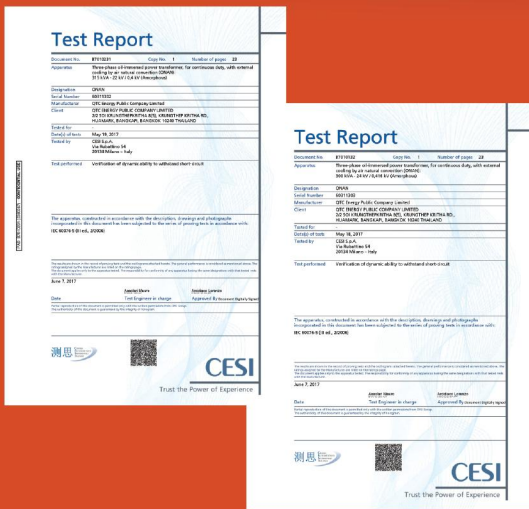




**QTC ENERGY**  
 AMorphous metal  
 Distribution  
 Transformer  
 (AMDT)

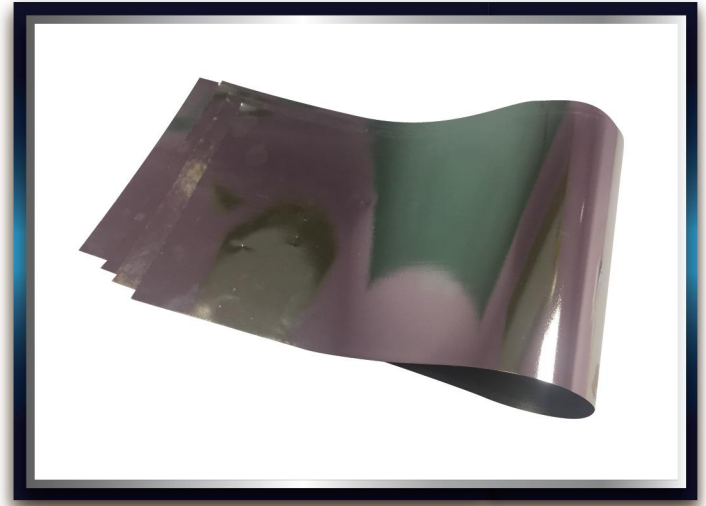


Under the cooperation between Hitachi Metals, Ltd. and QTC ENERGY PCL, we can develop and produce the Amorphous Transformers, which are environmentally friendly transformers. The Amorphous Transformers can save the energy, and have very high efficiency at AAAo-Ak level (FprEn 50588-1:2013), thus can reduce Greenhouse gas emission from electricity generating according to National Economic & Social Development Plan No. 11, 12.

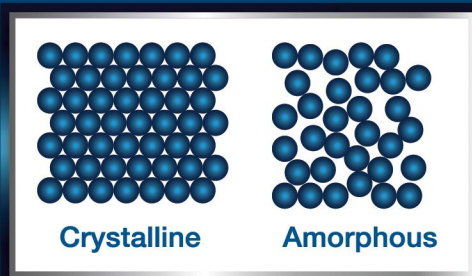
**Short Circuit Performance**  
**CESI Italy**

The Amorphous Transformers are the best solution to reduce electric energy loss. The Amorphous Transformers, which change the magnetic core material from Silicon Steel to Amorphous Alloy, can reduce the exciting current, and the No-Load Loss(NLL) by up to 65-70% , comparing with Silicon Steel.

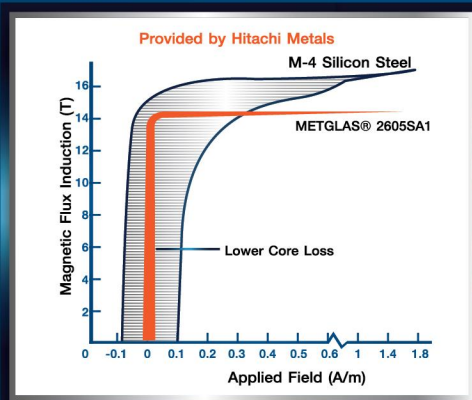
QTC Energy PCL and Hitachi Metals, Ltd. are the first company in Thailand, who are capable of design and manufacturing for Amorphous Transformers. We also can design to meet the specification of MEA and PEA. At present, we have commercially made the transformer of 1000 kVA (for PEA specification) and 500 kVA (for MEA specification), with the maximum capacity up to 3000 kVA.



