Refrigerant Usage & Management - Case Study

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OUR VISION

To be the world's most trusted seafood leader, caring for our resources to nurture generations to come

OUR MISSION

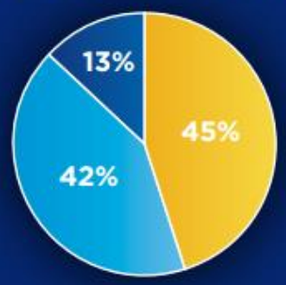
To be the seafood industry's leading agent of change, making a real positive difference to our consumers, our customers and the way the category is managed.

Thai Union's Footprint

Production Location, Innovation & R&D Center

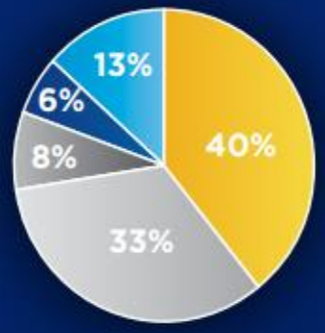
2016 NET SALES

Breakdown by Category



Ambient Seafood	Frozen, Chilled Seafood and Related Business	PetCare, Value Added and Other Business
		

Distribution by Market



USA · Thailand · Others · Europe · Japan

FISHERY SUPPLY CHAIN

Thai Union

Wild Capture

Production

Distribution

Sales

Large Scale Buyers

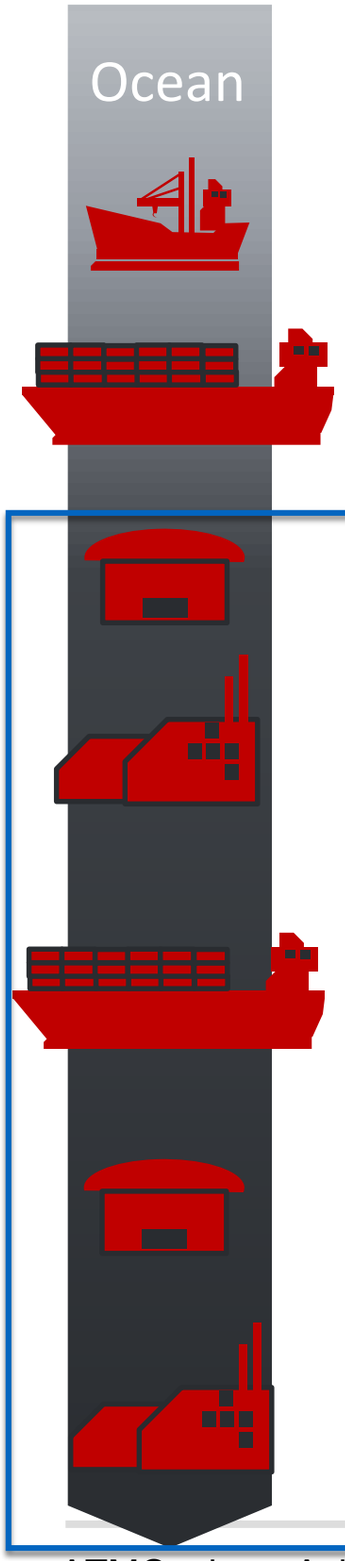
Retailers/ Restaurants

Mini Marts

Consumers

Cold Chain in Seafood Industry

#1



Fishing vessel

- Refrigeration may be required on the fishing vessels to preserve the catch between fishing locations and port

Shipping Vessels

- Refrigeration is required on the shipping vessels if tuna needs to be shipped to processing plant, if processing plant is not at the same area with fishing port

Cold Storage

- Refrigeration is required to preserve fishes while awaiting to be processed.

Primary Processing Plant

- Refrigeration is required in the processing process.

Shipping Vessels

- After primary processing plant, products may be shipped to secondary processing plant or to distribution center.
- Refrigeration is required on the shipping vessel.

Cold Storage

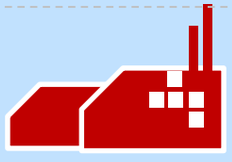
- Refrigeration is required to preserve fishes which awaiting to be distributed or processed.

Second Processing Plant

- Refrigeration may required in the processing process.

