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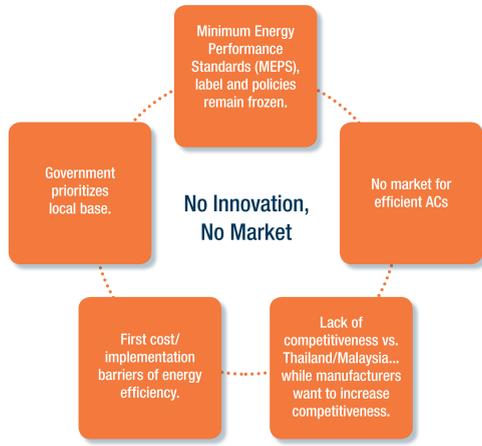
## Accelerating Cooling Efficiency in Indonesia

### Technical analysis supports air-conditioning market transformation in Indonesia

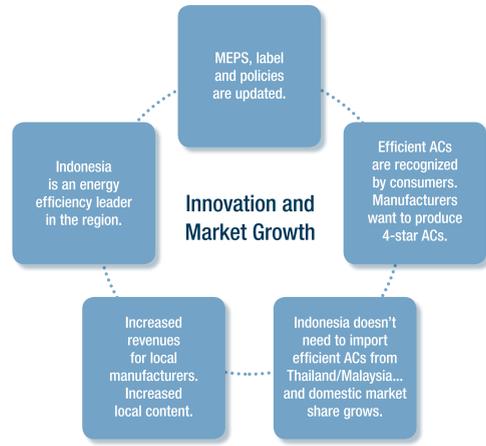
Sales of air conditioners (ACs) in Indonesia have been increasing by 11% each year, and projections suggest that 170 million new AC units by 2035 could increase peak demand by over 20 GW. Large-scale deployment of highly efficient and increasingly affordable inverter-driven (variable-speed) ACs could reduce Indonesia's AC electricity use by 30%–50%. However, adoption of inverter-driven ACs has lagged in Indonesia: the technology constitutes only 10% of the Indonesian AC market, compared with 40% in Southeast Asia and 65% in China.

Our technical analysis supports transformation of Indonesia's AC market. We estimate the costs and benefits of producing and selling higher-efficiency ACs in Indonesia. Based on this analysis, we show that robust AC energy-efficiency programs could provide economic benefits to Indonesian AC manufacturers and consumers while reducing national energy use and greenhouse gas emissions. We outline steps that could be taken to implement the AC energy-efficiency programs.

#### CURRENT SITUATION: Vicious Cycle



#### GOAL OF PROJECT: Virtuous Cycle



#### STEP 1: Revise Efficiency Metric

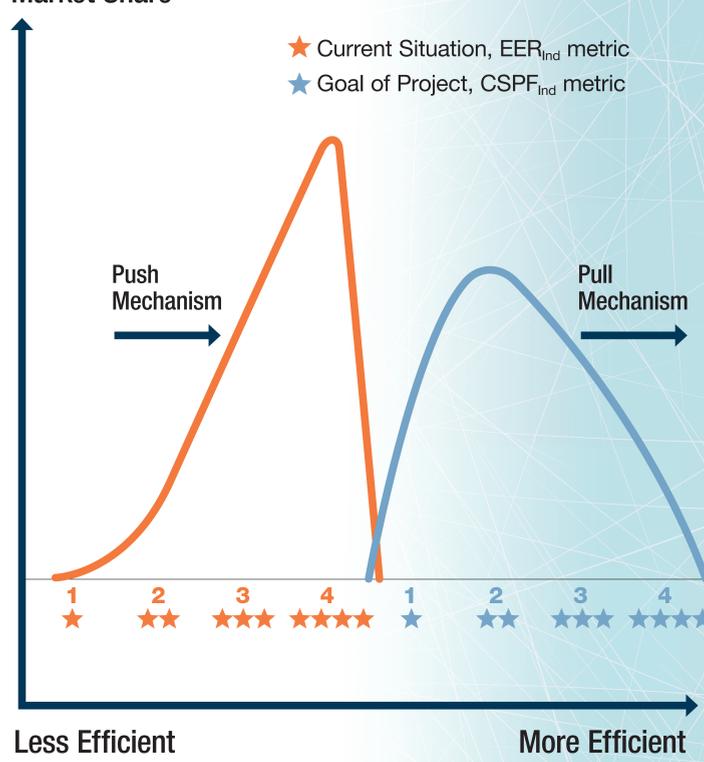
- ISO 16358 has been adopted by Indonesian Bureau of Standards
- However, stakeholders support the revision of the metric
- Develop a cooling seasonal performance factor (CSPF) to reflect Indonesia's climate conditions



