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Project Overview and Preliminary Analysis

Submitted by: International Institute for Energy Conservation

APEC
VIET NAM
2017

Workshop on Reducing Losses in Power Distribution Through Improved Efficiency of Distribution Transformers
Jeju, Korea
28 March 2017

Asia-Pacific Economic Cooperation

ASEAN SHINE

Reducing Losses in Power Distribution through Improved Efficiency of Distribution Transformers (EWG 05 2015A)

Project Overview and Preliminary Analysis

28 March 2017 | Jeju, Republic of Korea

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ORGANISERS:

International Copper Association Southeast Asia
Copper Alliance

CSC China Standard Certification

IIEC International Institute for Energy Conservation

Outline

1. Project Background
2. Project Objectives
3. Main Outputs
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5. Preliminary Analysis
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Project Background

- Asia-Pacific Economic Cooperation (APEC), the International Copper Association (ICA) and the China Standard Certification Company (CSC), initiated the project to provide knowledge and experience obtained from designing, planning and implementing improved efficiency of distribution transformers;
- Study and analyze benefits from the adoption of the upcoming IEC 60076-20 standard;
- Share experiences and lessons learnt through EE policies and regulations aiming for improved efficiency of DTs in the residential, commercial and industrial sectors;
- Formulate policy recommendations and strategies for future acceleration of energy efficiency practice in the APEC economies;

Project Objectives

- The long-term goal of the project is to support APEC economies with adoption of the IEC 60076-20 standard, to drive technology changes and increase DT's energy performance. The specific objectives of the project are:
  - **To build** the capacity of policy makers on the impact of adopting IEC 60076-20 standard for their economies in terms of electricity distribution loss reductions and GHG emission reductions and;
  - **To provide** policy makers with clear policy recommendations that are made in consultation with key stakeholders (testing laboratories, manufacturers, standard making bodies etc);

Main Outputs of the Project

IIEC-Technical Consultant

- Review of Past Studies;
- Comparative Analysis and Technical Recommendations;
- Workshop to discuss with key stakeholders key issues and policy recommendations;
- Preparation of a Policy and Regulatory Recommendation based on Consultation Workshops with key stakeholders;

Comparative Analysis of Existing Standards (Status)

- Detailed studies are being conducted to compare existing standards with the new IEC standards;
- load/no load losses are used to determine the energy performance of Distribution Transformers (DTs).
- Based on the comparative analysis the formulation of recommendations will be made regarding the method to best regulate energy performance in DTs to minimize uncertainty in energy saving benefits and drive technology improvements (from 50% EE to load/no-load losses standard);

Policy and regulatory recommendations (Status)

- Through active consultation with beneficiaries, the project is formulating policy and regulatory recommendations to assist APEC economies in adopting the new IEC standard (ongoing);
- A direct one-on-one consultations with utilities, policy-makers and manufacturers
- The policy recommendations report will include clear guidelines to the development of policy roadmaps for the intention of policy makers;

Consultation workshops and Conference

- The main objective of the today's workshop is to ensure effective consultation with strategic stakeholders;
- To share experiences and lessons learnt from leading practitioners and best-practice through EE policies and regulations;
- To disseminate the outputs of this project and develop partnerships to initiate domestic processes for adoption of the new IEC standard;