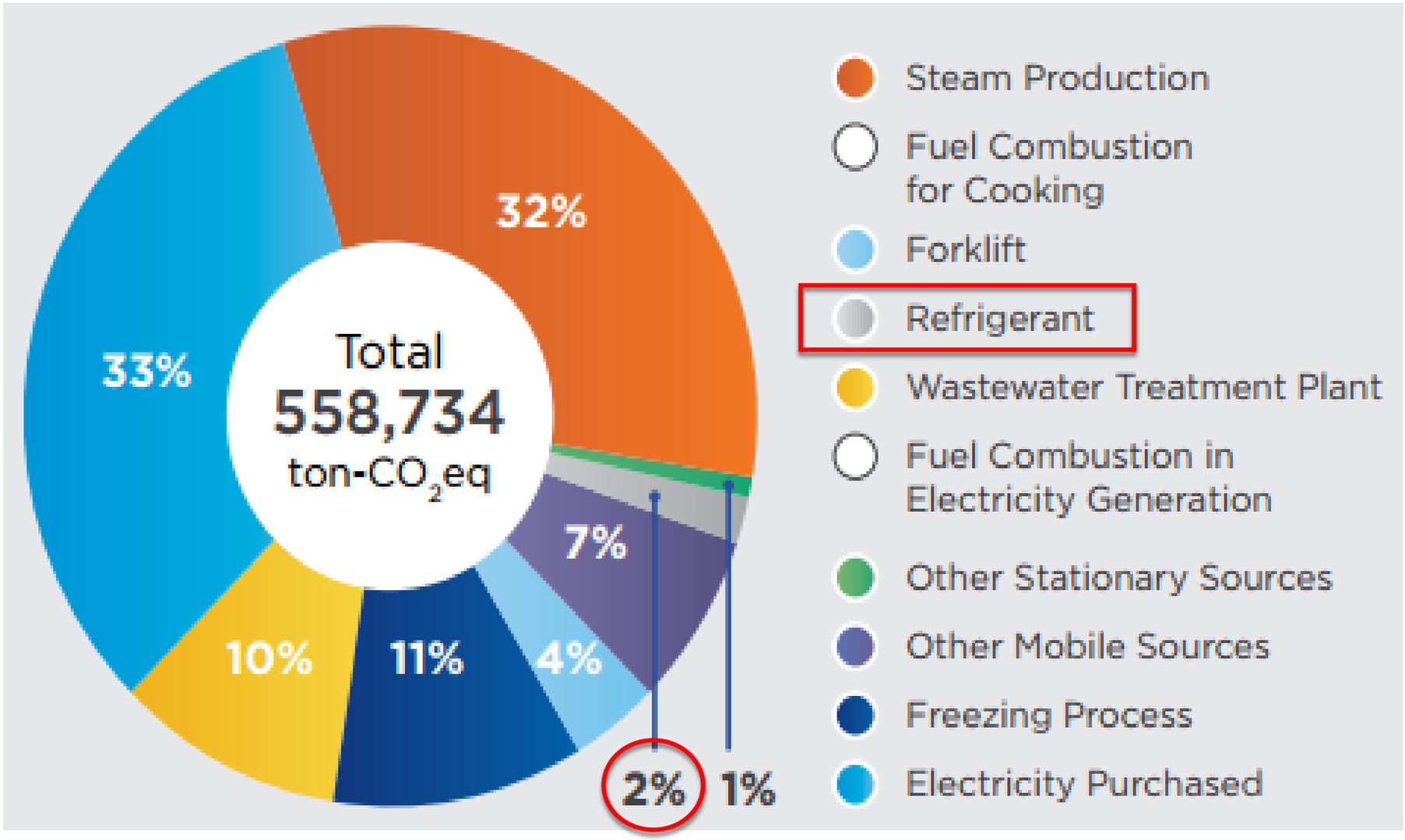
TU Scope

Example of Demands on Refrigerants

	Freon Low safety hazard High environmental hazard	Ammonia High safety hazard Low environmental hazard
 Fishing Vessels	• R22, R134a, R407a, R410A are commonly used • Minimal amount of Ammonia would be refilled during the maintenance	• Commonly used for large vessel • Minimal amount of Ammonia would be refilled during the maintenance
 Shipping Vessels	• Refrigeration system is installed for each containers. This contributes the large portion of refrigerants use on shipping vessels • Refrigeration system is also spilt type of air conditioner for crew areas • R22, R401A, R417A, R404A, R134A, HFC407A • Minimal amount of Ammonia would be refilled during the maintenance	• Not commonly used on shipping vessels
 Cold storage	• R22, R401A, R417A, R404A, R134A, HFC407A usually for split type of air condition unit in office. • Refrigerants are also used for refrigeration system of cold storage • Minimal amount of Ammonia would be refilled during the maintenance	• Commonly used for cold storage • For well maintained system without leakage, system would not have to be refilled
 Processing Plant	• R22, R401A, R417A, R404A, R134A, HFC407A usually for spilt type of air condition unit	• Commonly used for large refrigeration system in processing areas. • Due to complex controlling need, system may requires the ammonia recharging up to 1 ton of ammonia for 500 kW refrigeration system.

