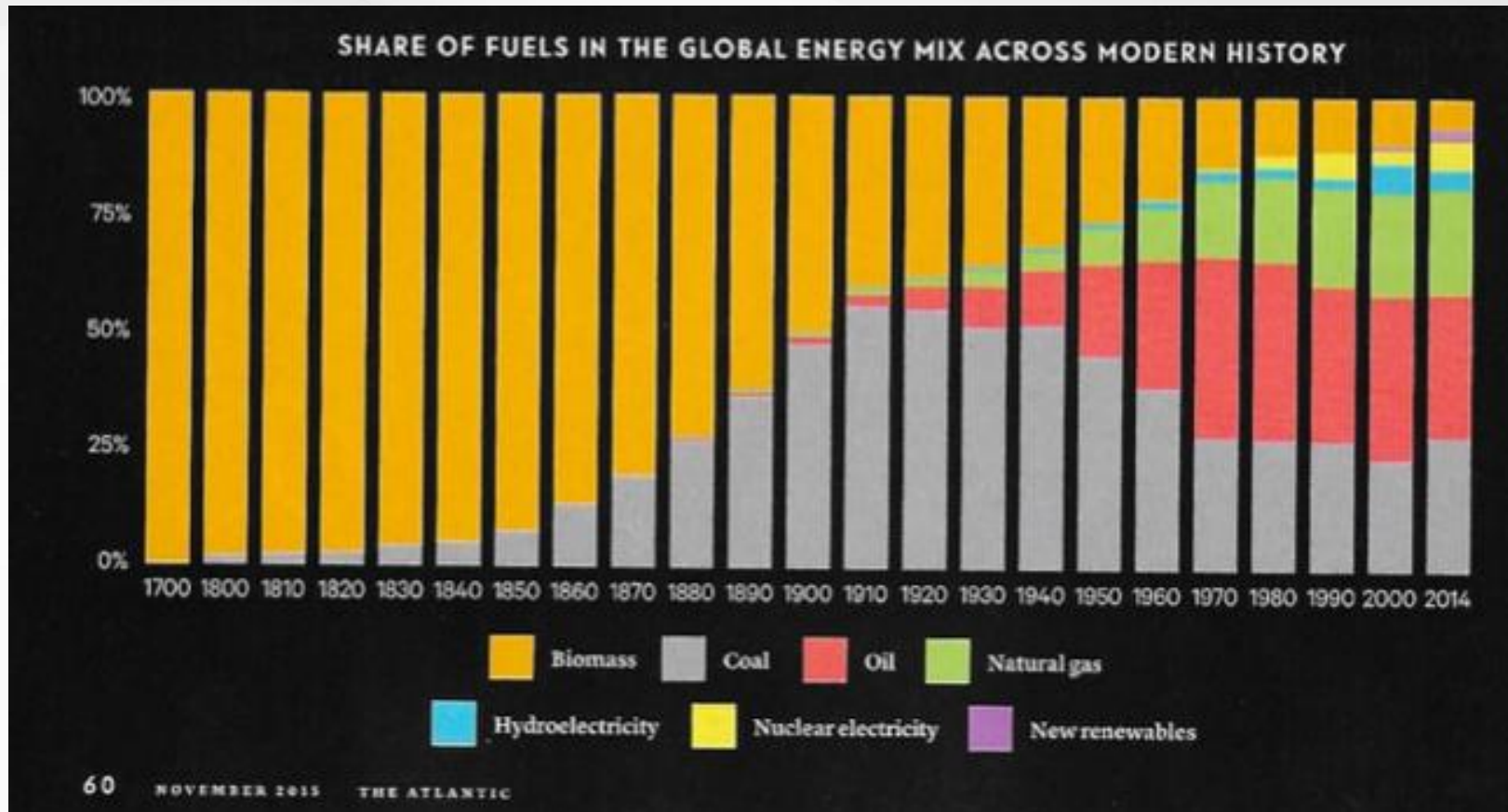


01

ENERGY TRANSITION AND VIETNAM ENERGY OUTLOOK



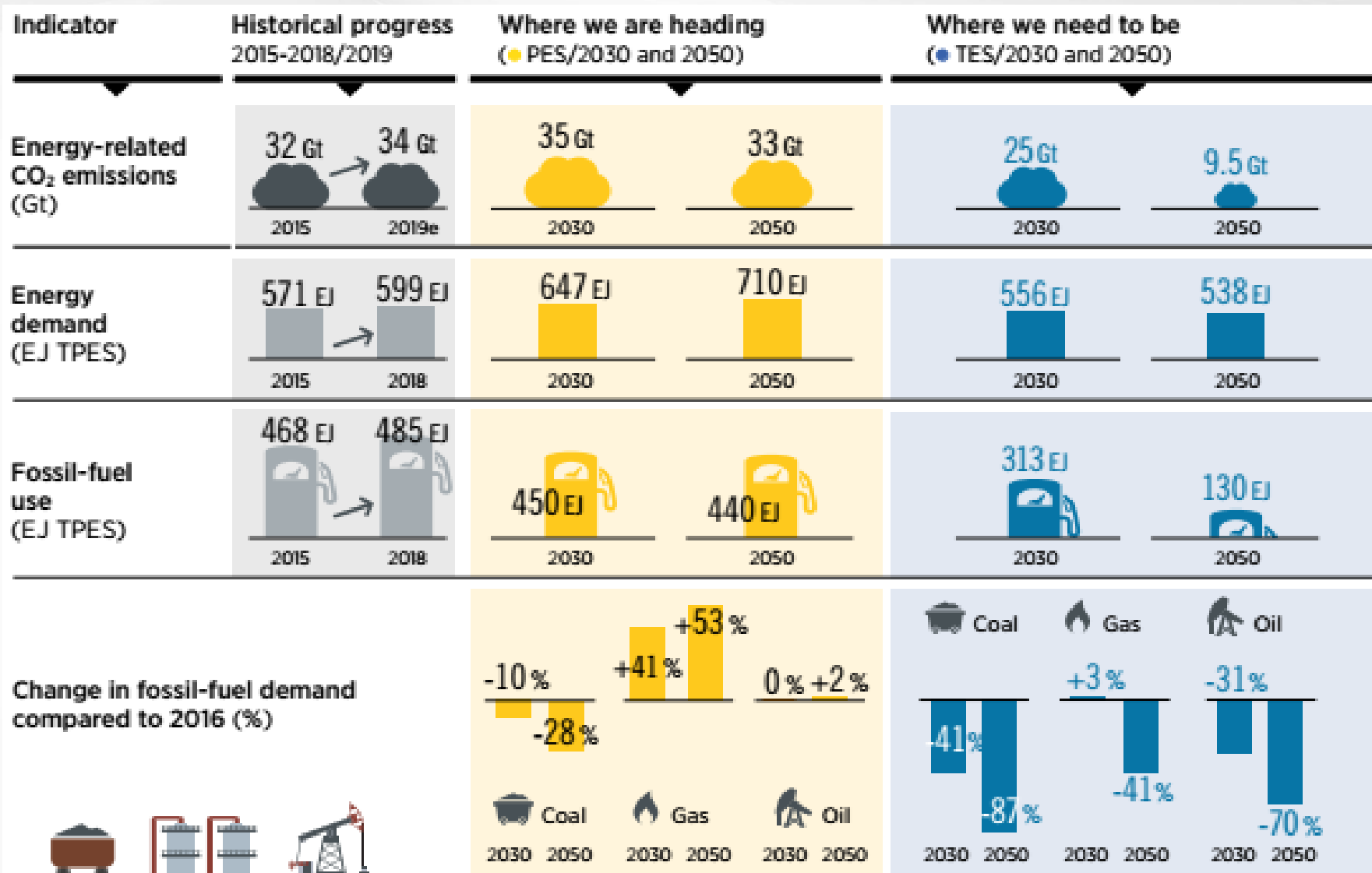
MOTIVATION FOR ENERGY TRANSITION



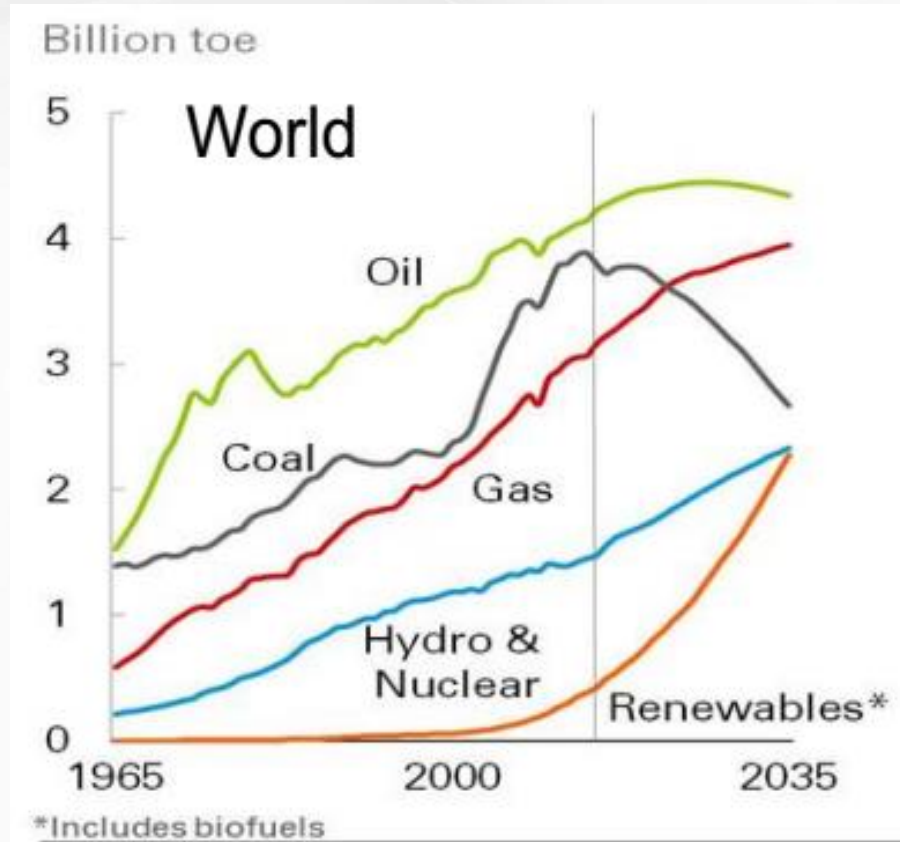
- Past transition driven by market forces, new option(s) being more convenient and economic;