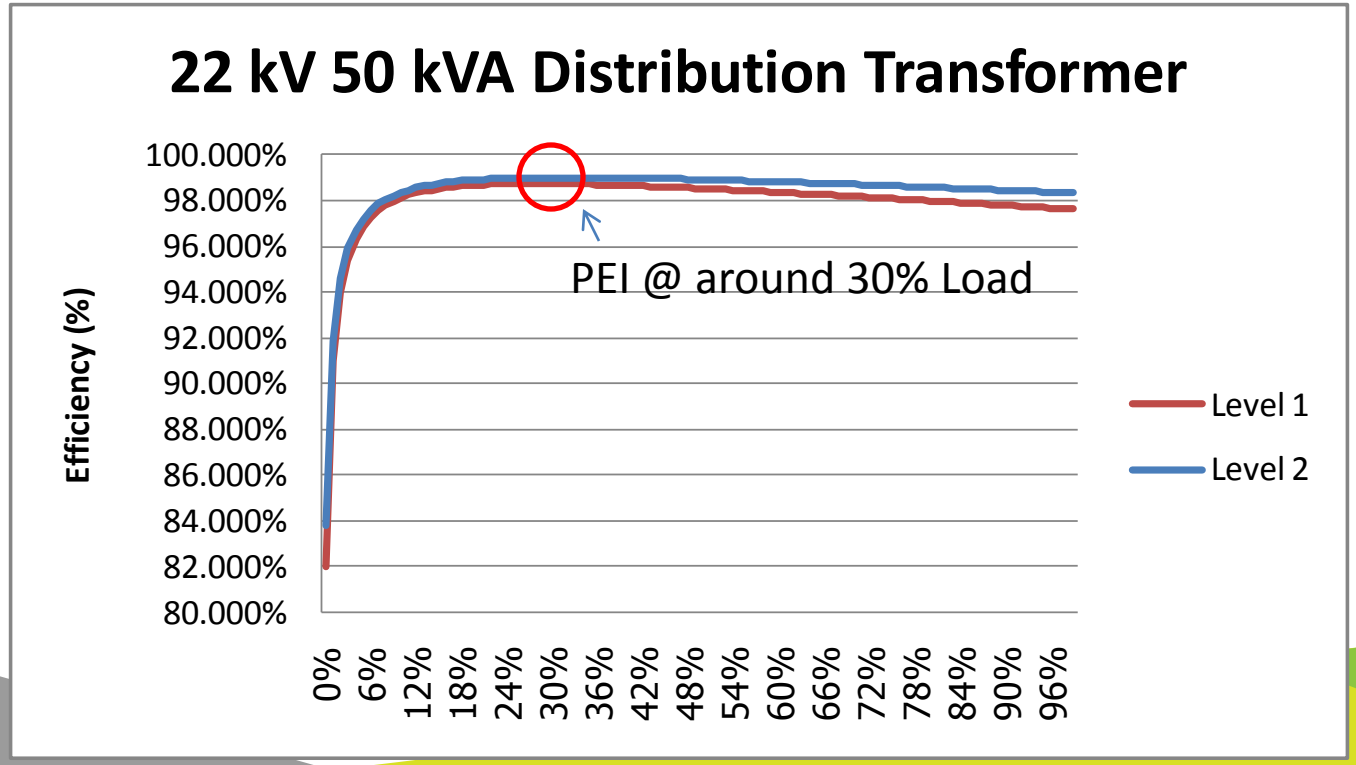
PRELIMINARY ANALYSIS

IEC TS 60076-20

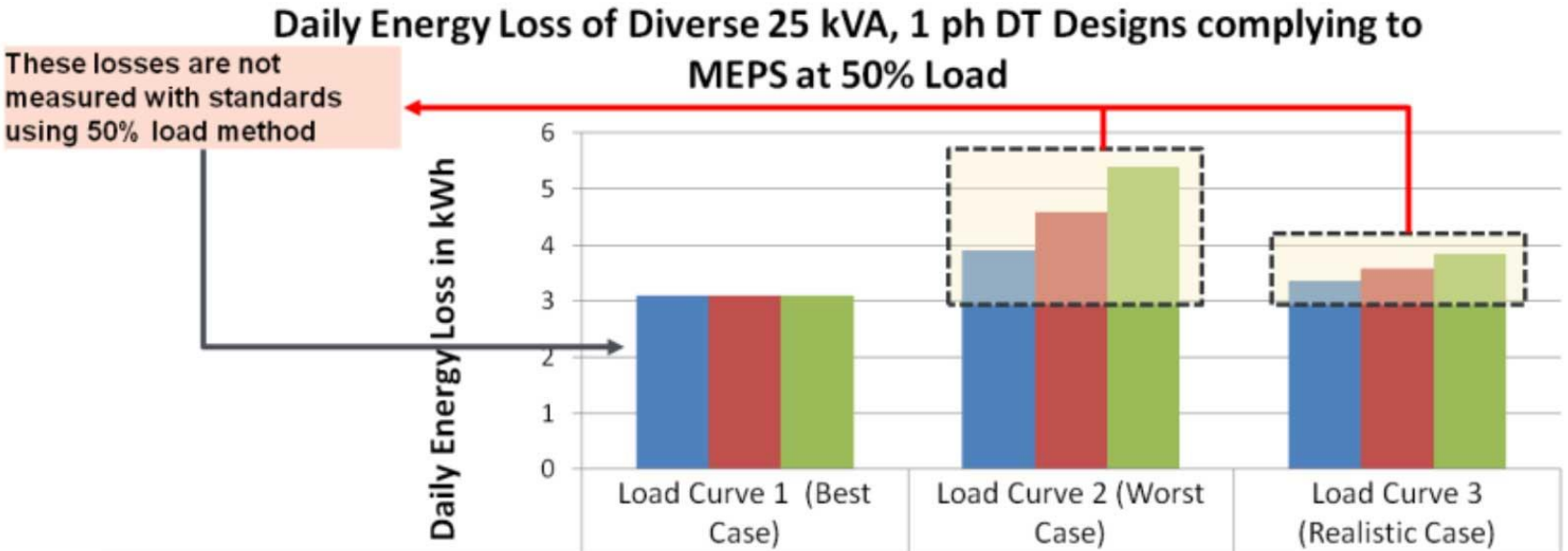
- The most recent edition published in 2017
  - Power Transformers – Part 20: Energy Efficiency
- Provides methods for efficiency and efficiency index calculation
- Provides two levels of recommendations
  - Level 1 is for basic energy performance
  - Level 2 is for high energy performance
- Energy performance MAY be specified in one of the following ways:
  - Minimum PEI (Peak Efficiency Index)
  - Maximum load losses and maximum no-load losses
  - Minimum Efficiency Index at a load factor of 50%