TU Scope

Thai Union GHG Content by Activities

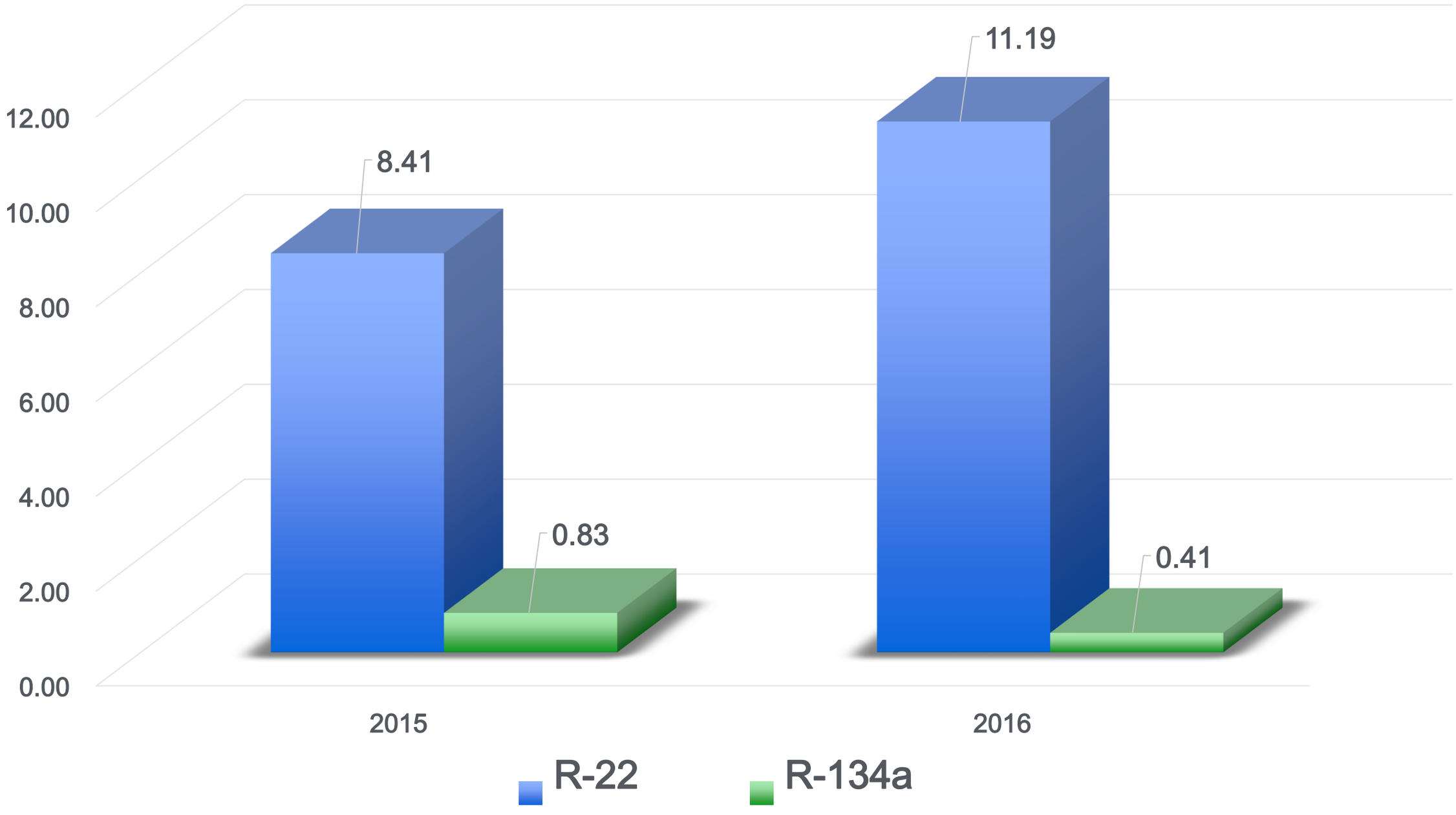


This pine chart shown that in Y2016 our refrigerant usage was estimated 2% of total GHG emission activities.

About 76% of our GHG emission came from our use of fuel. For example

- Coal and bunger oil in steam production (32%)
- Electricity Purchased (33%)
- Cryogenic Freezing Process (11%)

Thai Union Refrigerant consumption for air conditioning, refrigerator and freezer Y2015 - 2016 (Ton)



Safety Practices for Ammonia System

Ammonia Safety Hazards Identification

Ammonia Leakage

Treat (cause) → *Risk Controls* → **Top Event** → *Response Controls* → **Consequence**

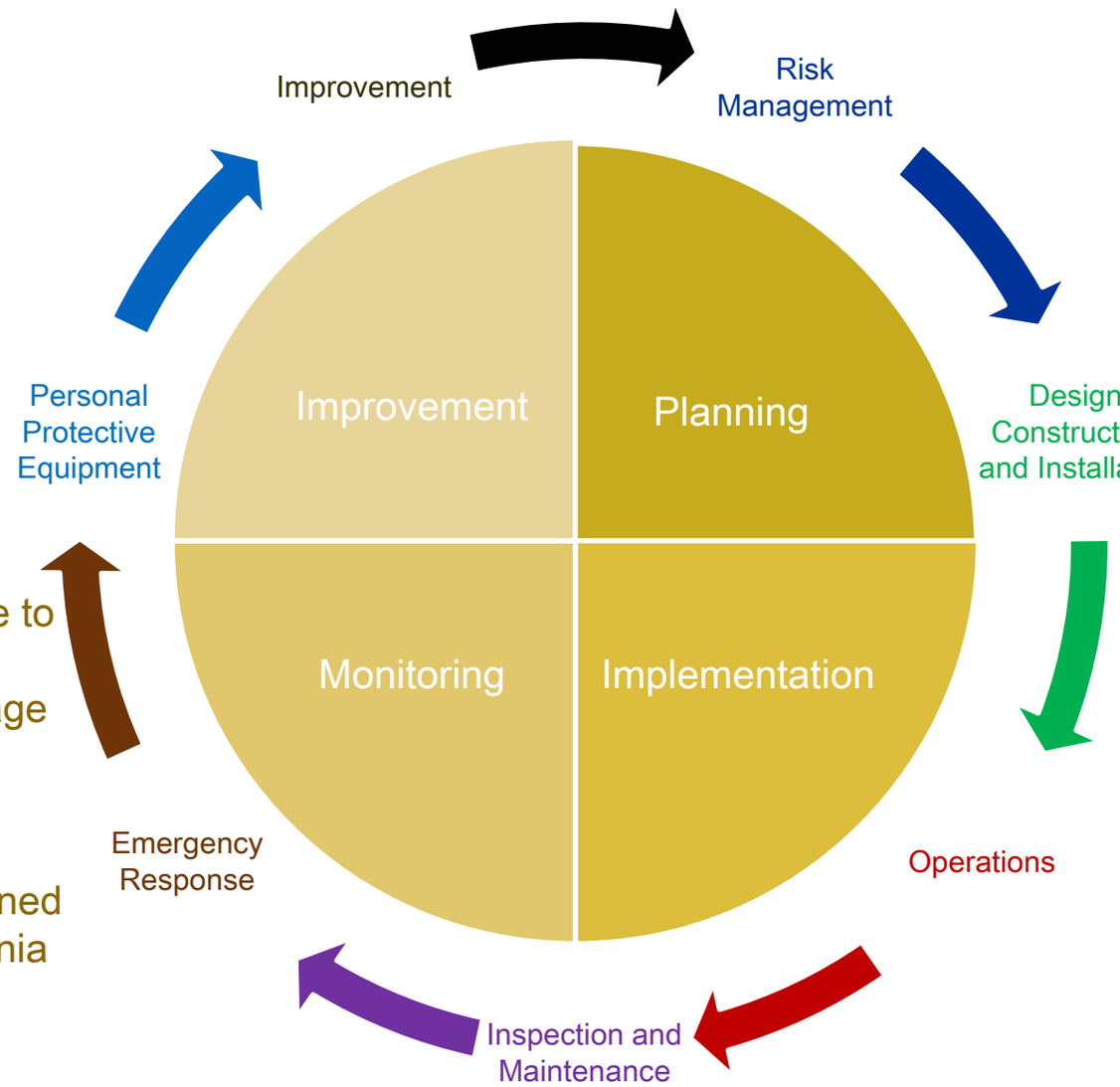
- Ammonia Stress Corrosion Cracking (Internal)
- External corrosion (non-insulated equipment)
- External corrosion (insulated equipment)
- Embrittlement of ammonia equipment/piping
- Over pressurization of system
- Damage of ammonia containers or ammonia equipment during refilling operation
- Failure of seals
- Hydraulic shock
- Mechanical impact
- Thermal expansion of ammonia leading to failure of line
- Vibration/ fatigue
- Damage to ammonia system due to external fire
- Human error while operating the ammonia system
- Failure of welds
- Release of ammonia during drainage of oil or liquids
- Release of ammonia from unused piping connection section
- Natural Disaster