- The new transition driven by environment factors, government leadership more important.



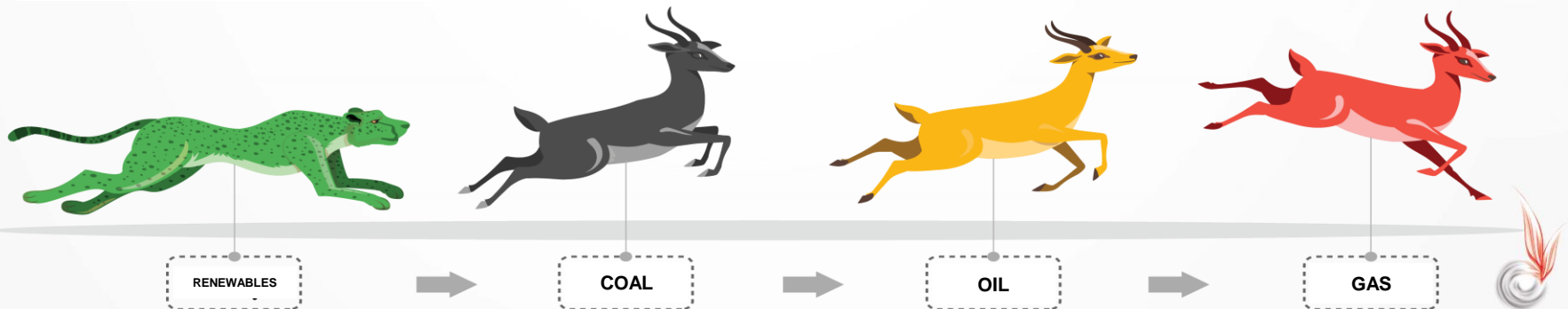
TARGET ON CO₂ REDUCTION



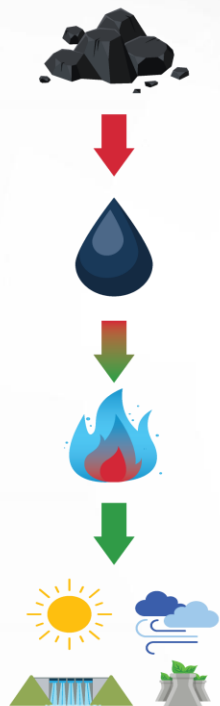
CHANGES IN THE WAY TO USE ENERGY



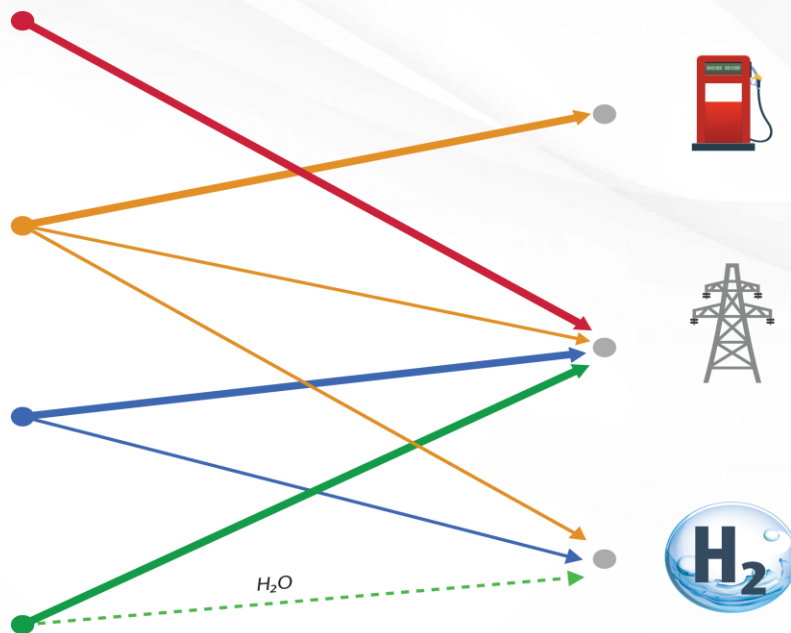
Energy transition is energy increase as all energy types increased in spite of the percentage variation.