#### STEP 2: Revise Energy Efficiency Label, Information Program

- 80% of the market labeled as most efficient, sending a confusing signal to consumers and discouraging manufacturers from introducing high efficiency products in the Indonesian market
- Create 1- to 4-star categories to cover the entire market efficiency (with 4-star being only a fraction of the market)

#### Market Share



#### STEP 3: Complementary Programs / Pull Mechanism

Build on the 4-star label or higher

- Policies to Benefit Users:

- Bulk Procurement: Use economies of scale to drive down costs
- Rebates to lower first cost barrier and encourage adoption of efficient technology by consumers

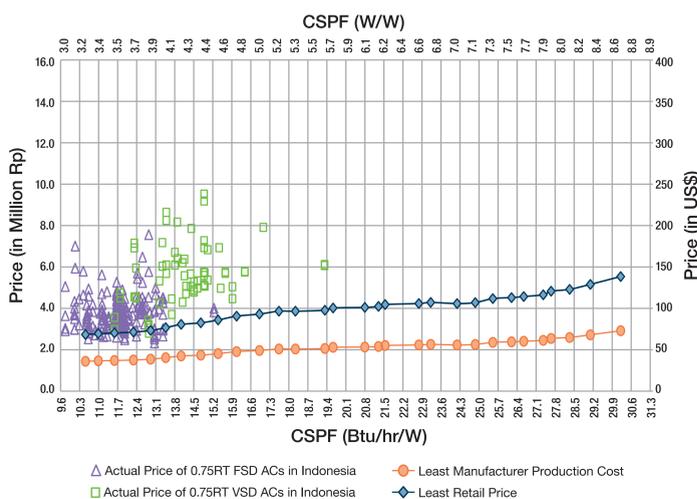
- Policies to Benefit Suppliers: Grants to manufacturers to upgrade energy efficiency, coordinated with refrigerant transition under the Kigali amendment

#### STEP 4: MEPS / Push Mechanism

- Steps 2 and 3 pave the way for MEPS revision
- Government adopts roadmap to reach long-term target and give visibility to all players
- Target level is based on technical/engineering analysis
- Impacts are more certain because MEPS are mandatory
- Ban of imports that do not meet standard, reducing environmental dumping

#### Engineering Analysis Shows Low Cost of Higher AC Efficiency

We develop a cost-versus-efficiency curve based on more than 300 configurations of fixed-speed drive (FSD) and variable-speed drive (VSD) mini-split ACs rated at 0.75 refrigeration tons (RT)—or 9,000 Btu/hr—calibrated using market data collected via the web (Letschert et al. 2017). Manufacturer cost and retail price increases are minimal across much of the efficiency range.



#### Higher AC Efficiency Benefits Indonesia

- Consumer payback period of 1 to 3 years for ACs under various higher-efficiency scenarios
- Harmonization with upcoming Chinese MEPS will result in national consumer savings of 3 billion US\$ (net present value through 2035)
- Economic benefits to manufacturers under all higher-efficiency inverter-driven AC scenarios, with benefits increasing as efficiency increases
- Electricity savings of up to 47 TWh annually by 2035
- Avoided demand of up to 8 GW in the power sector by 2035, valued at 16 billion US\$
- Avoided CO<sub>2</sub> emissions of up to 270 million metric tons (cumulative 2021–2035)



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Presented at the eceee 2019 Summer Study, 3–8 June 2019, Belambra Presqu'île de Giens, France

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ACKNOWLEDGEMENTS: Overlook International Foundation and U.S. Department of Energy

#### REFERENCES:

Letschert, Virginie, Sarah Price, Nihan Karali, Won Young Park, Nikit Abhyankar, Ambereen Shaffie, Nihar Shah. Accelerated Air Conditioners Efficiency Trajectory for Indonesia. Forthcoming report. Lawrence Berkeley National Laboratory.

Letschert, Virginie, Brian F Gerke, Michael A McNeil, Thomas Tu, Brian Dean, Edi Sartono, Jaya Rajasa, and Chad Gallinat. "Baseline Evaluation and Policy Implications for Air Conditioners in Indonesia." 9th International Conference On Energy Efficiency In Domestic Appliances and Lighting. 2017.

