



MHI view on materials efficiency

**Some KPI examples in line with
Use less / Use longer principle**

World Materials Forum 2016

9 June 2016, Nancy, France

Chairman of the Plenary Session 1: KPI's for materials efficiency

President and CEO, Shunichi Miyanaga

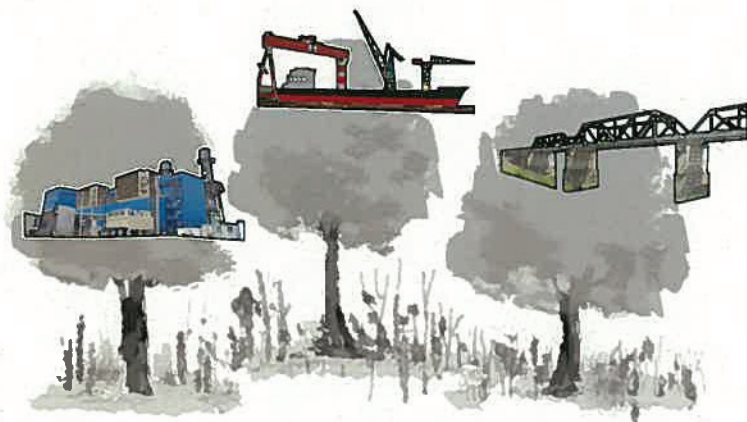
MITSUBISHI HEAVY INDUSTRIES, LTD.

MHI Future Vision on Material Efficiency



The Evolution of Materials Efficiency

PAST



FUTURE



Material Efficiency in the past

- Material life is limited because of material properties.
- Material recyclability is limited due to insufficient data on material composition and small scale of recycle loop



**Requires a lot of primary material
because recyclability is limited**

Material Efficiency in the future (1)