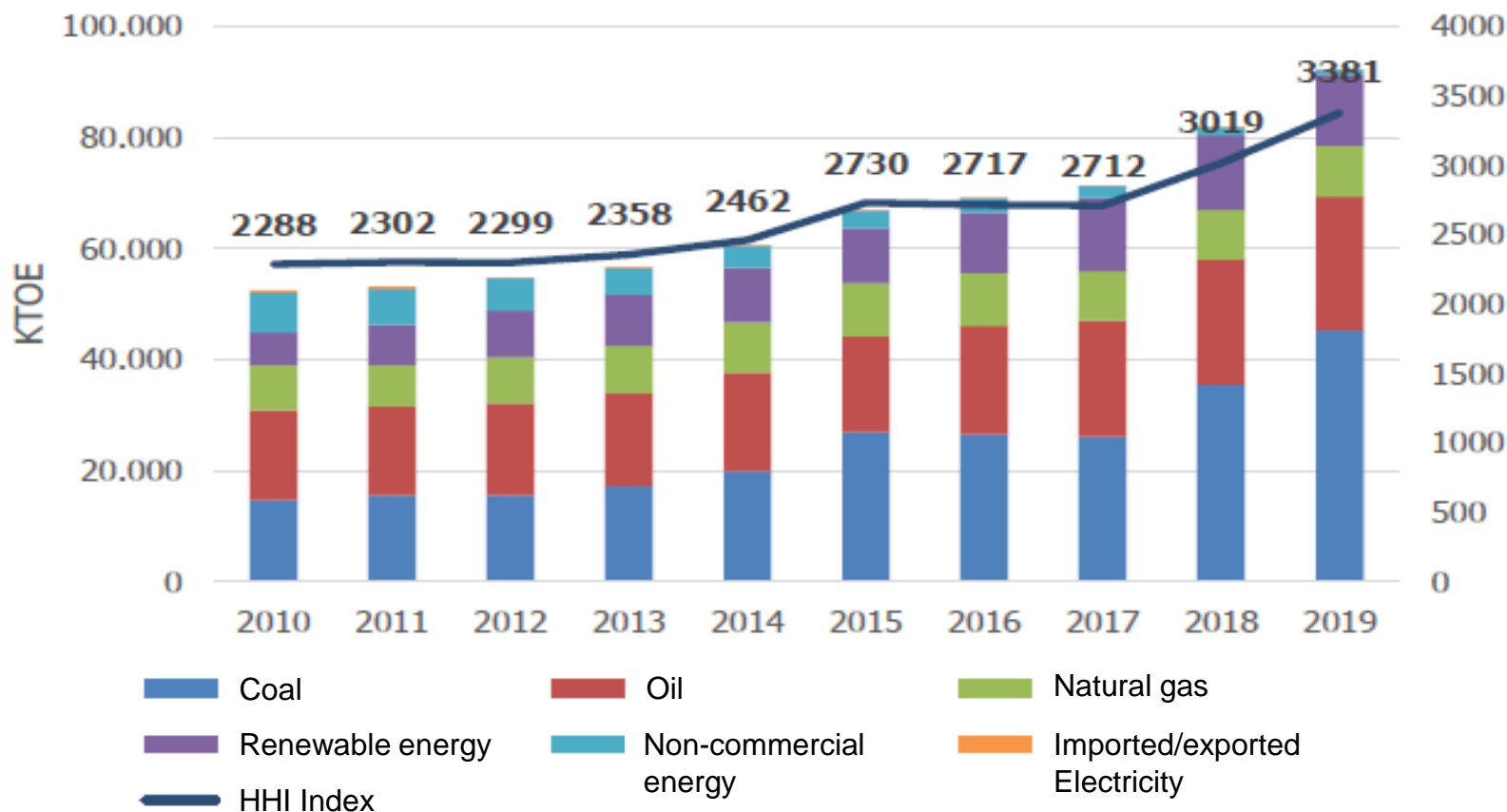
PRIMARY ENERGY



SECONDARY ENERGY



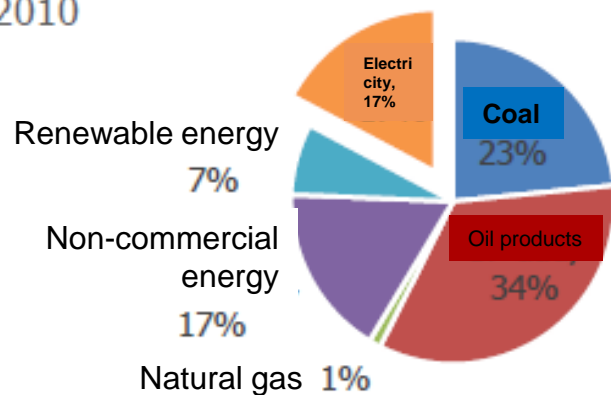
SHARE OF TOTAL PRIMARY ENERGY SUPPLY IN VIETNAM



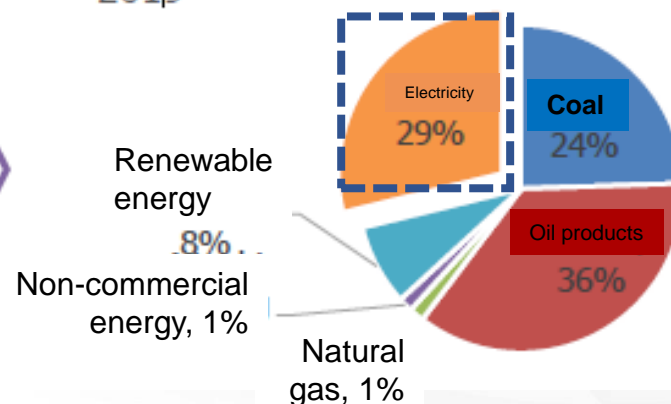
- Coal & oil as major resources of primary energy supply;
- Stable gas supply for power generation (82%) & fertilizer production (10%);
- Fast development of renewable energy.



