

Introduction of Alternative Refrigerant in the Thailand Air Conditioning Sector

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Outline

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

Thailand's AC Sector in Context

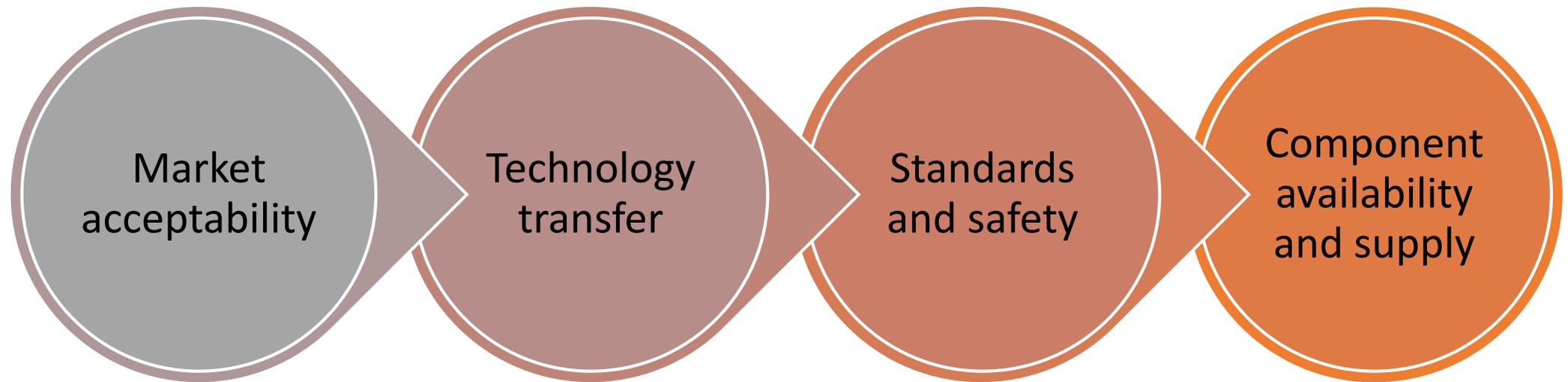
- 2nd largest residential AC manufacturing base in E. Asia and major export hub
 - ~10+ million unit/yr (10% for local market)
 - Multinationals + local companies
 - Local companies focuses on domestic and lower-end markets, as well as larger units
- HCFC baseline (2012)
 - To meet 10% reductions, needed to eliminate 8,800 tons of HCFCs
 - HCFC-22 based manufacturing dominated with 7% growth
 - Critical to address AC sector to slow R-22 demand in manufacturing and servicing
- Choice of alternative refrigerant
 - Mainstream refrigerants in developed countries: R-410A
 - Refrigerant technology has to be lower in GWP

Choice of Alternative Refrigerant

- Alternative refrigerant technology beside R-410A was new – not tested or used in developed countries
- Choices being considered by potential beneficiaries (Thai-owned enterprises): R-290 vs. R-32
- Concerns centered primarily on safety and standards, technology access, market acceptability and competitors, and size of typical AC manufactured
- Industry chose 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

	R-290	R-32
Flammability	Highly flammable (A3)	Mildly flammable (A2L)
Safety standards	Very low charge limit that could impact performance	Has charge limit but allow for performance optimization
Safety design & modification	High incremental cost	Moderate incremental cost
Technology development	Developed by manufacturers in developing countries (China, India)	Developed by multinational manufacturers (Japan)
Training	High cost for aftersales service training	

Issues Encountered



Market Acceptability

- Market acceptability is a concern given issues of flammability and costs.
- Tackled on different fronts to overcome R-410A bias:
 - Create confidence and scale through involvement of a major MNC (Daikin) leading to agreement that it too will launch R-32 AC in the market
 - Dialogue with Thai industry that some market for R-410A (EU) will close if they to that route
 - Other MNCs in Thailand not willing to go to R-32 and prepared to aggressively promote R-410A in Thailand. Japan gov., due to its domestic policy on high GWP gases, may have put pressure on parent companies in adopting same technology in their Thailand operations

Technology Transfer

- Availability of the technology
 - Daikin had agreed to provide free access to 93 basic application patents to industry in developing country and later on free access worldwide to promote R-32 technology
 - WBG-Daikin organized a factory visit in Japan for the Thai industry on equipment installation and safety measures
 - Multiple consultations organized with 14 Thai companies along with industry association (Thai AC Club)
- Thailand industry remained reluctant as access to patent is not necessary translated to “know-how”
 - Daikin agreed to provide tailored support to participating companies to improve manufacturing process (“Clean-Dry-Tight” manufacturing approach) during project implementation
 - This would lead to higher quality, more reliable AC products to build confidence and demand in R-32 technology