- Use Less Energy by durable lightweight materials



■ Use Less

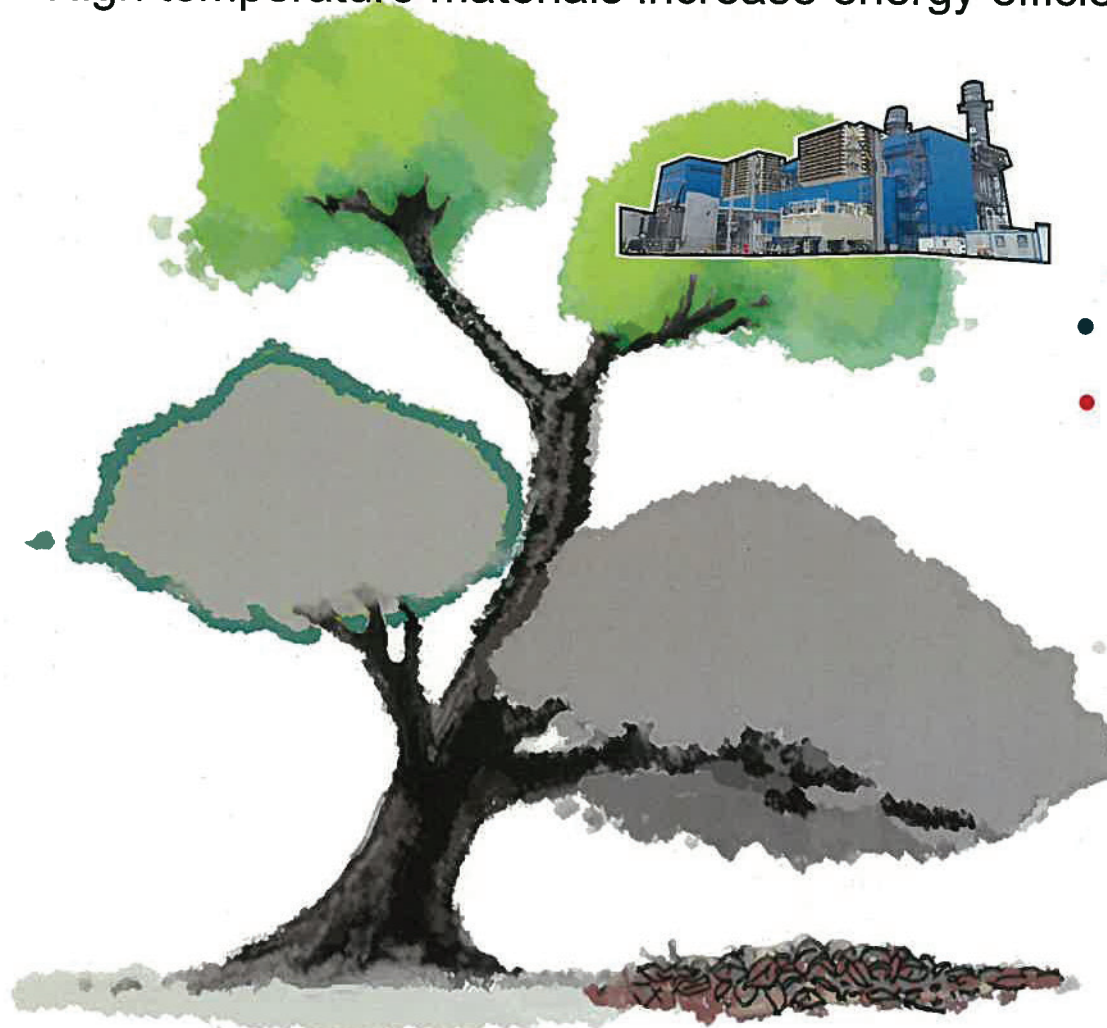
Aircraft, Commuter Trains

- **Advanced Aluminium alloys & CFRP**

Material Efficiency in the future (2)

- Enhanced service life by reparability
- High temperature materials increase energy efficiency also

- Use Longer
- Use Less



Power plants

- **High temp. Materials**
- **Advanced Repairing Technologies**

Material Efficiency in the future (3)

- Decrease material use by enhancing its durability

- Use Longer
- Use Less

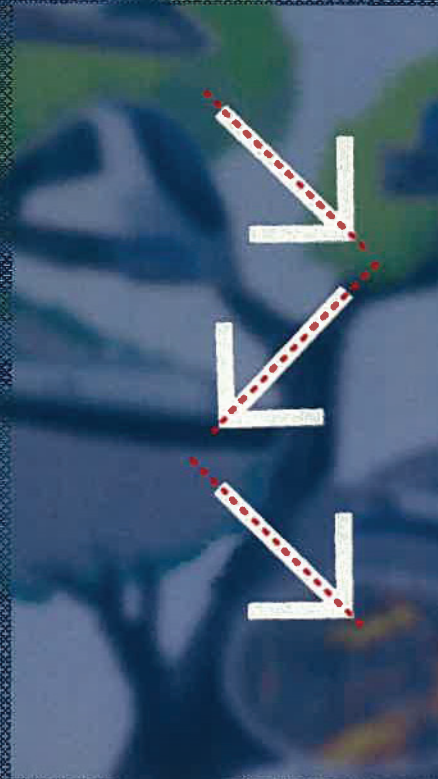


Bridges and Tankers

- **Advanced Coating technologies**
- **High Strength Steels** instead of normal (thicker) steel plate

Material Efficiency in the future (4)