## What is AMORPHOUS TRANSFORMERS?

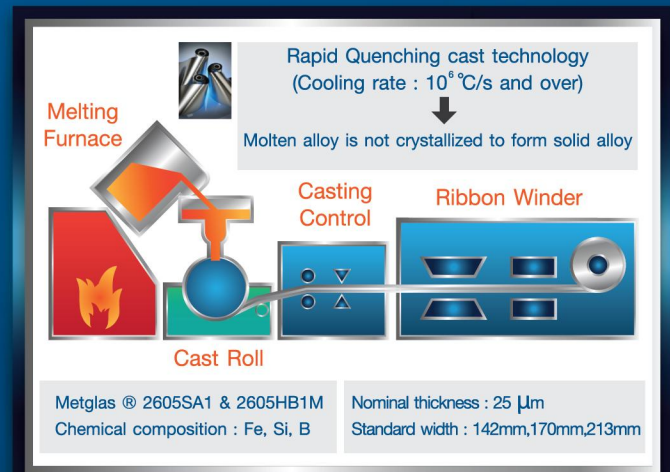


Amorphous Alloy is a general term for a metal with a non-crystalline structure of atom. Internal structure of the material has disordered. In transformers with amorphous cores, a ribbon of amorphous alloy is wound forming the core. The big benefit of amorphous transformer is that amorphous alloy has lower hysteresis losses. In addition, eddy current loss is decreased because the thickness is approximate 25  $\mu\text{m}$ , which is about 1/10 comparing with silicon steel. Therefore, the No-Load Loss (Eddy Current Loss and hysteresis loss) can be decreased to about 1/3 of silicon steel's.



## MANUFACTURING OF AMORPHOUS METALS

- Molten Metal Feed through small nozzle slot onto rapidly moving, water cooled substrate.
- Rapid Solidification  $10^6$  C/s



# Why Use Amorphous Alloy for Transformers?

## 1. No-Load Losses (NLL) is lower than Silicon Steel

**Hysteresis Loss** → When applying magnetic field, random atomic structure leads less friction than Silicon Steel. Therefore it is easy for Amorphous Alloy to magnetize and demagnetize resulting in low Hysteresis Loss.

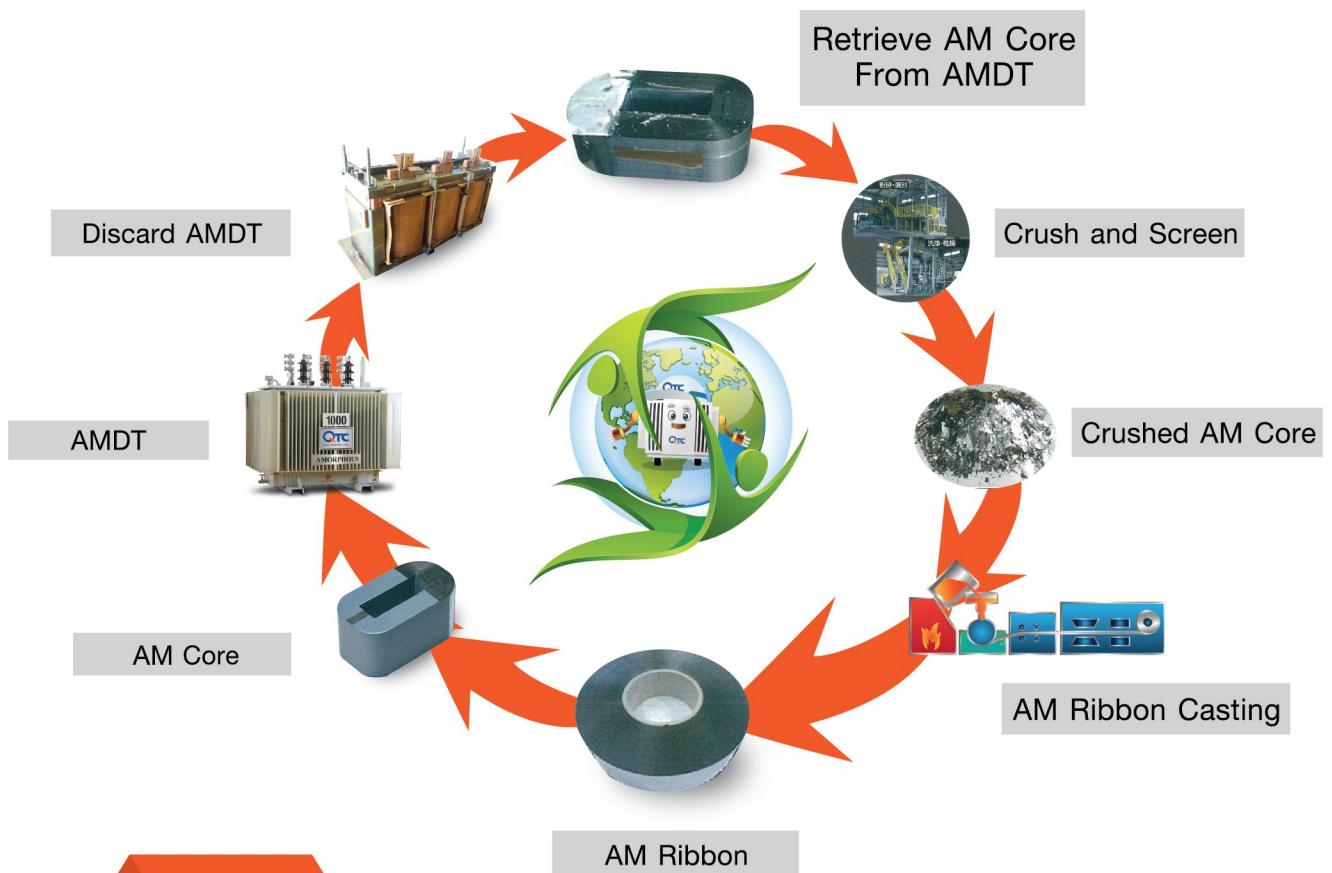
**Eddy Current Loss** → Amorphous Alloy have very thin laminations (25 micron). Thin laminations result in lower eddy current loss as compared to Silicon Steel.