2010

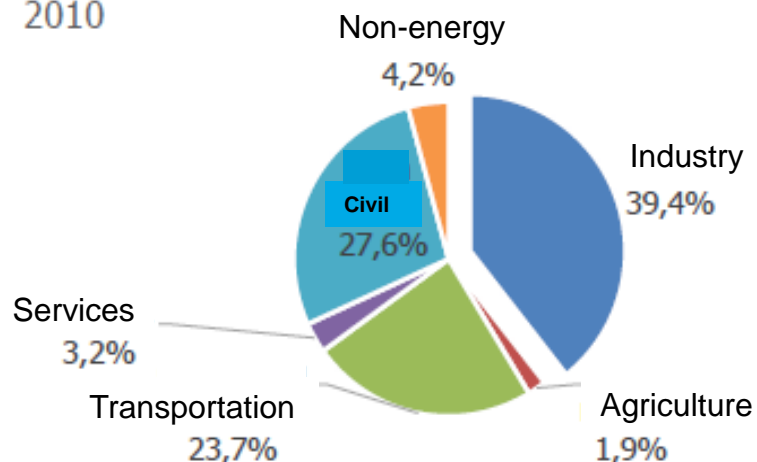


2019

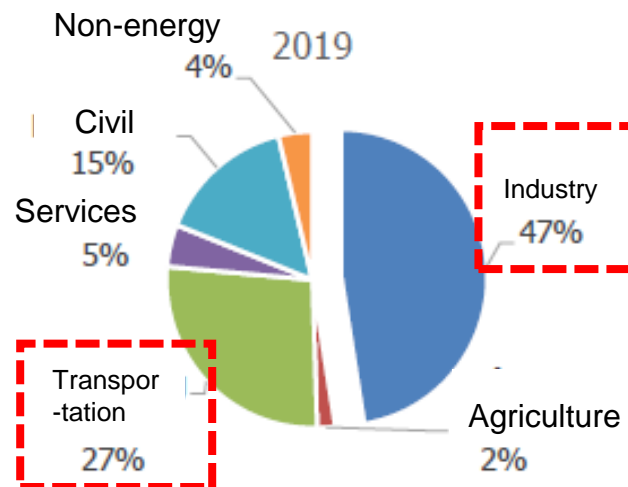


CHANGES IN ENERGY CONSUMPTION AS FUELS BETWEEN 2010 & 2019

2010

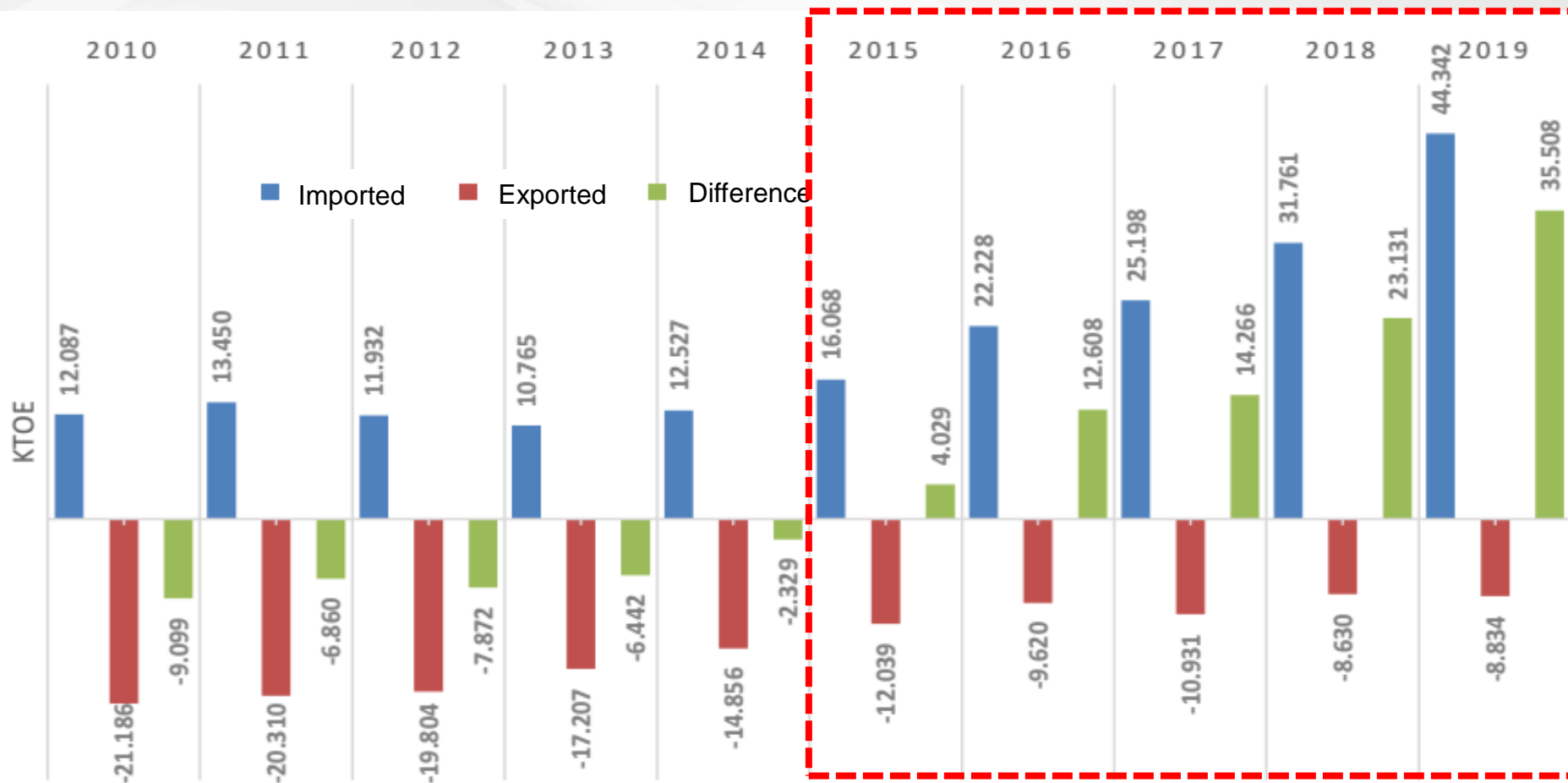


2019



CHANGES IN ENERGY CONSUMPTION IN AREAS BETWEEN 2010 & 2019





Imported & exported of energy in Vietnam



- Coal and oil are major supplies of primary energy during 2010-2019;
- Natural gas used as fuel for gas power plants and feedstock for fertilizer production;
- Fast development of renewable energy due to high potentials in renewable resources in Vietnam and government policies;
- Fast growth of electricity consumption, especially in transportation and industry sectors;
- Vietnam became an energy importing country since 2015.



- ✓ **Energy plays a key role in development of Vietnam;**
- ✓ **Energy transition has been occurring in Vietnam.**





02

PVN'S DEMAND ON HYDROGEN

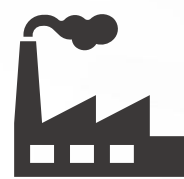




PVN

Exploration
& Production

Gas Industry

Power
GenerationRefinery -
PetrochemicalPetroleum
Services

**Exploration &
Production**



**On behalf of Government to exploit oil
& gas resources**

Gas Industry



Gas transport & distributing

Power Generation



**Power generation from coal, natural gas & hydro
100% of gas power market (18% of total capacity)**

**Refinery-
Petrochemical**



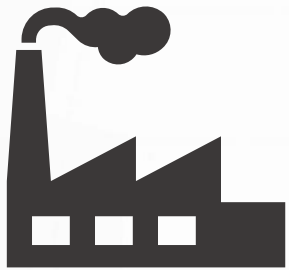
**02 Refineries + 02 Fertilizer Plants + 01 Polyester Plant
Meet 70% of fuel, 70% of urea, 20% of petrochemical demand
& Distribute 20% of fuel market**

Petroleum Services



Provide services to oil & gas activities





Refinery - Petrochemical



Dung Quat Refinery (BSR)
6.5 million tons of crude oil/year
Dung Quat, Quang Ngai



Nghi Son Refinery-Petrochemical
10 million tons of crude oil/year
Nghi Son, Thanh Hoa



Phu My Fertilizer Plant (PVFCCo)
800,000 tons of urea/year
Phu My, Ba Ria-Vung Tau



Ca Mau Fertilizer Plant (PVCFC)
800,000 tons of urea/year
Ca Mau



Dinh Vu Polyester Plant (VinaPoly)
170,000 tons of polyester fiber/year
Dinh Vu, Hai Phong



Refinery/Plant	Hydrogen uses	H ₂ capacity (ton/h)
Dung Quat Refinery (after upgrading & expansion)	Sulfur removal	0.47
Nghi Son Refinery & Petrochemical	Sulfur removal	17.43
Phu My Fertilizer Plant	Additional hydrogen required as feedstock contains 30% of CO ₂	2.05
	100% of hydrogen as feedstock	12.31
Ca Mau Fertilizer Plant	Additional hydrogen required as feedstock contains 30% of CO ₂	1.89
	100% of hydrogen as feedstock	11.33