Standards and Safety

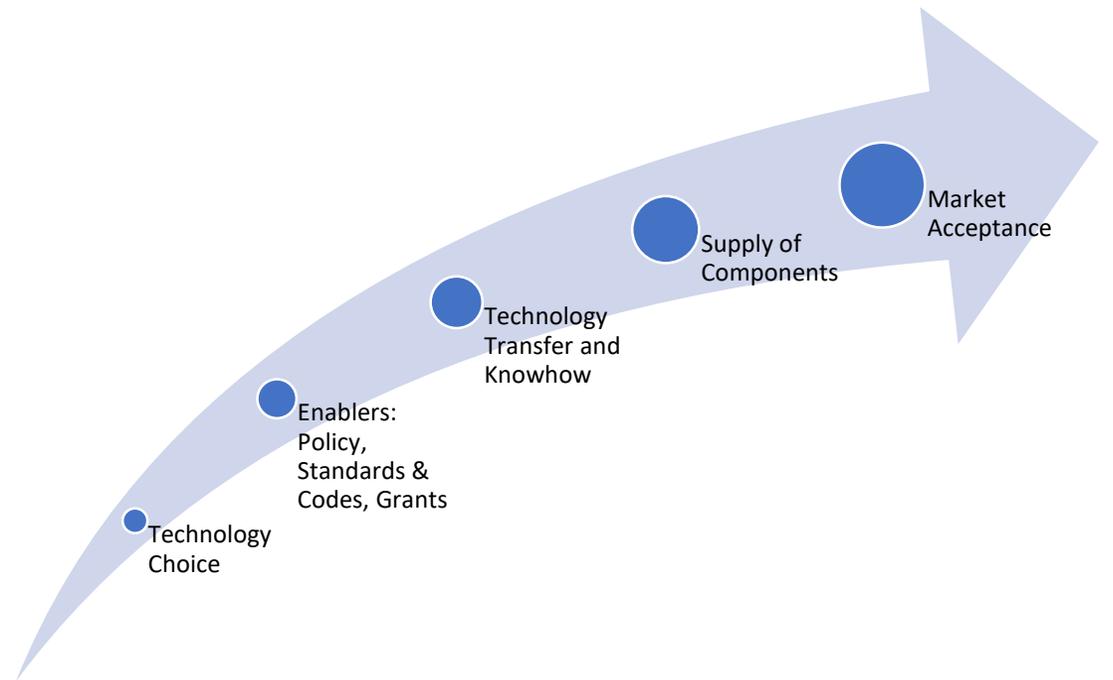
- Thailand building codes restrict use of highly flammable refrigerant in AC in high-rise buildings. Would this apply to R-32?
- This issue was tackled on different fronts:
 - Thailand Council of Engineers, based on request from National Ozone Unit, confirmed R-32 is not considered a highly flammable substance
 - Department of Industrial Works commissioned an independent safety assessment of R-32. Conclusion: R-32 can be safely used in a split type AC with cooling capacity not over 53,500 BTU/hr (15.75kW) provided the inside unit is wall-mounted
 - WB reviewed ISO-5149-2014 which recommends a maximum refrigerant charge size for A2L (mildly flammable) and A3 (highly flammable) refrigerants based on building occupancy category and equipment location.
 - WB shared experiences of other countries on dealing with R-32 refrigerant – primarily Japan’s risk assessment studies carried out by Japan Refrigeration and Air-Conditioning Industry Association (JRAIA)
- Based on tests and evidence, Department of Public Works and Town Country Planning decided to modify regulations to allow installation of split-type AC with capacity up to 53,500 BTU/hr in high-rise building

Component Availability and Supply

- R-32 AC requires new compressor designed specifically for R-32
- At that time, one rotary compressor manufacturer produced R-32 compressor in the most popular size range but there was a gap for the larger units needed by the Thai industry for their market segment
- Due to competition, each company tends to deal directly with the compressor supplier but was turn down due to low volume. Thailand AC Club coordinated efforts to compile individual demands leading to critical mass thus convinced supplier to produce R-32 compressor in larger size range.