- Toxic effects serious onsite injury/fatality
- Toxic effect serious offsite injury/fatality
- Fire or explosion serious injury/fatality
- Low temperature burn serious injury/fatality
- Adverse impact to the environment

Safety Management for Ammonia

- ✓Management Review
- ✓Non-Conformance Handling and Corrective Action Management

- ✓Personal Protective Equipment (PPE) Management to ensure proper PPEs are distributed to employees according to the exposed risks



- ✓Hazard Identification (HAZID)
- ✓Management of change procedure

- ✓Qualified designer
- ✓Material selection and design in accordance to ANSI/IIAR2, ANSI/ASHRAE 15, EN378 standards
- ✓Over pressurization of System ASME Section VIII
- ✓Qualified contractor to install the system
- ✓Non destructive testing after installation

- ✓Emergency response in accordance to OSHA CFR 1910.38
- ✓Drill and training on Ammonia leakage response, taken regularly
- ✓Leak scenario assessment
- ✓Emergency response equipment in place (e.g. gas detector, self-contained breathing apparatus- SCBA, ammonia protection suit)

- ✓Qualified operator and restricted access to ammonia area
- ✓Hourly, shiftily monitoring (e.g. performance, pressure) and visual inspection
- ✓Operator health medical surveillance
- ✓Safe operating procedure available (e.g. ammonia recharging, draining oil or liquid)
- ✓Work permit for abnormal work and hazardous work
- ✓Ignition source control