Efficiency Profile of DTs

	Level 1	Level 2
Min PEI	98.741%	99.014%
Max NL/LL	90/1100	81/750
Min EI@50%	98.657%	99.004%

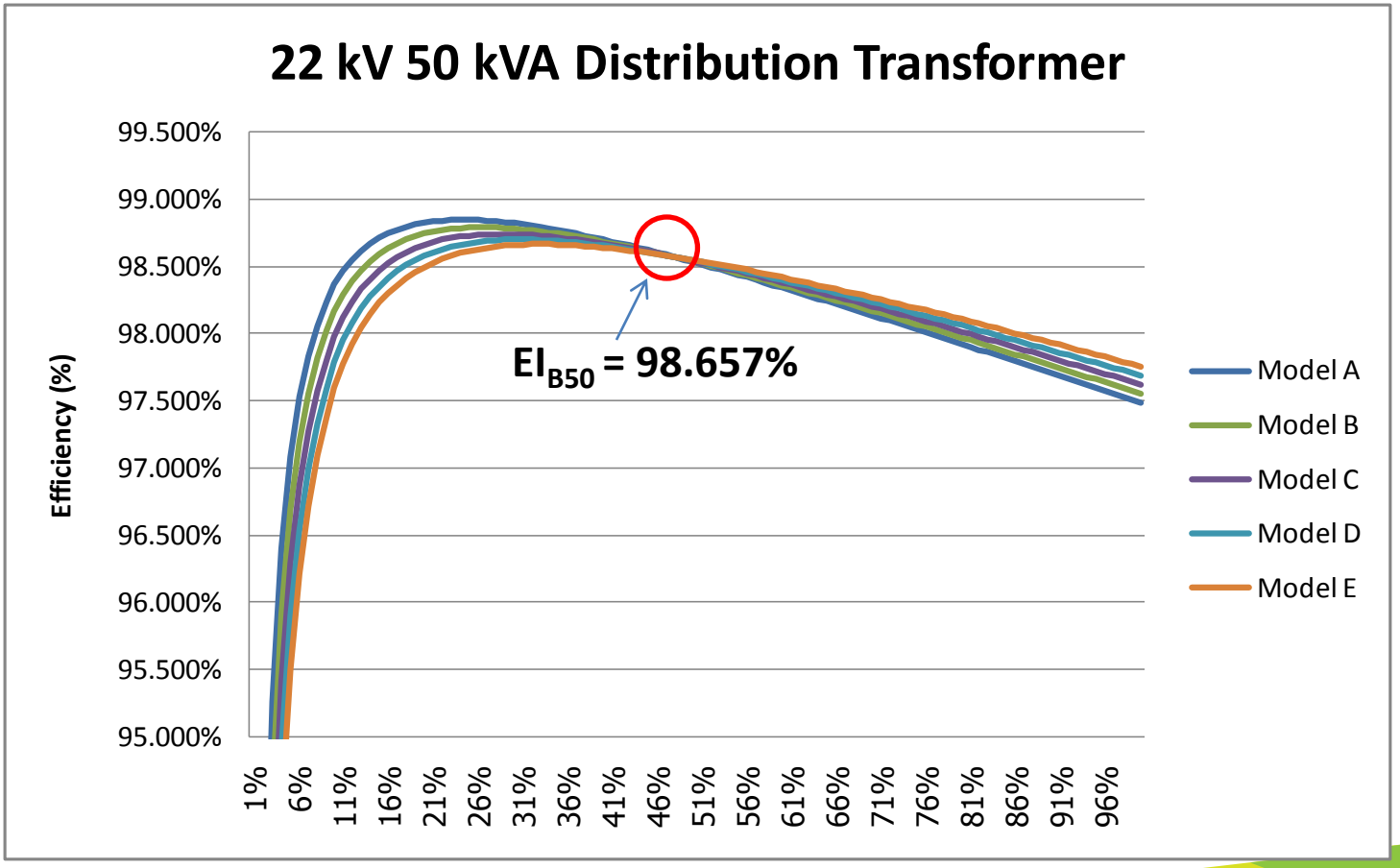


Reservation on 50% Load Factor Efficiency



Source: Estimation by ICA

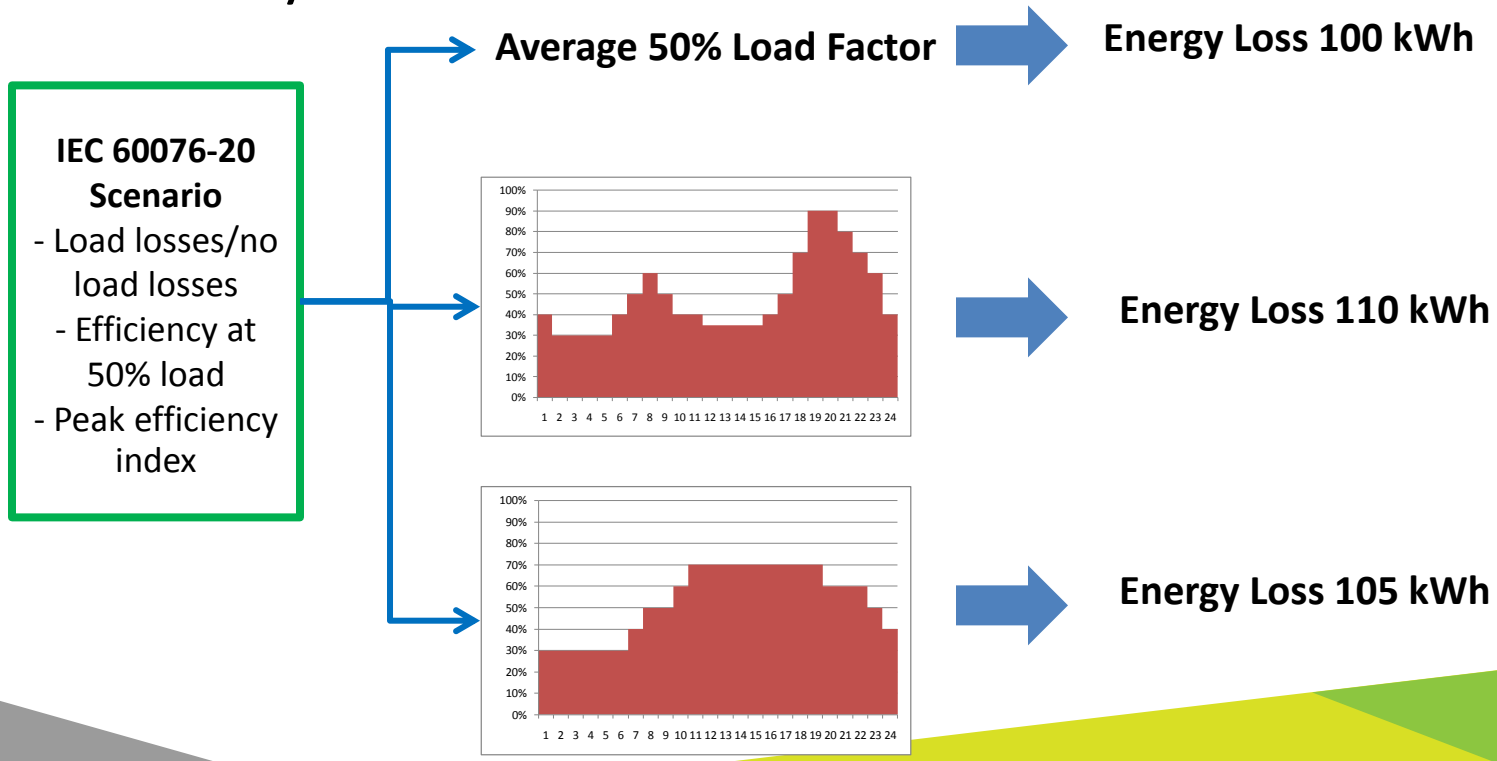
Same EI @ 50% Load for different NL/LL



Estimation of Energy Savings

- Average load factors are generally used to estimate total energy losses and savings.

- Prelim analysis found that:



Analysis Approach

Compiling DT Population at the Utility Level
Classifications by kV/KVA

Defining DT Losses/ Efficiency

Baseline Scenario
MEPS/ Utilities' Procurements

IEC 60076-20 Scenario
- Load losses/no load losses
- Efficiency at 50% load
- Peak efficiency index

Defining Analysis Methodology

Typical Load Profiles for Different End-Use Sectors

Annual Variation/ Load Factor

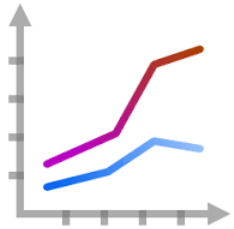
Key Variables: Electricity Tariff (current/ projection), Emission Factor, discount rate, service life