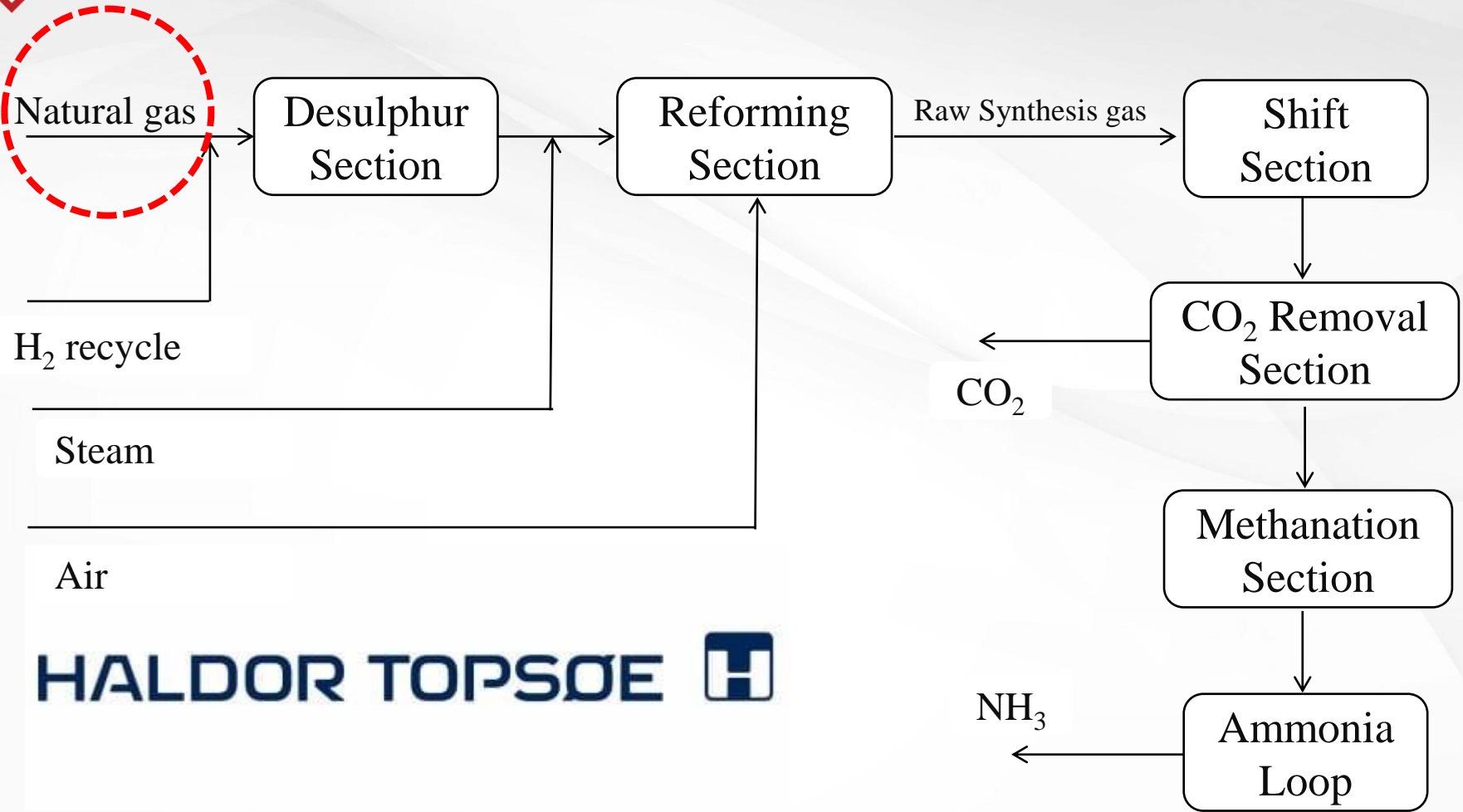




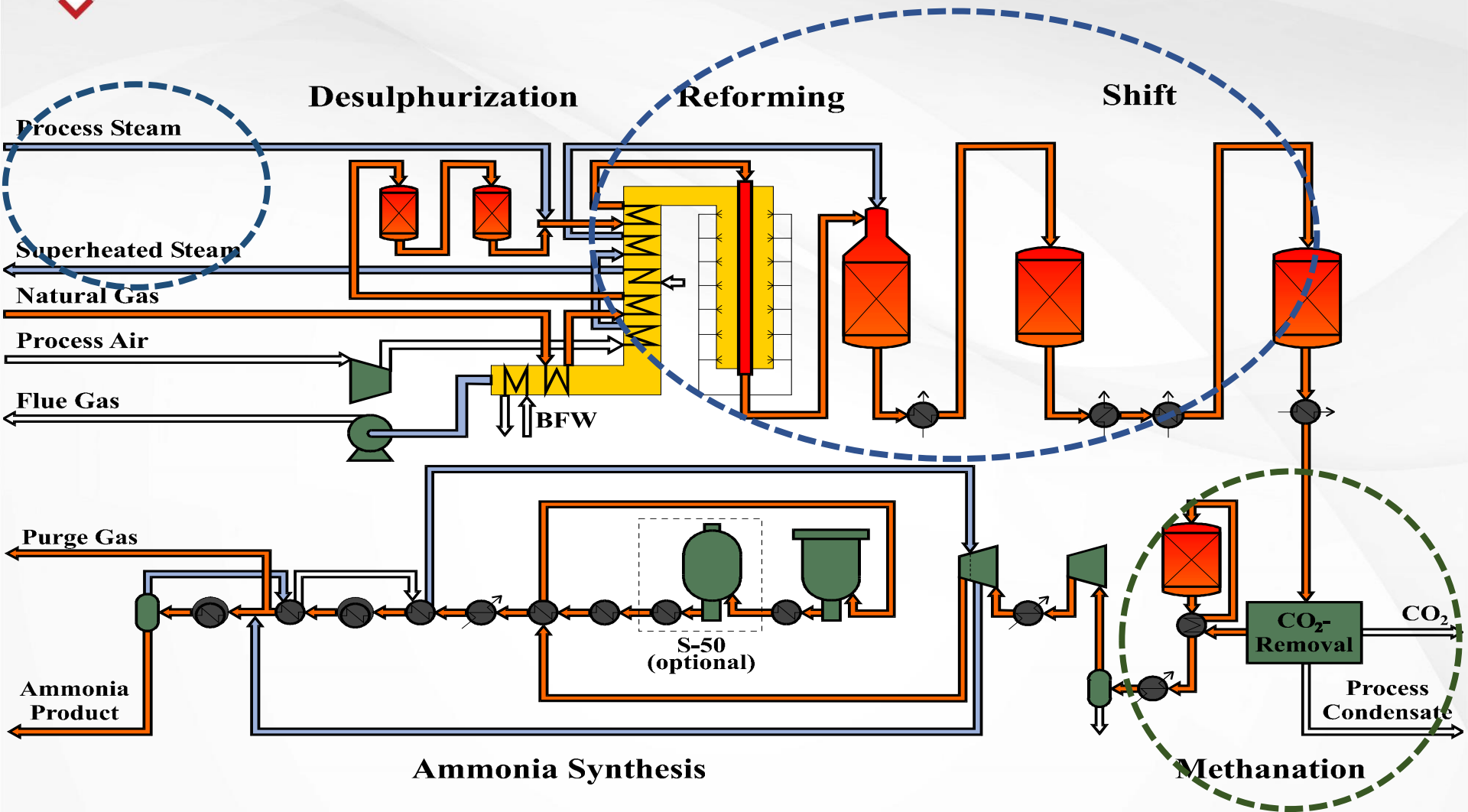
03

**CURRENT FEEDSTOCK AND
TECHNOLOGIES FOR HYDROGEN
PRODUCTION AT PVN'S PLANTS**

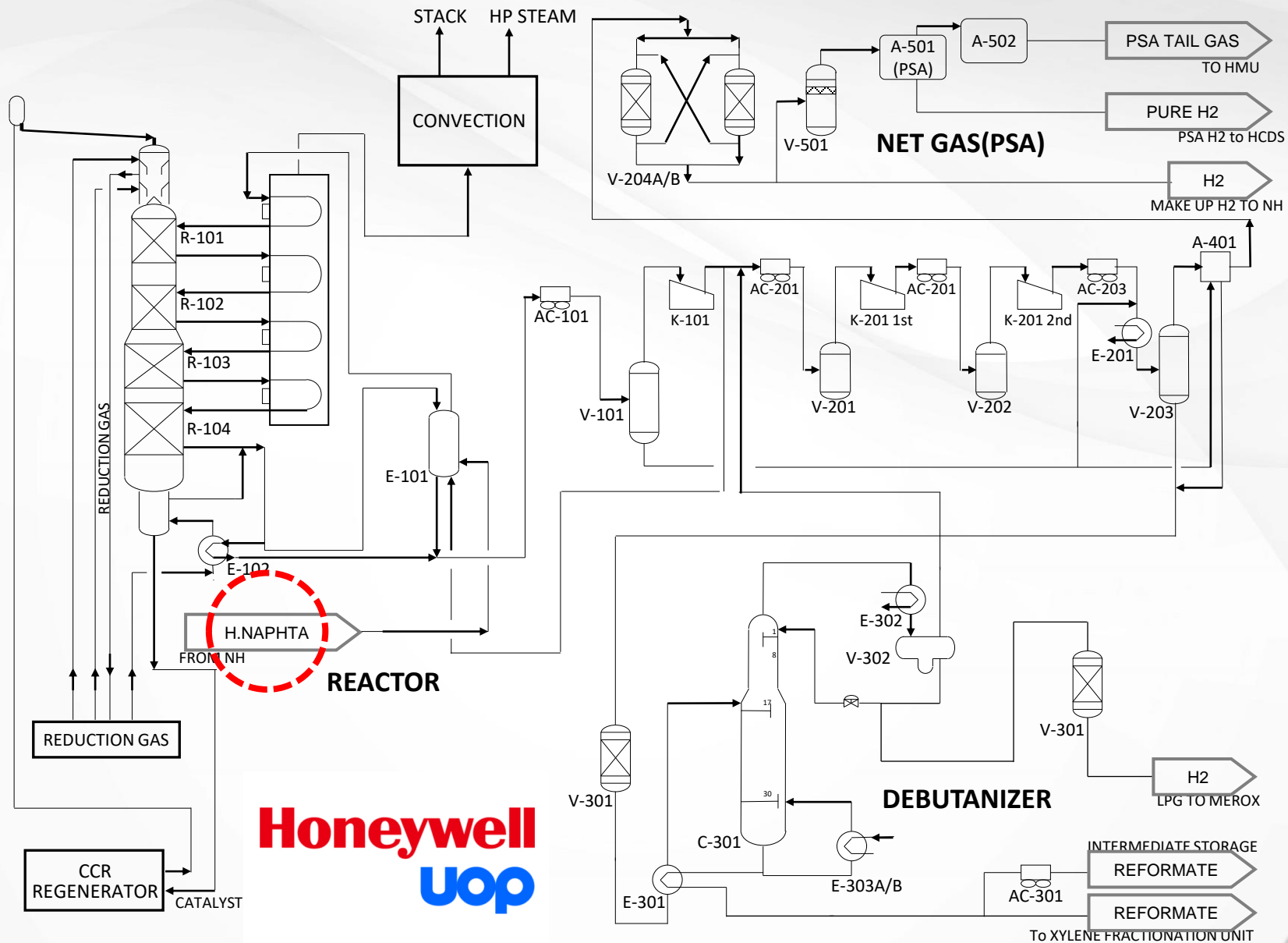




Almost 7 kg of **carbon dioxide** per 1 kg of hydrogen **produced by steam reforming**. However, due to heat losses and inefficiencies, the actual number in practice in a large **hydrogen** plant is 9.3 kg of **CO₂** produced per kg of **hydrogen production** (Robert Rapier, 2020). 1 kg of **hydrogen** is the energy equivalent of 1 gallon of gasoline, which **produces** 9.1 kg of **CO₂** when combusted.

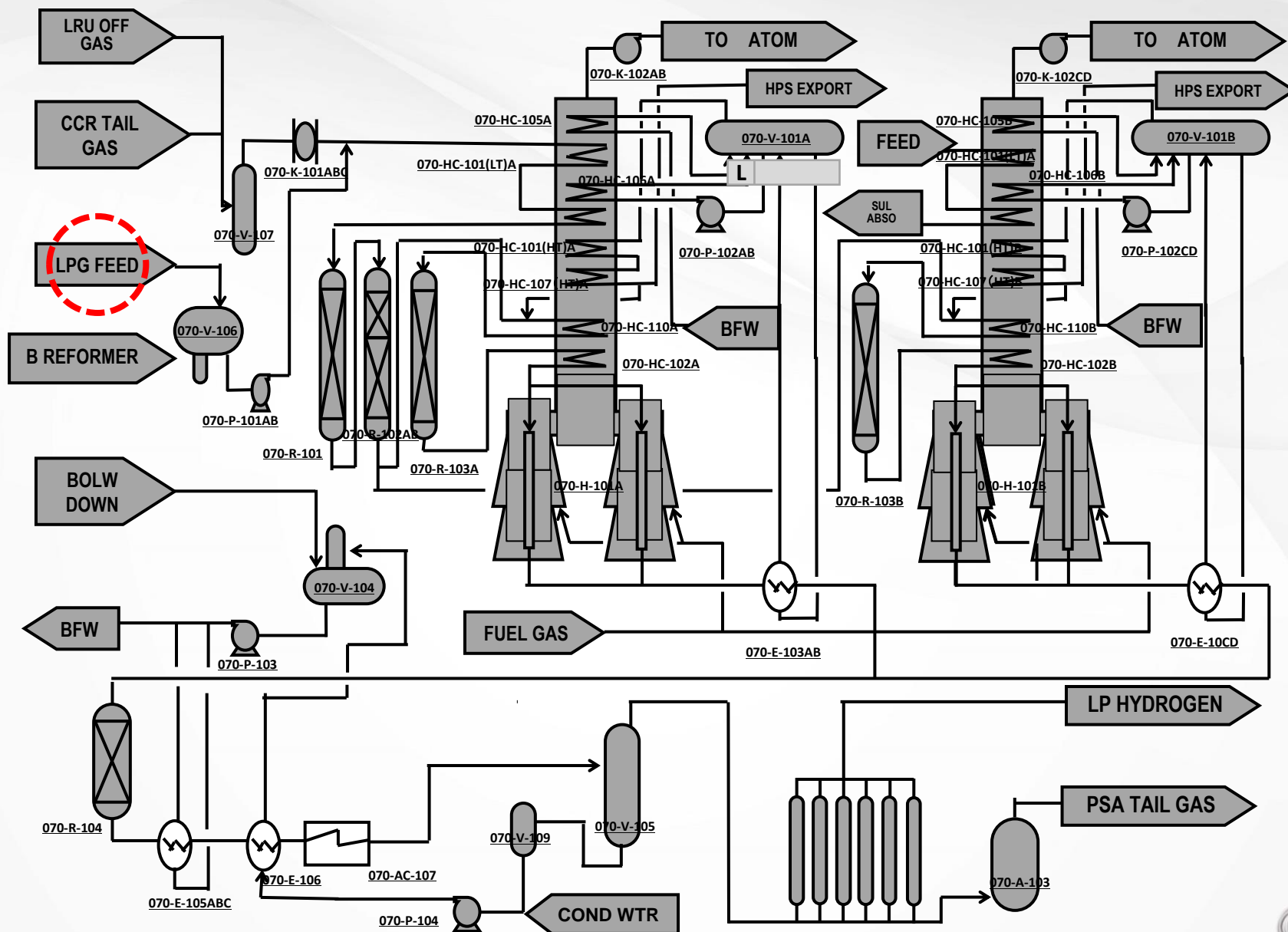


Indeed, 1 ton of urea will emit about 0.73 tons of **CO₂**, but its **carbon** footprint, derived **through** a full life-cycle analysis, will be closer to 5.15 tons **CO₂-equivalent** (CO₂e).



