Resource Efficient and Cleaner Production

Concept, Practices & Applications

Surabaya, 16 February 2017

National Resource Efficient and Cleaner Production (RECP) Programme Indonesia

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Swiss Confederation

UNIDO

Kementerian Lingkungan Hidup dan Kehutanan

Kementerian Perindustrian

RECP Introductory Training
Efisiensi Sumber Daya dan Produksi Bersih

Concept

Applications

Practices

RECP for green industry
Resource Efficient and Cleaner Production emerged as a business response to worsening (industrial) pollution and escalating use of natural resources.
Resource Efficient and Cleaner Production
Efisiensi Sumber Daya dan Produksi Bersih

• Finding and implementing ways to
  – Improve productive use of materials, water and energy;
    • Thereby
  – Reduce the generation of waste, effluent and emissions;
    • Thereby
  – Improve well being of employees, consumers and community;
    • Thereby
    • .......
Productive output per unit of resource consumption

Pollution intensity per unit of productive output
RECP Issues

Produktivitas Bahan Baku
Pemilihan dan efisiensi bahan baku

Produktivitas Air
Pemilihan dan efisiensi air

Produktivitas Energi
Pemilihan dan efisiensi energy

Intensitas Sampah
Penurunan dan buangan yang aman dari limbah

Intensitas Limbah Cair
Penurunan dan Pengolahan air limbah

Intensitas Emisi
Penurunan dan Pengendalian gas buang
Resource Efficient and Cleaner Production can be implemented through – combinations of – different prevention practices
Efisiensi Sumber Daya dan Produksi Bersih

- Tata Kelola Area Kerja
- Substitusi Bahan
- Modifikasi Produk
- Peningkatan Pengendalian Proses
- Modifikasi Peralatan
- Penggantian Teknologi
- Pemanfaatan Produk Samping
- Guna Ulang Dan Daur Ulang di Lokasi Sendiri
• Maintain a clean, organized and productive workplace to eliminate avoidable ‘wastage’

• Typical solutions
  – Switch off what is not in use
  – Repair what needs reparation
  – Keep workplace organized and clean
  – Minimize and manage inventory
  – Confirm right way for all tasks
  – Keep staff motivated
• Choose inputs that are efficient, effective and/or pose minimum harm to the environment and health

• Typical solutions
  – Use renewable energy
  – Use sustainably-sourced renewable materials
  – Use of recycled materials, water and energy
  – Use fit for purpose materials
  – Use less harmful substances
  – Source locally
Monitor and control processes and equipment so that they always run at highest efficiency and with lowest wastage

- Typical solutions
  - Standard operating procedures and process monitoring
  - Sub-metering water, energy and materials
  - Preventive maintenance
• Make existing equipment more efficient and less wasteful

• Typical solutions
  – Insulation
  – Proper alignment of production line
  – Improve process temperature, pressure, speed, mixing
  – Automatic switch off & level controls
  – Combine process steps in same equipment
• Change over to new technology that is more efficient or produces less waste

• Typical solutions
  – Efficient boilers, motors, fans, compressors etc.
  – Change of core process, e.g. chemical to mechanical cleaning
  – Equipment with integrated recovery loops
  – Advanced separation processes
  – Solar dryers, heaters and lighting
• Use previously ‘wasted’ material, energy and/or water for similar or alternative purpose in company

Typical solutions
• Countercurrent or cascaded use of water and energy
• Condensate and heat recovery
• Reuse of incoming packaging for outgoing products
• Convert a previous ‘waste’ for a useful use elsewhere

Typical solutions

• Provision of used cooling water for external heating or cooling purposes

• Segregate recyclables for external recycling and resource recovery, such as composting

• Symbiosis - use waste material for new product development
• Redesign product to reduce its environmental impact during production, use and/or disposal

• Typical solutions
  – Design for optimal product lifetime
  – Design for lower material use
  – Design for low-waste manufacturing
  – Design for refurbishment, recycling etc.
RECP Method

**Root Source Analysis**
WHERE?
Quantification of the different usages and sources

**Root Cause Diagnosis**
WHY?
Factors contributing to resource usage and pollution sources

**Option Generation**
HOW?
Alternative ways to avoid the identified causes
Resource Efficient and Cleaner Production has been beneficially applied in many industry sectors, including sugar and food, steel and metal products.
Kibos Sugar & Allied Industries

RECP Profile

RESOURCE PRODUCTIVITY (change in %)