## 2. Energy saving potential and reducing CO<sub>2</sub> emissions

→ AMDT contributes energy saving and CO<sub>2</sub> emission reduction in electricity network

## 3. Environmentally friendly product, recycle is available

→ Recycle flow of AMDT



Reference from Hitachi Metals, Ltd.



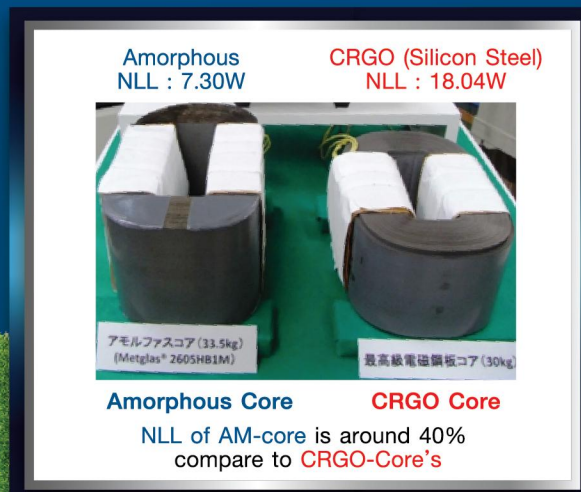
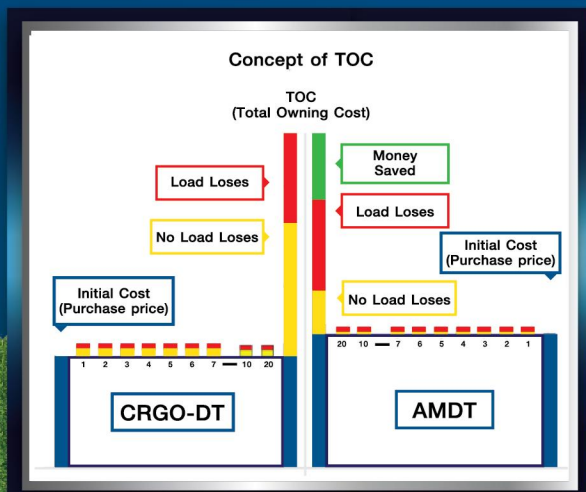
# How to produce AMDT



## Benefit of AMDT

Concept of Total Owning Cost (TOC)

1. Distribution transformer usually can be operated 20-30 years or more (average life time in EU is around 40 years).
2. Purchase of Distribution Transformer based on initial price is not economical in their life time.
3. TOC takes account of initial price and running cost in a life time, not only initial price.
4. Price of energy efficiency product such as AMDT is usually higher than Cold Rolled Grain Oriented Distribution Transformer (CRGO-DT) but running cost is lower than CRGO-DT
5. TOC is suitable for economic analysis of energy efficient and long life products.
6.  $TOC = \text{Initial Purchase Price} + \text{Cost of Future Energy Loss}$ .