Honeywell
UOP





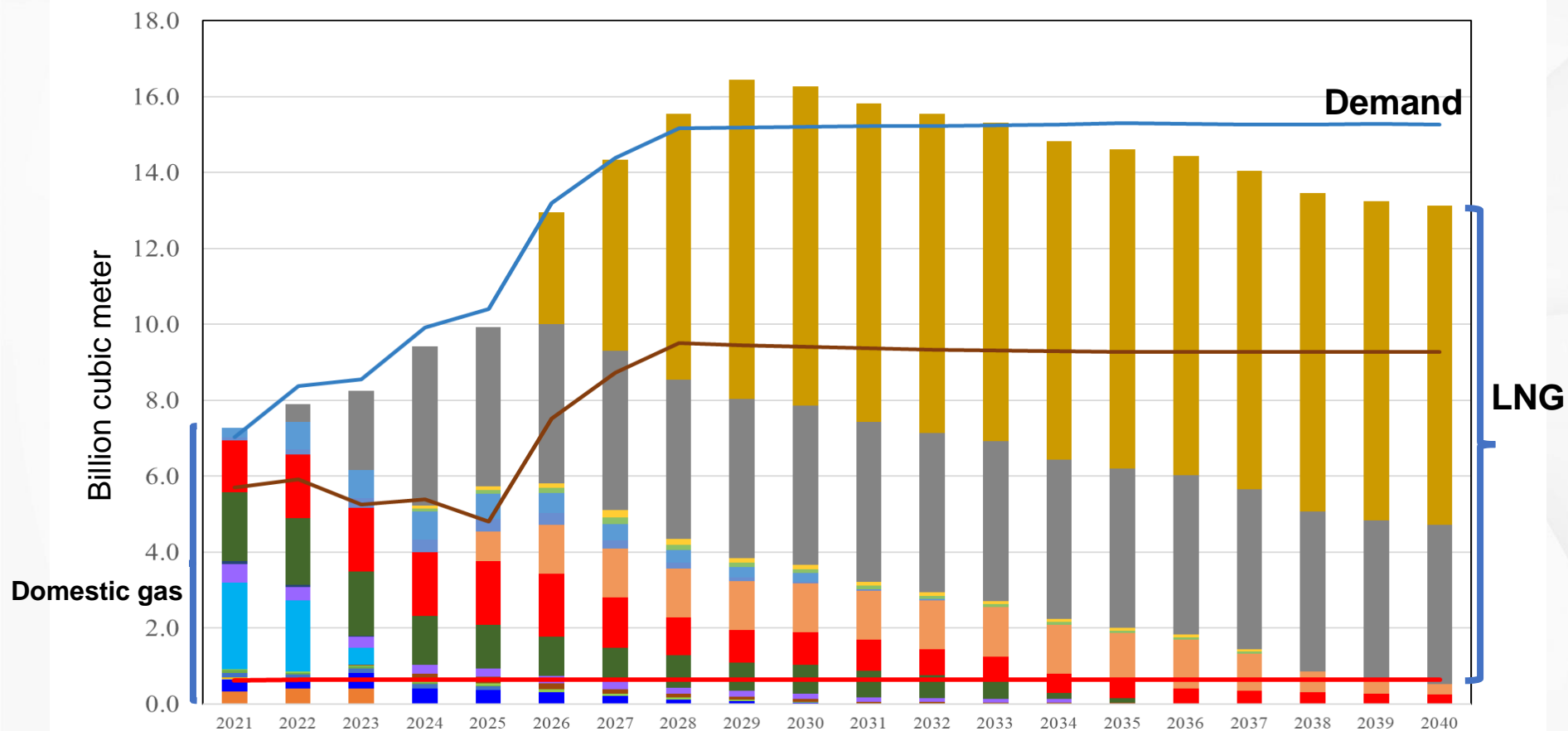


04

SUSTAINABLE DEVELOPMENT IN HYDROGEN FOR PVN

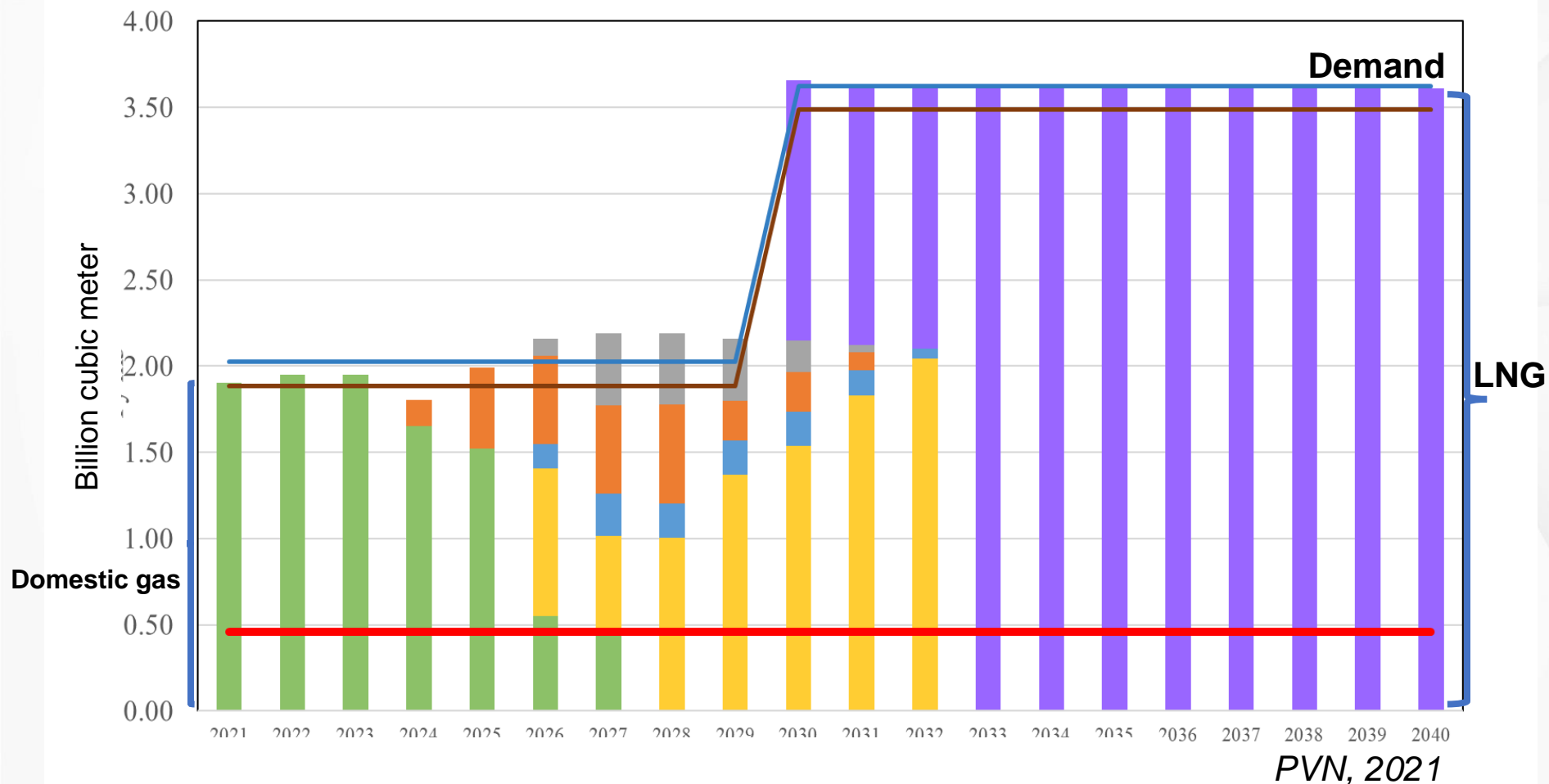


GAS SUPPLY-DEMAND FOR SOUTH-EAST REGION

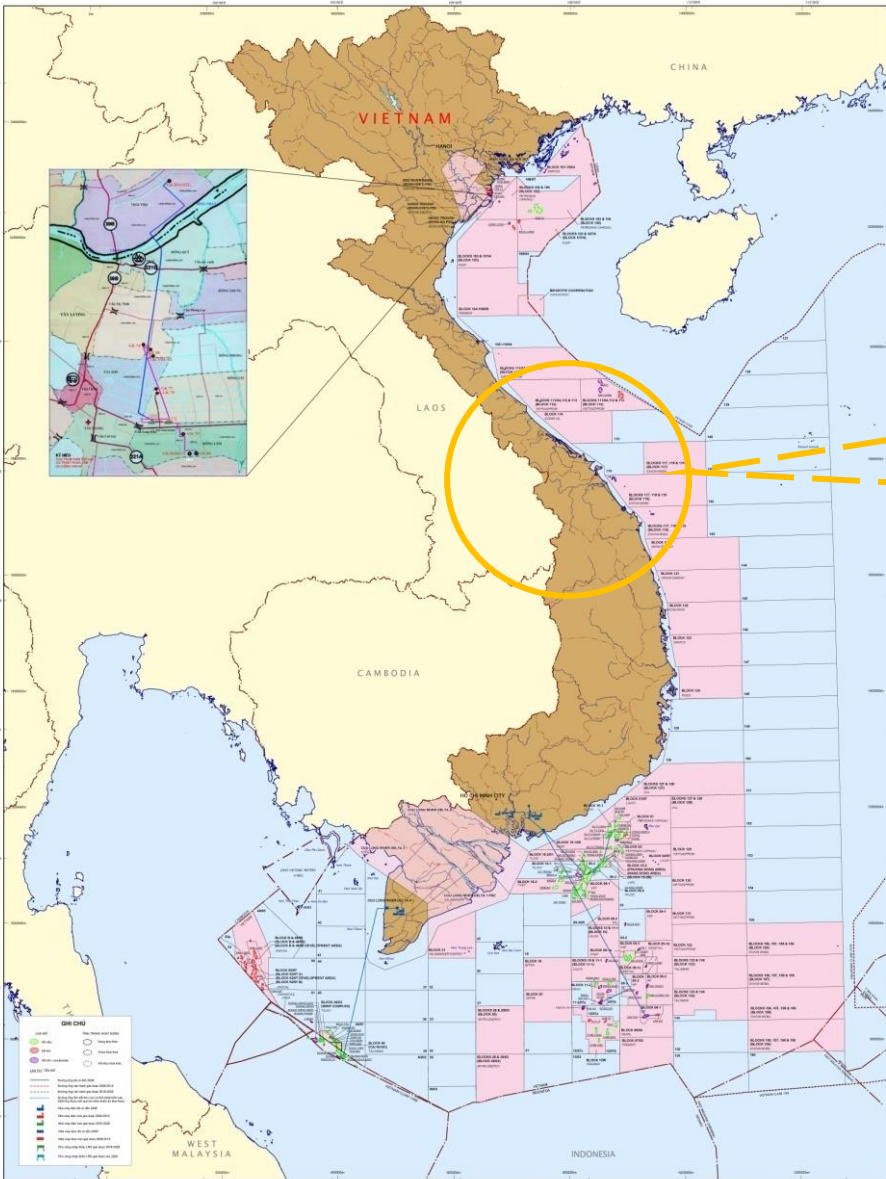


PVN, 2021

GAS SUPPLY-DEMAND FOR SOUTH-WEST REGION



CO₂-RICH NATURAL GAS RESOURCES IN VIETNAM



- Proved natural gas reserves: ~700 bcm (2017);
- CO₂-rich natural gas fields are quite popular: 10-60 mol% of CO₂.

- Gas field: Ca Voi Xanh (Block 117-119)
- First gas: 2023
- Gas output ~ 4.5 - 5.0 BCM/Y (Net HC):

Component	Composition (mol%)
N ₂	9.88
CO ₂	30.26
H ₂ S	0.21
C ₁	57.77
C ₂	0.92
C ₃	0.31
C ₄	0.18

RENEWABLE RESOURCES IN VIETNAM



SOLAR

- Potential: 35,000 MW;
- Installed: 19,400 MWp (16,500 MW).



WIND

- Potential: 510,000 MW;
- Installed: 377 MW (11 projects);
- Plan: 6,000 MW by 2030.



BIOMASS

- Potential: 6 million MW (2050);
- Installed: 10 MW from wastes, and 325 MW from biomass .



MORE ENVIRONMENTAL REGULATIONS



- EU:
 - Roadmap on reduction of CO₂ emission of 40% by 2030, 60% by 2040, and 80% by 2050;
 - CO₂ tax upto >100 USD/ton;
- Energy transition and hydrogen economy;
- Strategy on net zero carbon by 2050 by energy companies



- Demonstration on CO₂ tax up to 2027 and official requirement since 1/1/2028;
- CO₂ reduction of 8% by 2030, and 25% with further support from outside;
- For energy sector:
 - Renewables used by 15-20% by 2030, and 25-30% by 2045;
 - Emission reduction of 15% by 2030, and 20% by 2045.