Projecting Energy Consumption/ CO2 Emission

Baseline Scenario
Energy Consumption / CO2 Emission (2017-2036)/ LCC

IEC 60076-20 Scenario
Energy Consumption / CO2 Emission (2017-2036)/ LCC

Extrapolation at the APEC Economy Level
- Baseline
- IEC 60076-20
- Savings

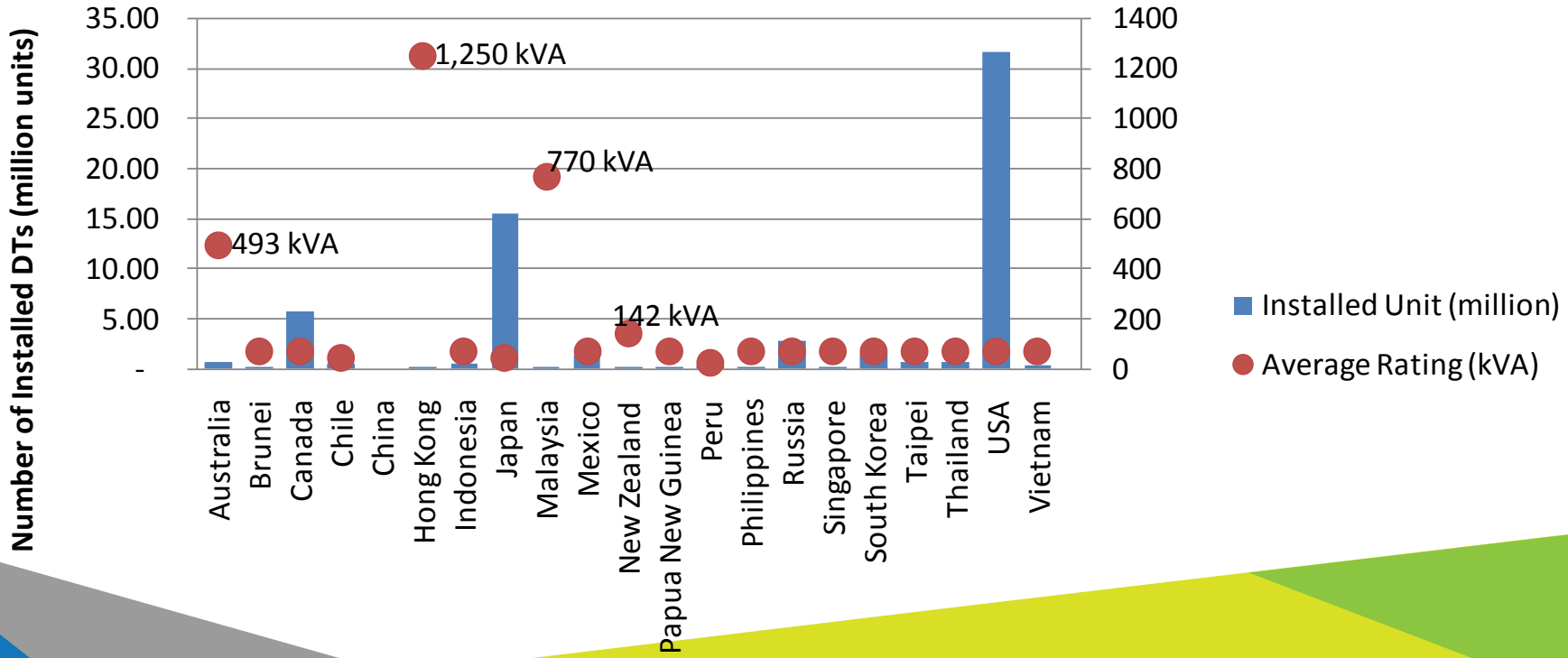


Previous Studies

- APEC Distribution Transformer Survey (APEC EWG 2013)
- EE Potential for Distribution Transformers in the APEC Economies (2013)
- Asset Maintenance, Refurbishment and Replacement Practices in ASEAN Utilities (HAPUA Working Group 3, 2015)
- Market Study for Transformers and Power Cables in Thailand (ICA 2016)
- Market Research on Copper – Intensive Technologies in the Philippines (ICA 2016)