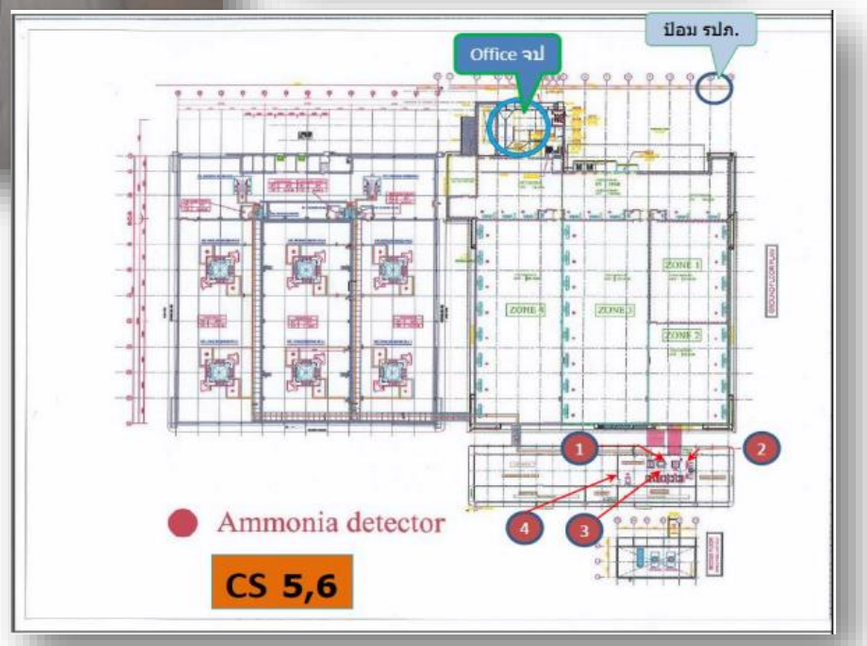
- ✓Annual safety inspection
- ✓Periodically non destructive testing after installation (e.g. receiver thank, pipeline)
- ✓Maintenance, overhaul, replacement of equipment per operating hours as manufacturer's instruction
- ✓Maintenance and repair procedure available
- ✓Qualified constructor for maintenance or repair

Best Practices for Ammonia Leakage Control

- ✓Emergency response in accordance to OSHA CFR 1910.38
- ✓Drill and training on Ammonia leakage response, taken regularly
- ✓Leak scenario assessment