# Calculation Example

1000 kVA 3Ph 50 Hz Dyn11 22000-400/230V Impedance 6.0%  
 S/N: 56311834  
 FprEN 50588-1:2013 AAA0-Ck (Po,Pk)

Annual loss of electricity cost (money amount/year)

$$= \left[ \frac{\text{NLL (W)} + \text{LL (W)} \times \frac{(\text{Load Factor})^2}{100}}{1,000} \right] \times 24\text{h} \\ \times 365 \text{ (days)} \times \text{Energy cost (Baht/kWh)}$$

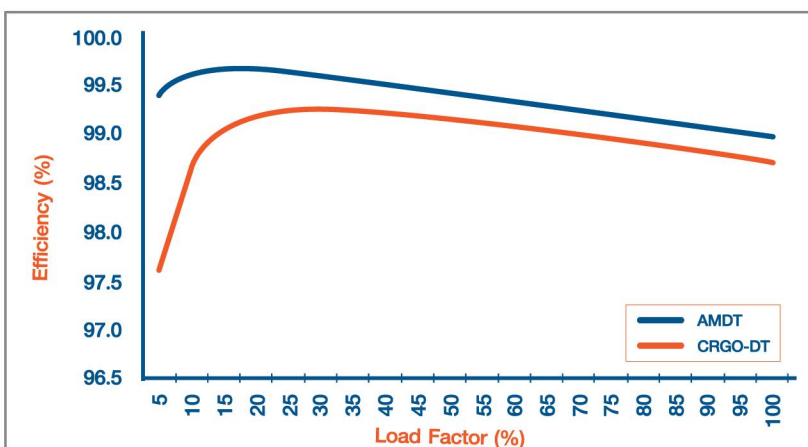
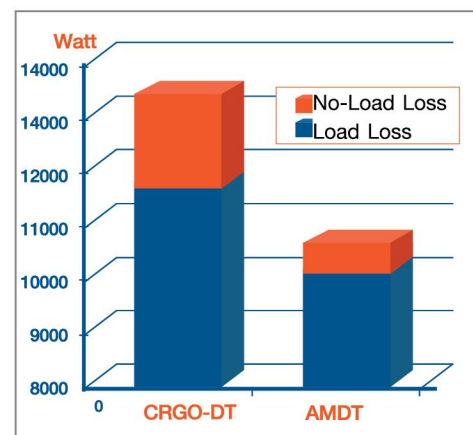
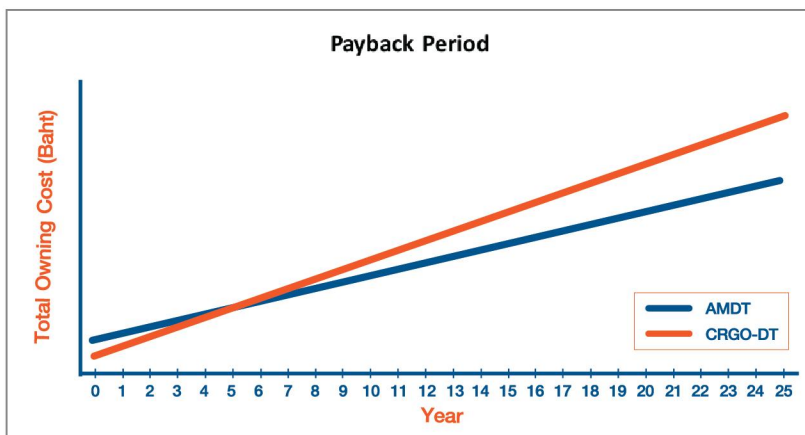
CO<sub>2</sub> Emission

$$= \left[ \frac{\text{NLL (W)} + \text{LL (W)} \times \frac{(\text{Load Factor})^2}{100}}{1,000} \right] \times 24\text{h} \\ \times 365 \text{ (days)} \times \text{CO}_2 \text{ EF}^* \text{ (kg-CO}_2\text{/kWh)}$$



\*Emission Factor (EF) = 0.5813 kg-CO<sub>2</sub>/kWh Thailand Grid Mix Electricity LCI Database 2552 (2009)

	No Load Loss (Watt)	Load Loss (Watt)	Load Factor (%)	Time (Hr/Year)	Energy Cost (Baht)	Cost (Baht/Year)	CO <sub>2</sub> Emission (kg/year)
CRGO-DT	1,206	12,085	50	8,760	4.00	148,123	21,526
AMDT	283	10,161	50	8,760	4.00	98,927	14,377
Difference	923	1,924	-	-	-	49,196	7,149



The result of using 3 phase Amorphous Transformer size 1000 kVA (according to PEA specification), it can reduce the loss by 923 watt/transformer or 8,085 kWh/year, which is equivalent to reducing the Greenhouse gas by 7.15 ton/year.