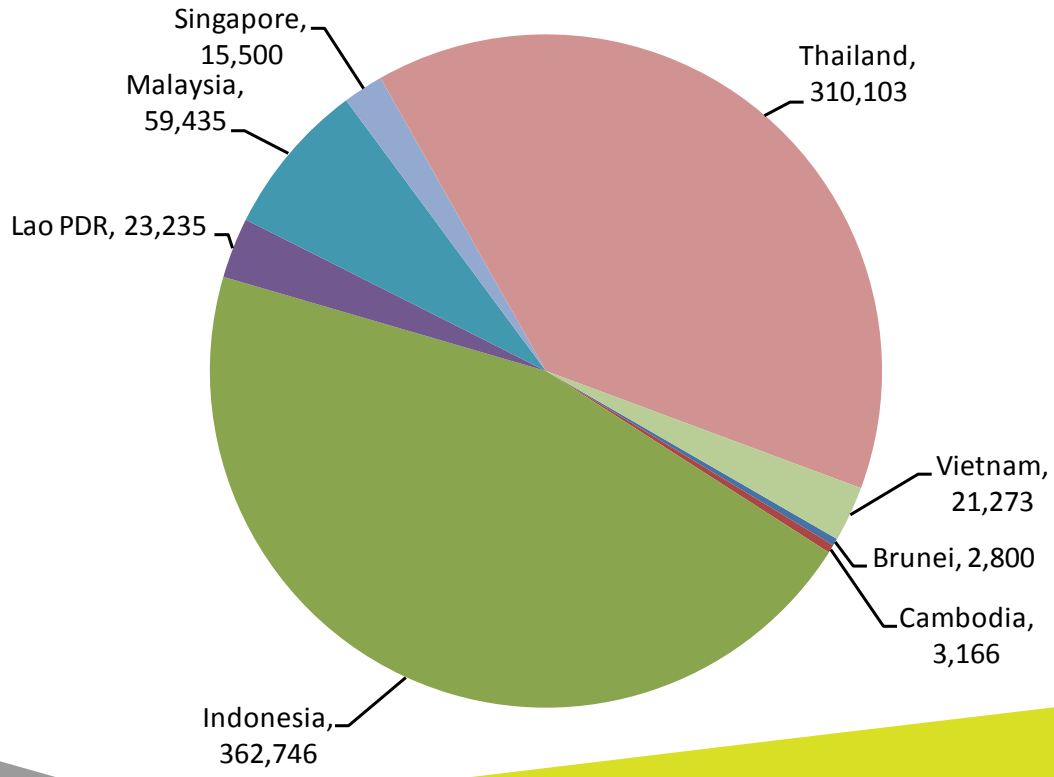
DT Inventory in APEC Economies

- More than 63 million units
  - Covering utilities + private sector, excluding China
  - Estimated using the Bottom-Up Energy Analysis System (BUENAS)
- Average sizes 73 kVA – 1,250 kVA