- ✓Emergency response equipment in place (e.g. gas detector, self-contained breathing apparatus- SCBA, ammonia protection suit)

Best Practices for Ammonia Leakage Control

- ✓Gas detectors installed where there is leakage potential assessment
- ✓Signal from gas detection is monitored and/or activated the alarm to initiate the emergency response
- ✓Gas detectors are calibrated at least annual basis to ensure its accuracy



Greenhouse Gases Management at Thai Union

TU Environmental & GHG Reduction Target in Y2020

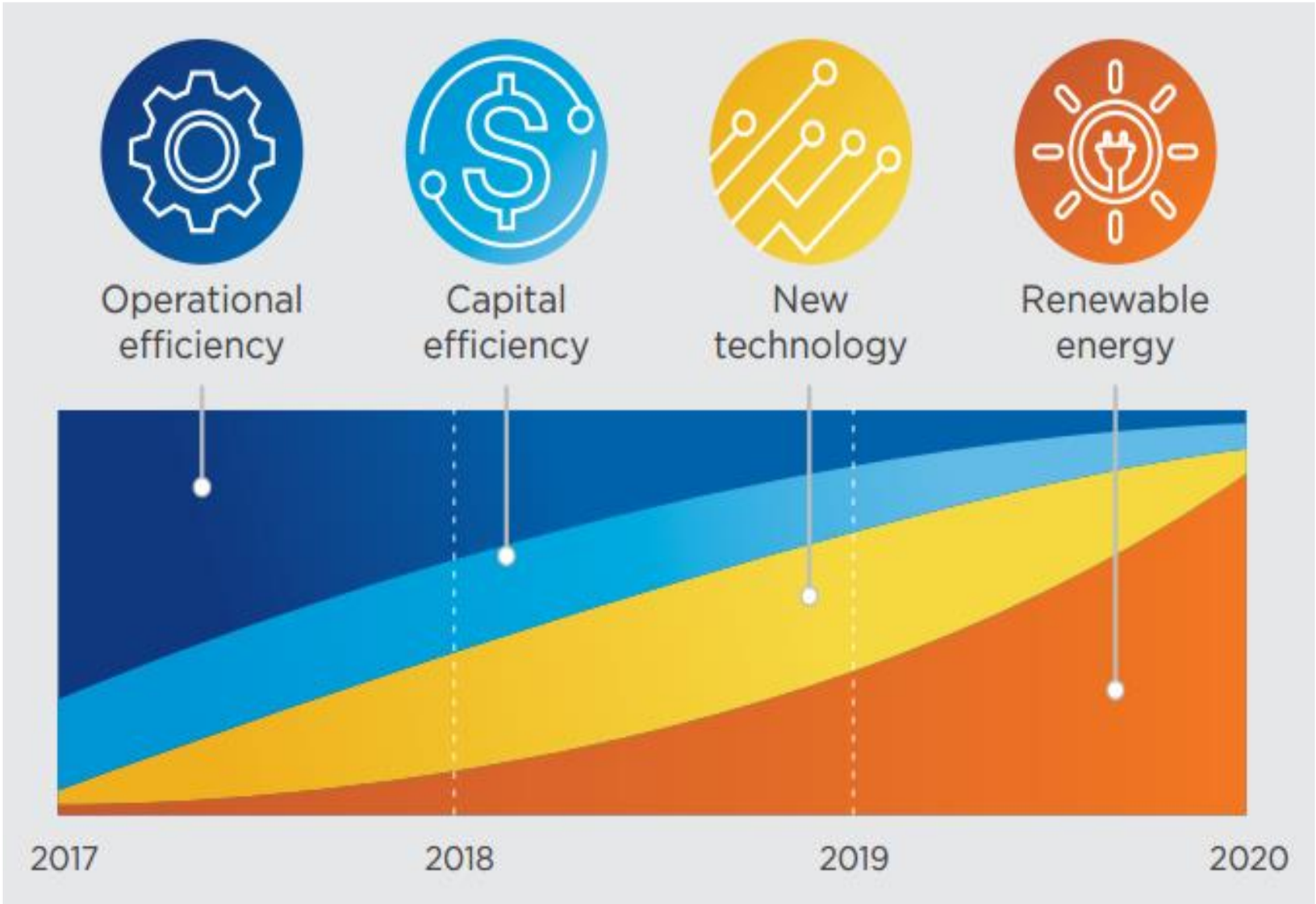
GHG (Ton CO_2 eq / Ton FG)	30%
Water Consumption (m3 / Ton FG)	20%
Waste to Landfill (Kg / Ton FG)	20%