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>80</td>
<td>53</td>
<td>119</td>
</tr>
<tr>
<td>Materials</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Water</td>
<td>5</td>
<td>2</td>
<td>124</td>
</tr>
</tbody>
</table>

POLLUTION INTENSITY (change in %)

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>-44</td>
<td>-34</td>
<td>-10</td>
</tr>
<tr>
<td>Waste water intensity</td>
<td>-54</td>
<td>-39</td>
<td>-57</td>
</tr>
<tr>
<td>Waste</td>
<td>-39</td>
<td>-39</td>
<td>-44</td>
</tr>
<tr>
<td>Option 1: Water Management:</td>
<td>Investment of US$ 5,625</td>
<td>Water use reduction from 400 m³ /day to 250 m³ /day i.e. 120,000 m³ to 75,000 m³ /yr.</td>
<td>Reduction in wastewater.</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>• Repair of tap leakages</td>
<td>Approx. US$ 1,875 in cost savings per yr.</td>
<td>• Improved waste water quality</td>
<td>Reduced electricity costs</td>
</tr>
<tr>
<td>• Leaking water pipes and hoses replaced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pipe diameter reduction for car washing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ban of hose washing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Flow meters fixed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Recycling of process water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Maximization of steam recovery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced wet washing</td>
<td>Cost Savings US$ 1,606 p/a</td>
<td>• Less chemical use</td>
<td>• Zero waste water discharge achieved</td>
</tr>
<tr>
<td>• Elimination of hose use to clean juice and molasses spills</td>
<td></td>
<td>• Reduced usage of treated water for construction and road watering during dusty weather.</td>
<td></td>
</tr>
<tr>
<td>• Redirection of storm waters away from effluent drainage line</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Constructed waste water storage tank for wastewater reuse</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 3: Materials Management:</th>
<th>Nil as per the time of baseline data.</th>
<th>Low material waste load</th>
<th>Aesthetic balance of the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Re-use of wooden wastes</td>
<td></td>
<td>• Larger storage area due to extra available space</td>
<td></td>
</tr>
<tr>
<td>• Use of bagasse for firing boiler to enhance power generation. Filter mud used as fertilizer.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Option 4: Energy Management:
- Energy management team formation
- Awareness creation to staff regarding energy management via posters and notices.
- Instill culture of turning off equipment and lights when not in use.
- Delamping to rid off high energy consuming bulbs i.e. 400w to 22w energy saving bulbs.
- Additional transparent polycarbonate sheets installed at mill house provide adequate light during the day, eliminating use of six (6) bright 250watt bulbs. 100% E saving day time.
- Capacitors installed for power storage.
- New energy efficient cane kicker of 55kw/75hp installed. The old one was inefficient.
- Old 100HP squirrel cage induction motor for the cane chopper was replaced by more efficient 200HP slip ring motor with automatic liquid resistance starter.
- Old Cane carrier motor (37kw/40hp) was replaced by an energy efficient 45kw/60hp, 81 Amps, fitted with a VFD.
- Another new efficient motor: 37kw/40hp/64 with VFD was installed for the Rake carrier, drawing only 44Amps, another 31% saving.
- New EE AC motor (450kw/600hp/850 Amps with VFD fixed for Mill Sand drawing only 700amps-12% saving. Top roller pressure feed (TRPF) motor (110kw/150hp/184 Amps) also installed for Mill 5 and draws only 66Amps-64% saving.

<table>
<thead>
<tr>
<th>Delamping Investment – US$ 8,047</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Savings US$ 32,851p/a</td>
</tr>
<tr>
<td>US$445 investment</td>
</tr>
<tr>
<td>US$1,826 savings p.a.</td>
</tr>
</tbody>
</table>

Investment US$ 14,000
Cost Saving of US$ 15,028 p.a.
US$4,705 investment
US$13,065 savings/yr.
US$5,588 investment
US$4,749.8 savings/yr.

US$12,235 investment
US$19,823 savings/yr.

US$2941 investment
US$10,715 savings/yr.

US$9411 investment
US$80,364 savings/yr.

US$4705 investment
US$65,327 savings/yr.