PVN'S STRATEGY ON ENERGY TRANSITION

E & P

**Increased
gas
production**

GAS

**LNG &
gas
market**

POWER

**Development
of renewable
energy**

**PROCESS
-ING**

**Petrochem
-icals,
Biofuels &
H₂**

SERVICES

**Value chains
of LNG &
Offshore
wind power**

After 2030, PVN is participating in value chain of blue/green hydrogen.

- Technologies for hydrogen production, storage and transportation;
- Integration of blue/green hydrogen in PVN's refineries, petrochemical, and power plants;
- Demonstration of hydrogen value chain in Vietnam;
- Strategy and roadmap on hydrogen development.



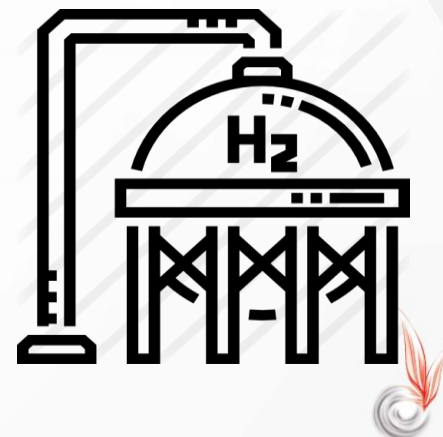


05

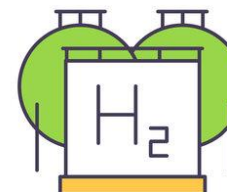
CONCLUSIONS AND RECOMMENDATIONS



- Energy transition is occurring in the world, including Vietnam;
- Hydrogen is produced and consumed at PVN's refineries and fertilizer plants;
- PVN's current hydrogen is grey, and both opportunity and challenge are existing for blue/green hydrogen development;
- PVN is establishing a strategy on energy transition and hydrogen development is one of its key targets.



- **Connection to German experts for consulting and experience sharing about strategy, roadmap and policies on hydrogen development and energy transition;**
- **Connection to German investors in the fields of hydrogen and renewable energy;**
- **Introduction of advanced technologies for hydrogen production, storage and transportation;**
- **Pilot/demonstration tests for new technologies in the real conditions of Vietnam.**





THANK YOU

