



# Introduction of Alternative Refrigerant in the Thailand Air Conditioning Sector

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# Thailand AC Sector – Introduction of R-32

## Outline

- Thailand's air-conditioning (AC) sector in context
- Choice of alternative refrigerant to R-22
- Issues encountered in converting to non-HCFC technology
- Thailand's experience and results in summary

# Thailand's AC Sector in Context

- 2<sup>nd</sup> largest residential AC manufacturing base in E. Asia and major export hub: ~ 10 million units/yr (10% for local market) made of multinationals + 14 Thai companies.
- Market somewhat segmented with local companies focused on the domestic and lower-end markets, as well as larger units.
- At project baseline (2012):
  - Sector dominated by HCFC-22 based manufacturing, growth at 7%
  - To meet obligations to the Montreal Protocol of 10% reductions from the baseline, Thailand needed to eliminate 8,800 tons of HCFCs
  - 43% of Thailand's HCFC consumption went towards refrigeration and AC manufacturing.
  - Critical to address AC sector to slow R-22 demand in manufacturing and downstream servicing.
  - AC sector has the technology to convert if necessary: R410A
- Project funding considerations – refrigerant technology has to be lower in GWP...

# Choice of Alternative Refrigerant

- Alternative refrigerant technology other than R-410A is new – not tested nor used in developed countries.
- Considerations in decision by potential beneficiaries (Thai-owned enterprises): R-290 vs. R-32
  - R-290 - Highly flammable, despite voluntary handling standard industry is wary; high costs in safety measures and training (aftersales)
  - R-32 - Mildly flammable; major manufacturer is developing and testing the technology, moderate costs in safety measures but aftersales training costs also high
- Concerns centered primarily on safety and standards, technology access, market acceptability and competitors, and size of typical AC manufactured.
- Industry prefers R-32 after weighing pros/cons and benefits/risks of the two but enterprises need convincing that this technology is compatible with the realities of the current market...

# Issues Encountered

## Technology and the Market

- **Market acceptability** is a concern given issues of flammability and costs. Tackled on several fronts: Create confidence and scale through involvement of a major player while assuring small enterprises they will not be shut out of the market, and may gain. Together this can overcome the R-410A bias.
  - Dialogue with main R-32 AC manufacturer (Daikin) leads to agreement that it too will launch R-32 AC in the market.
  - Dialogue with Thai industry leads to 6 interested companies (out of 14) that see some markets (EU) will close if they go to R-410A.
- **Availability of the technology** is not clear as R-32 technology is patented... Daikin had already agreed to provide developing country industry free access to 93 basic application patents as a means to encourage commercialization for HFC-32 based AC. In addition, other multinationals in Thailand not willing to pay for R-32 technology and prepared to aggressively promote 410A in Thailand.

# Issues Encountered

## IPR and Technology Transfer

- Thai industry remains reluctant as access to technology is not necessarily access to know-how. Although technology choice has been made and is provided by Daikin, there is still the “doing” left which requires intensive efforts and guidance.
  - WBG-Daikin organize a factory visit in Japan for the industry on equipment installation and safety measures
  - Multiple consultations organized with the 14 companies, within the association (Thai AC Club) and bilaterally
- A deal on applying the technology is reached:
  - Daikin agrees to also provide tailored support to participating companies to improve AC quality (“clean-dry-tight” manufacturing approach) during project implementation
  - In return more reliable, quality R-32 AC market is assured in order to build confidence in the product and demand as this is new, high-profile – high risk for market acceptability
- Remaining issues:
  - Thai industry requires one last assurance – *when* will Daikin market R-32 AC in Thailand. Agreement on 2015 is reached after consultations and more study leading to more enterprises joining the project
  - Opposition by other multinational AC manufacturers in Thailand: It is believed that Japanese Gov. pressure to accept R-32 technology convinced other Japanese co. as this aligns with Japanese domestic policy on high GWP gases; Thai policy needed.

# Issues Encountered

## Standards and Safety

- Restrictions on the use of flammable refrigerant in AC in high-rise buildings – would this apply to R-32? Regulatory agencies needed clarity....
  - Thailand Council of Engineers, based on request from the NOU (DIW), confirms that HFC-32 is not considered a highly flammable substance.
  - DIW commissions independent safety assessment of HFC-32 in AC. Conclusion: HFC-32 can be safely used in a split-type with cooling capacity not over 53,500 Btu/hr (15.75kW) provided the inside unit is wall-mounted.
  - WBG reviews ISO-5149-2014 which recommends a max. refrigerant charge size for A2L (mildly flammable) and A3 (highly flammable) refrigerants based on building occupancy category and equipment location. Slide deck is prepared for discussion on revising building code.
  - WBG shares experiences of other countries on dealing with HFC-32 refrigerant – primarily Japan's research: risk assessment studies on HFC-32 carried out by the Japan Refrigeration and Air-Conditioning Industry Association (JRAIA).
- Based on tests and evidence, Department of Public Works and Town Country Planning has decided to modify regulation to allow installation of split-type AC with capacity up to 53,500 Btu/hr in high-rises.

# Issues Encountered

## Component Availability and Supply

- Design of refrigerant pathway required a new compressor
- One rotary compressor manufacturer supplying the market for all types of refrigerant compressors in the most popular size range. But for larger TR units (about 10% of the market and belonging to the Thai industry) there was a gap.
- Critical mass and coordinated efforts were needed to convince supplier to produce the R-32 compressor in larger size range – but this was not evident to private sector players who tend to go it alone (competition)



# Thailand's Experience and Results

- Identification and isolation of the challenge or hurdle
- Systematically addressing the challenge (step by step) while consulting stakeholders all along
- Building consensus among stakeholders by singling out the bottom line/interest of each
- Fostering confidence of policy-makers in new technology through information, particularly that from developed countries

## Results

- 2015: R-32 based AC introduced in Thailand by multinationals.
- 2016: 3 Thai AC manufacturers introduce R-32 AC; 30,000 units sold.
- July 1, 2017 ban of < 50,000 Btu R-22 AC manufacturing for domestic market.
- Performance of R-32 AC is better than / similar to R-22 & R-410 units.
- AC Club of the Federation of Thai Industries is a stronger collective, better able to meet evolving market demands as a unified front.
- Lab capacity to safely test R-32 prototypes for certification established.
- Lessons on the importance of guaranteeing compressor supply led to a Canadian grant to assist a Thailand reciprocating compressor manufacturer to develop R-32 based compressors; K-CEP