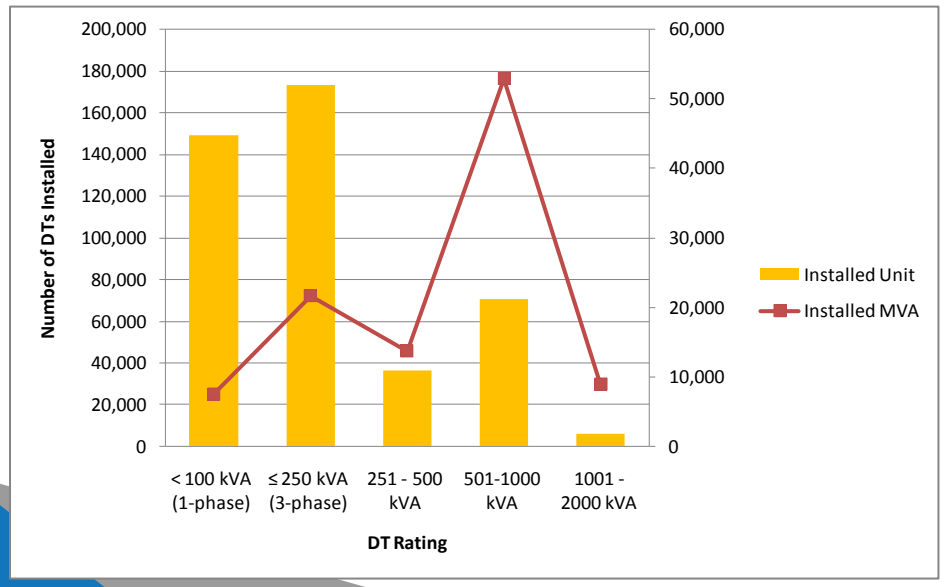
Utility DT Inventory in ASEAN

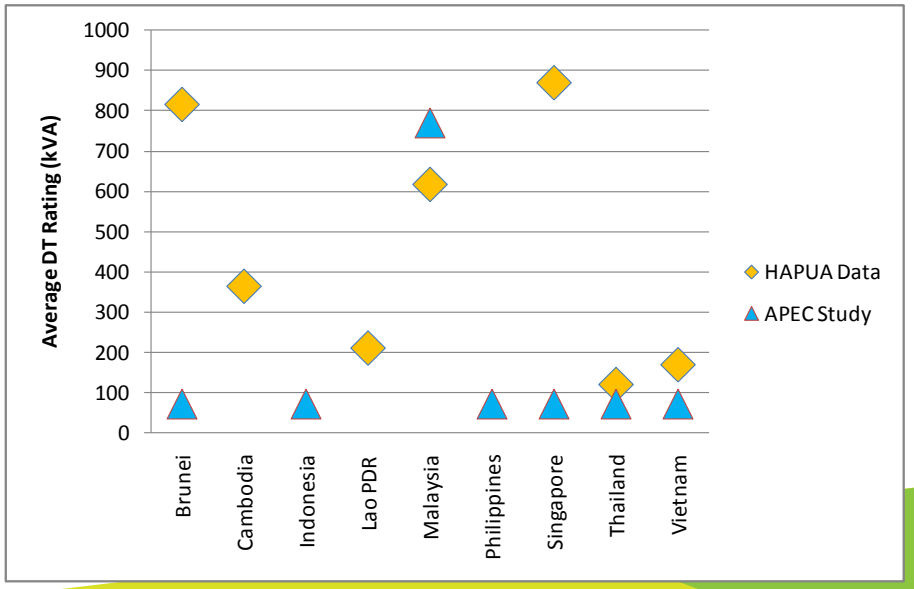
- More than 800,000 in 2013 (excluding the Philippines)
- Utility installations are about half of the total stock in each country.



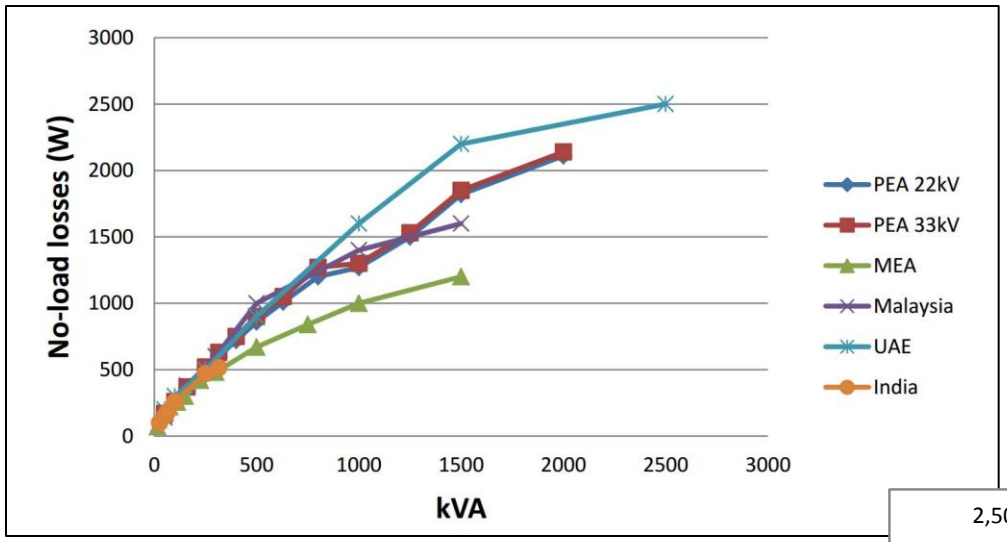
DT Rating in ASEAN

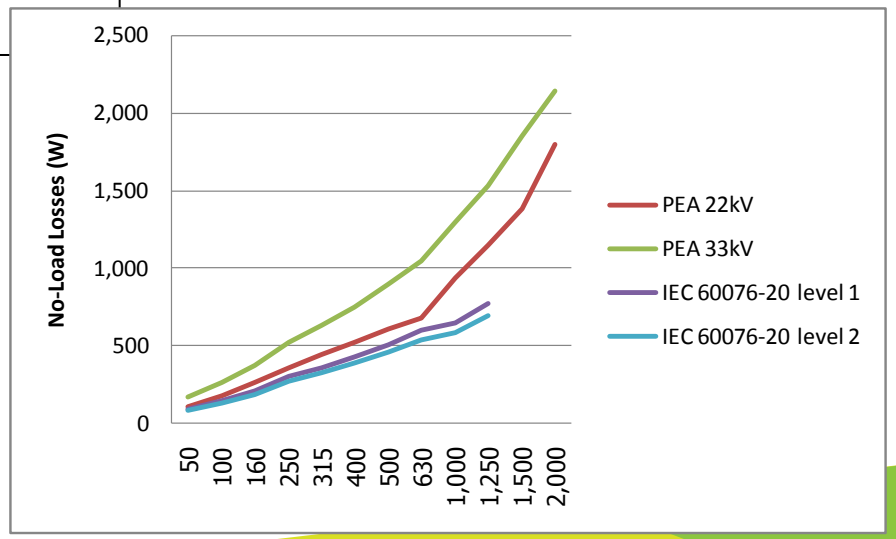
- APEC 2013 study assumed an average rating of 73 kVA in most ASEAN countries.
- HAPUA surveys - most utility DTs are 1-phase with rating <100 kVA and 3-phase rating ≤250 kVA but majority of kVA install is from 501 – 1,100 kVA.