Thailand's Experience

- 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 R-32 AC Market Development

- Performance of R-32 AC is better than R-22 & R-410A units
- Thailand AC Club of Federation of Thailand Industries is a stronger collective, better able to meet evolving market demand as a unified front
- Other opportunities:
 - Thailand reciprocating compressor manufacturer developing R-32 version with Canadian grant
 - K-CEP grant to improve energy efficiency in R-32 by assisting local Thai AC manufacturer to develop inverter-based AC and to lower first cost with economy of scale

2015

- R-32 based AC introduced in Thailand by multinationals

2016

- 3 Thai AC manufacturers introduce R-32 AC; 30,000 units sold

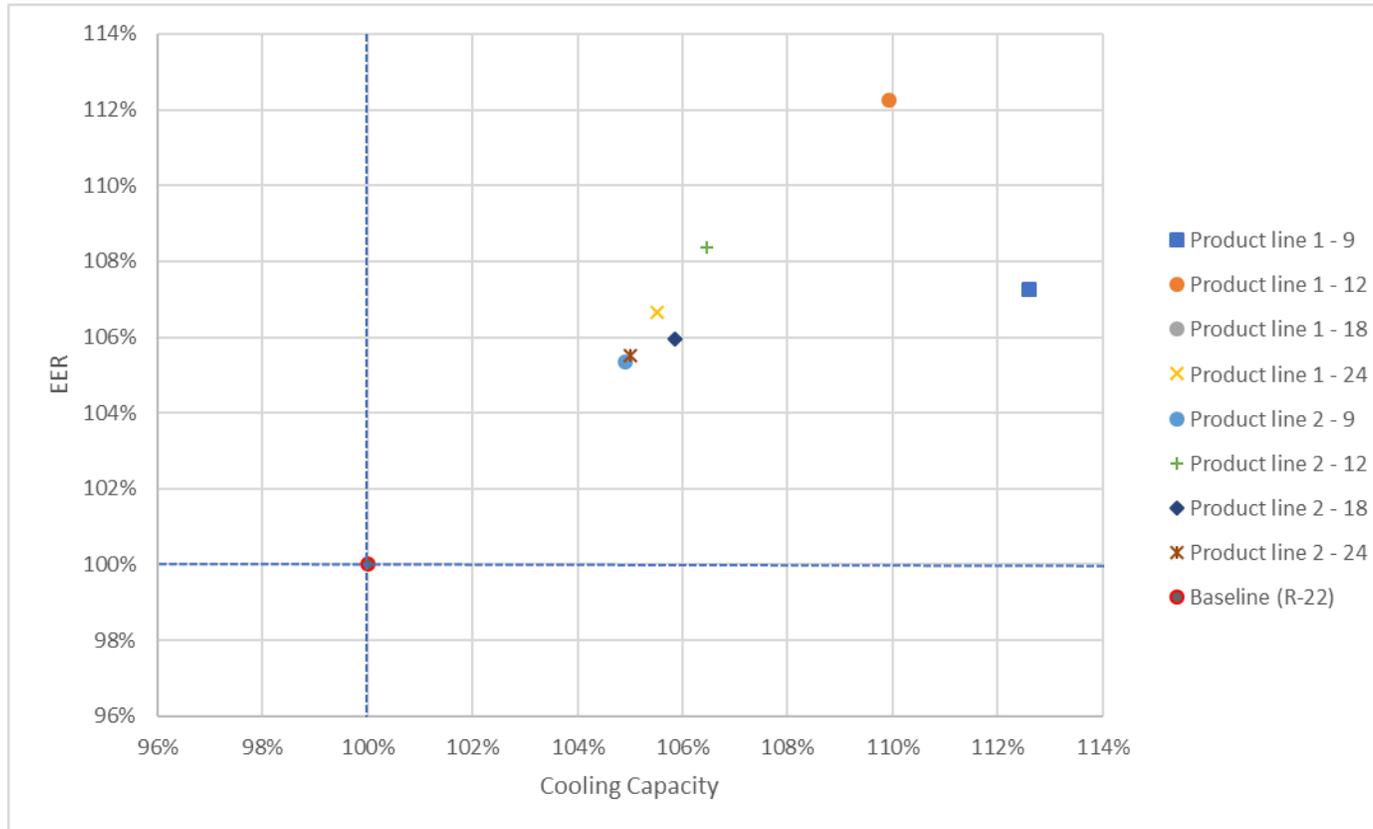
2017

- Ban of < 50,000 Btu/hr R-22 AC manufacturing for domestic market (1 July 2017)

2018

- More than 370,000 units R-32 AC sold

Performance of R-32 compared with R-22 models



Source: Saijo Denki