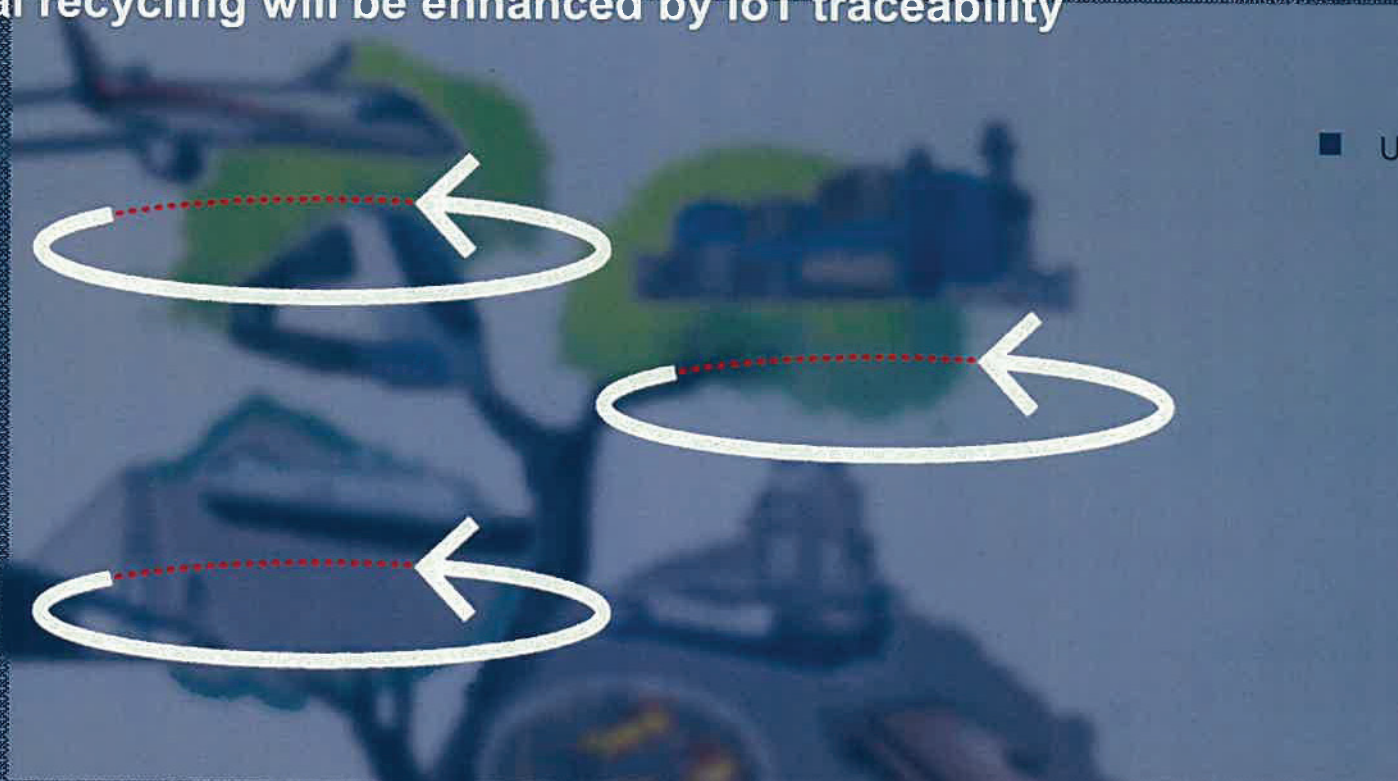
- Cascade recycling enhanced by quality standard



Cascade recycle

Material Efficiency in the future (5)