## LOW LOSS (AAo-Ak) Um ≤ 24 kV

RATED POWER	kVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
NO-LOAD LOSS	Watt	45	75	105	150	180	220	260	300	330	390	480	600	730	880	1100
LOAD LOSS AT 75 °C	Watt	750	1250	1700	2350	2800	3250	3900	4600	6000	7600	9500	12000	15000	18500	23000
SHORT CIRCUIT IMPEDANCE AT 75 °C	%	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
EFFICIENCY	%	99.08	99.23	99.34	99.41	99.44	99.49	99.51	99.54	99.54	99.54	99.55	99.89	99.89	99.56	99.57
APPROX. WEIGHT	kg	490	750	1020	1240	1590	1930	2160	2730	3460	3880	4230	5100	5870	7460	9510

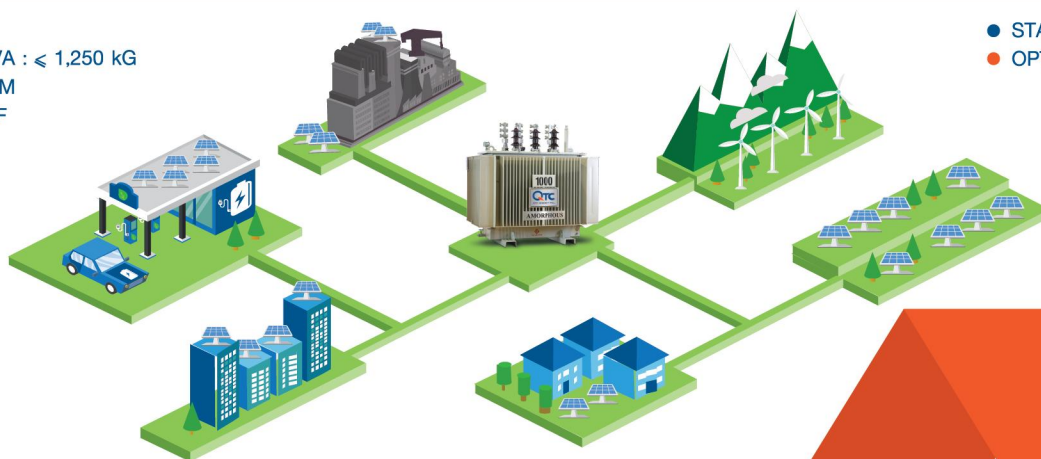
## MARKET LOSS Um ≤ 24 kV

RATED POWER	kVA	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
NO-LOAD LOSS	Watt	45	75	105	150	180	220	260	300	330	390	480	600	730	880	1100
LOAD LOSS AT 75 °C	Watt	950	1550	2100	2950	3900	4600	6600	6600	12000	13500	16000	20000	22700	26800	32500
SHORT CIRCUIT IMPEDANCE AT 75 °C	%	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

STANDARD ACCESSORIES	RATED POWER (kVA)															
	50	100	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	
HV BUSHING DIN 42531	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
LV BUSHING DIN 42530	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ARCING HORN	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
LIFTING LUGS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
OFF-CIRCUIT TAP CHANGER	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
LIFTING EYE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EARTH CONNECTION BM 12 DIN 48088	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
NAMEPLATE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
FILLING TUBE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BIDIRECTIONAL ROLLER	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
OIL DRAIN DEVICE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
OIL LEVEL INDICATOR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
THERMOMETER POCKET	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
THERMOMETER INDICATOR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
THERMOMETER WITH CONTACTS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TRANSFORMER PROTECTION RELAY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
WINDING TEMP RELAY	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CT	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CABLE BOX	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

NOTE :  
 WEIGHT OF 50-250 kVA : ≤ 1,250 KG  
 MATERIAL : 2605 HB1M  
 EFFICIENCY @ 50% LF

● STANDARD ACCESSORIES  
 ● OPTIONAL



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