Remark: 1.GHG Reduction include Scope 1 (direct emission), scope 2 (purchased energy & electrical) and scope 3 (packaging, water, waste etc.). In the beginning (first 1-3 year), we will focus on scope 1 and 2, then scope 3.
2. Reduction Target against 2016 base line.

TU GHG Strategy with 6 Modules

To reduce energy consumption in our business operations, Thai Union established an assessment program in 2016 that studied the top five opportunities for reducing greenhouse gas (GHG) emissions and developed relevant action plans. The assessment program summarizes how we will execute our GHG strategy. There are six modules in our GHG strategy.

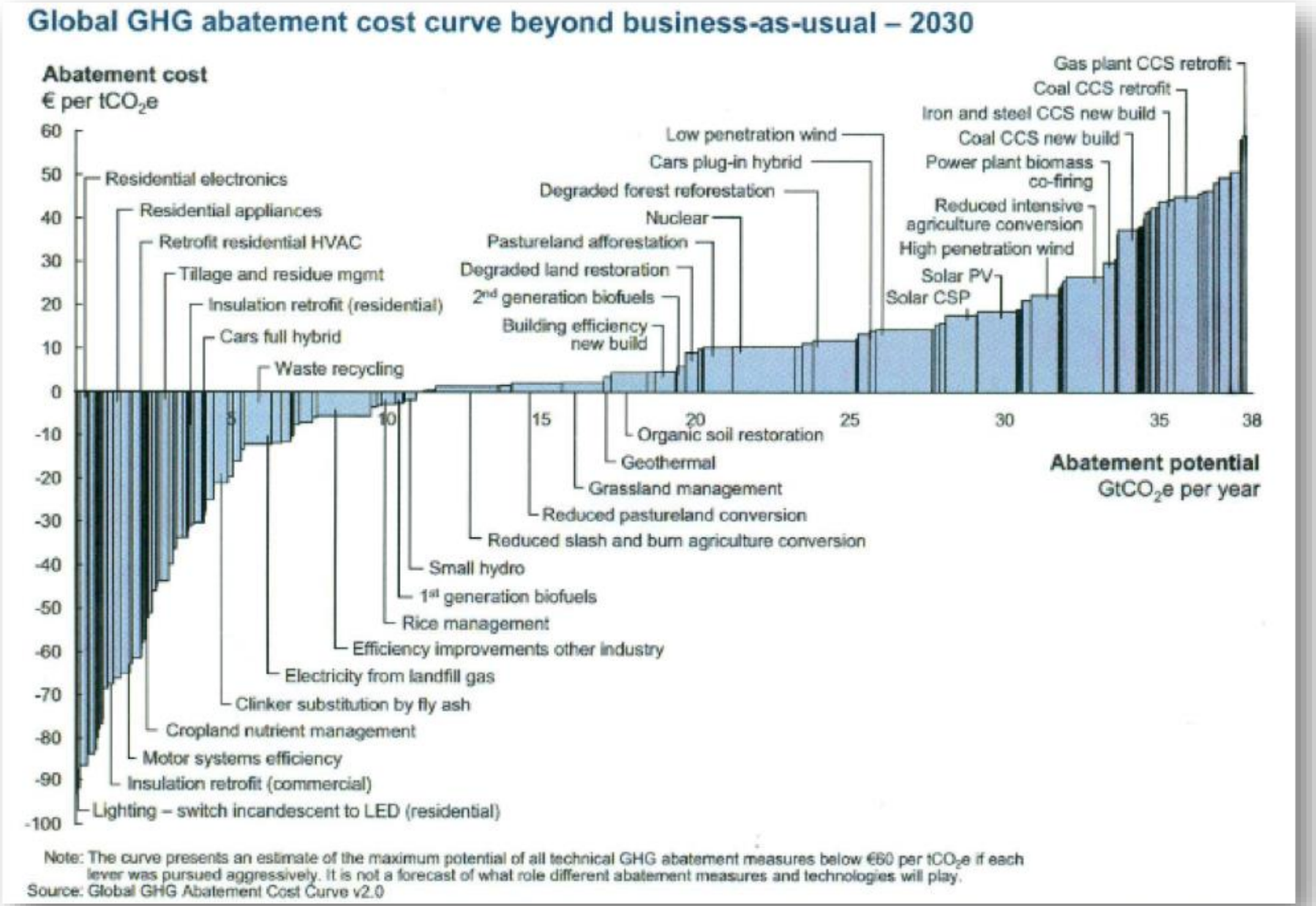
TU Sustainable Energy Generation Approach



Thai Union saves energy through four main initiatives:

1) Improving operational efficiency in our production lines;
2) Investing in more efficient equipment and processes;
3) Developing and deploying innovations or new technologies; and
4) Promoting renewable energy.

TU utilized Marginal Abatement Cost Curve (MACC) tool to prioritize GHG reduction projects



The chart provides an example of a MAC curve, generated by the tool, to support achievement of emission reduction targets for a portfolio of food retailing operations.

GHG Activities and Moving Forward

ISO14064 GHG Management Training on 20-24 Feb 17

Thailand V-ETS at TUF & TUM

Implementation Sun Seeker Project at TUF (Cold Storage 5, 6)

Promote and support LESS & TVER programs

Best Environmental Performance Awards

- Scope 3 GHG accounting
- CDP full engagement
- Climate risk and opportunity analysis
- Continue implement GHG reduction projects
- Green funding programs

0.81 → **0.57**

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 2018 2019 2020

Thai Union Signed T-VETS MOU

- Attended Thailand Voluntary Emission Reduction (TVER) survey at SCC
- Solar Seeker Project Feasibility Studied for TFM, APC, SCC, TUS and IOT
- Signed Contract for Solar Seeker Project at TUF

May – Oct GHG Mitigation Program for site TUF, TUM and IOT

SEC Meeting with TGO

CDP

enablon

- Carbon Disclosure Project (CDP) application
- Roll out and training on EHS reporting web base (Enablon)
- Implementation on GHG reduction projects
- GHG Management Manual
- EHS data verification by third party
- Green funding programs

TVETS Audit at TUF & TUM

Q1 - Communicated group envi. goals and targets for THA sites

Engage with UN for Sustainability Management of Refrigeration Technologies

Thailand V-ETS Meeting #1 – Food & Beverage Industries

ATMO sphere ASIA

Thank you very much!