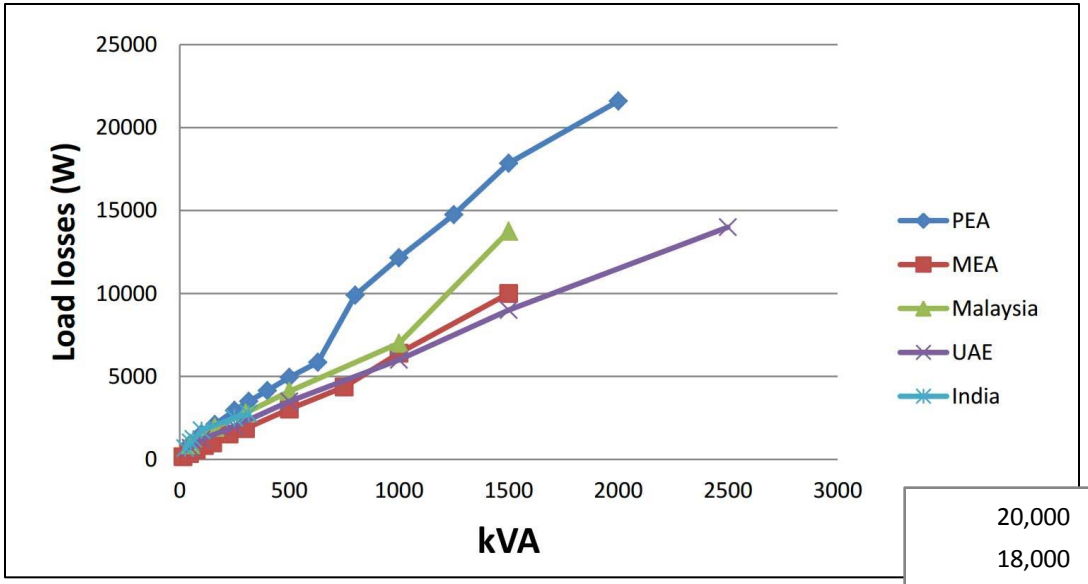


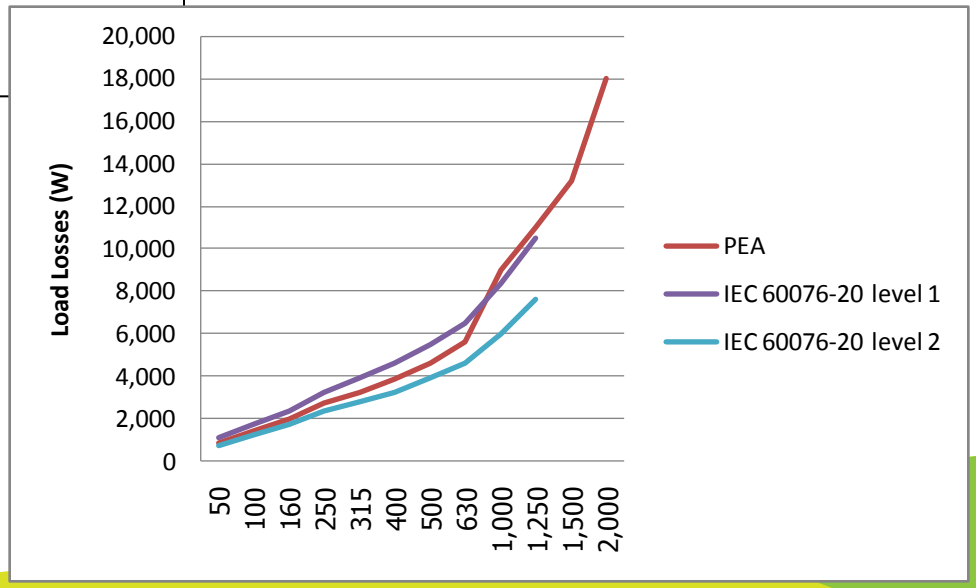
No-Load Losses in Asian Utilities





Load Losses in Asian Utilities





Next Steps

- Document policy and regulatory recommendations from this workshop;
- Detailed Technical Analysis of Existing Standard VS IEC Standard;
- Based on the Findings above Prepare Policy and Regulatory Recommendations;
- Findings will be shared with PSC members and discussed during the next workshop;

THANK YOU

For more information, please contact:
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