- Horizontal recycling will be enhanced by IoT traceability



IOT Traceability

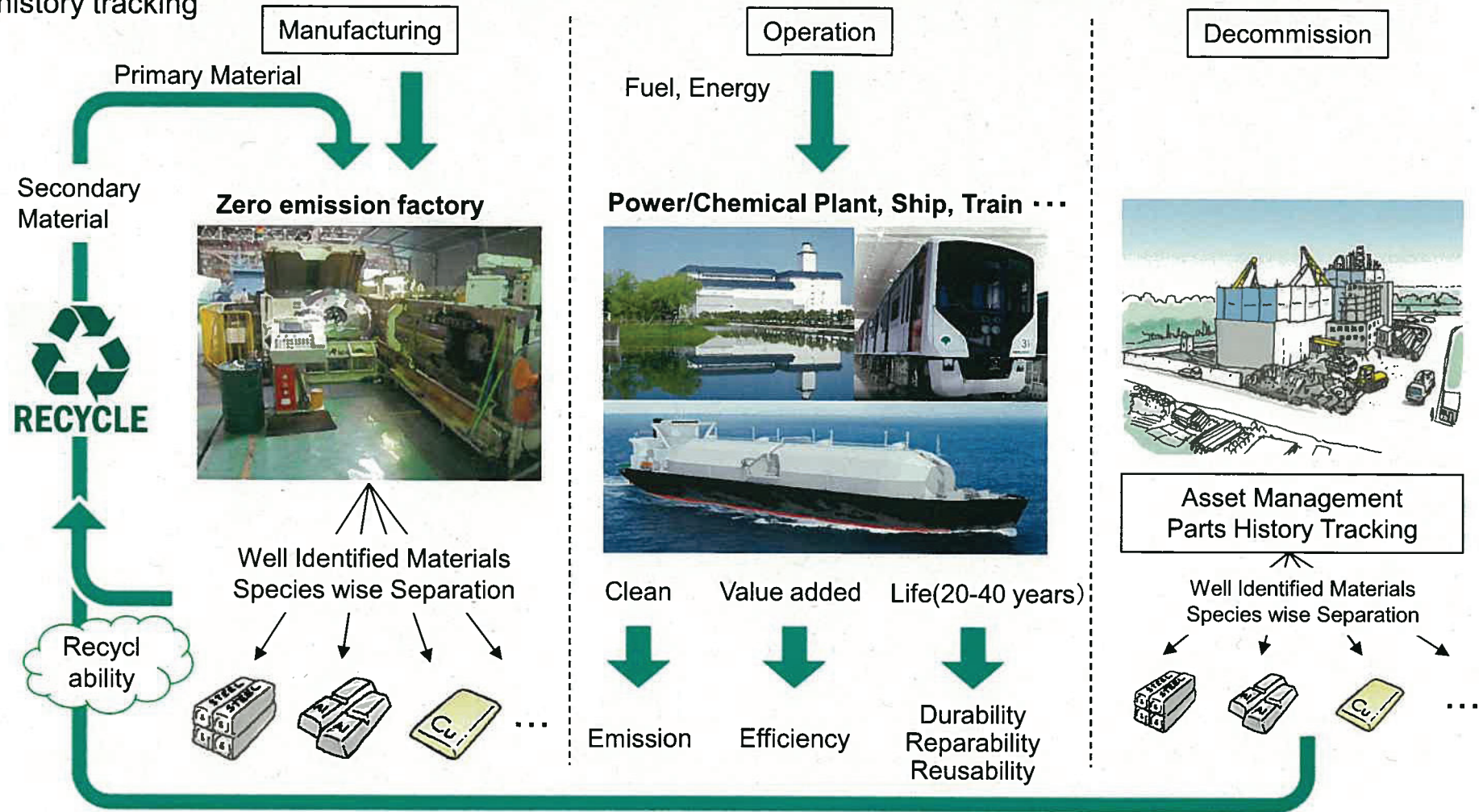
Material Efficiency in Manufacturing (Heavy Industries)



【Manufacturing】 Well Identified materials enable species wise separation.

【Operation】 Durability and reparability enables high resource efficiency through efficient long term operation.

【Decommission】 Recycling after long term operation over a few decades needs asset management by parts history tracking



Source : MHI HP,

Meaningful KPIs for major products categories



Life Cycle Stage	Principles (appropriate KPIs for each)	Digital Content Effectiveness Effective through stages	Major Products Category(Illustrative)				
			EEE*1	Vehicle	Aircraft	Power Plant	Bridge
Design	Material Choice	○	○	○	○	○	Effective on various products
	Modular				○	○	
	Use Less			○	○		
Procurement	More Recycle	○		○			
Production	Use Less	○	○				
	Less Waste	○	○		○	○	
Logistics	Use Less	○	○	○	Intermediate		
	Packaging		○				
Installation	Use Less					○	○
Use	Use Longer	○	Procurement Through Logistic dominant		○	○	○
	Repair			○	○	○	○
	Upgrade				○	○	
	Reuse	○		○	○		
	Use Less	○		○	○	○	Use stage dominant
	Sharing	○		○			
End of Life	Less Waste	○	○	○			○
	More Recycle	○	○	○	○	○	○
KPI for Key Value Offering			CPU Power	PK*2	RPK*3	Electricity	Traffic

Source : Alcatel HP, PSA HP, Airbus HP, MHI HP

*1: Electric and Electrical Equipment, *2: Passenger Kilometer, *3: Revenue Passenger Kilometer