- Energy use reduction by up to 24% 
- Lower KVA demand 
- Optimum power factor of 9.6 on average.

www.cpkenya.org

RECP Introductory Training
## Kibos Sugar & Allied Industries

### Option 5: Solid Waste Management:
- Re-use
- Recycling
- Donations /Free issuance to willing users i.e. filter mud, bagasse, waste concrete and ash
- Collection of sugar dust instead of waste

<table>
<thead>
<tr>
<th>Option 5: Solid Waste Management:</th>
<th>Investment cost US$ 212 (Manual labour)per month –US$ 2,544 per year</th>
<th>Activated recycling hence low solid waste buildup</th>
<th>Cleaner environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Returns of US$ 1,000 per month (US$ 12,000 per year)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Option 6: Air Emissions:
Monitoring of stack emissions annually (tests)

<table>
<thead>
<tr>
<th>Option 6: Air Emissions:</th>
<th>Environmental monitoring</th>
<th>Environmental monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test costs of US$ 882.7</td>
<td></td>
<td>Reduced GHG</td>
</tr>
</tbody>
</table>

### Total of all Implemented Options.

<table>
<thead>
<tr>
<th>Total of all Implemented Options.</th>
<th>Investment US$72,996.7</th>
<th>Estimated cost savings of US$ 259,229.8</th>
</tr>
</thead>
</table>

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### Energy Opportunities in Sugar Mills

<table>
<thead>
<tr>
<th>New equipment - Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>14 Measures</strong></td>
</tr>
</tbody>
</table>

- Thermal insulation of steam lines and valves
- Power factor improvement
- Installation of more efficient boilers
- Energy efficient motors
- Condensate recovery
- Installation of heat recovery from exhaust flue gases
- Installation of variable frequency drives or inverters on motors
- Improved energy efficiency of other hot processes
- Installation of energy efficient lighting
- Installation of heat recovery from water blow down
- Thermal insulation of the boiler or of the boiler feed water tank
- Introduction of more energy efficient equipment
- Heat recovery from other process
- Improved energy efficiency of the drying process

Sustaining Growth: Cleaner Production in Pakistan, National Productivity Organization and Cleaner Production Institute, 2016)
Energy Opportunities in Sugar Mills

- Process operation:
  - Metering
  - Improved moisture control in the compressed air network
  - Improved air combustion inlet
  - Improved monitoring of total harmonic distortion
  - Limited use of compressed air
  - Optimized loading/unloading of the compressors
  - Load management
  - Optimized pressure in the compressed air network
  - Tuning of the boiler burners and improvement of the air-to-fuel ratio

- Maintenance:
  - Repair of steam and condensate leakages
  - Control of compressed air leakage
  - Improved maintenance operations for electrical motors
  - Reduction of voltage unbalance
  - Improved maintenance of other machines or equipment

66 sugar mills in Pakistan
# Energy Opportunities in Sugar Mills

<table>
<thead>
<tr>
<th>Energy Opportunity</th>
<th>Estimated payback period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate recovery</td>
<td>0.1</td>
</tr>
<tr>
<td>Improve energy efficiency of other hot processes</td>
<td>0.3</td>
</tr>
<tr>
<td>Thermal insulation of steam lines and valves</td>
<td>0.4</td>
</tr>
<tr>
<td>Thermal insulation of the boiler or of the boiler feed water tank</td>
<td>0.6</td>
</tr>
<tr>
<td>Heat recovery from other process</td>
<td>0.6</td>
</tr>
<tr>
<td>Improve the air combustion inlet</td>
<td>0.6</td>
</tr>
<tr>
<td>Change for a more efficient boiler</td>
<td>0.9</td>
</tr>
<tr>
<td>Use energy efficient equipments</td>
<td>0.9</td>
</tr>
<tr>
<td>Change for energy efficient motors</td>
<td>1.1</td>
</tr>
<tr>
<td>Installation of heat recovery from exhaust flue gases</td>
<td>1.4</td>
</tr>
<tr>
<td>Installation of Variable frequency drives or inverters on motors</td>
<td>1.4</td>
</tr>
<tr>
<td>Installation of energy efficient lighting</td>
<td>1.5</td>
</tr>
<tr>
<td>Improve energy efficiency of the drying process</td>
<td>1.6</td>
</tr>
<tr>
<td>Flue gas Heat Recovery</td>
<td>Not available</td>
</tr>
<tr>
<td>Installation of heat recovery from water blowdown</td>
<td>Not available</td>
</tr>
</tbody>
</table>

- **Short payback period**: Condensate recovery, Improve energy efficiency of other hot processes, Thermal insulation of steam lines and valves, Thermal insulation of the boiler or of the boiler feed water tank, Heat recovery from other process, Improve the air combustion inlet, Change for a more efficient boiler, Use energy efficient equipments.

- **Medium payback period**: Installation of heat recovery from exhaust flue gases, Installation of Variable frequency drives or inverters on motors, Installation of energy efficient lighting.

- **Long payback period**: Improve energy efficiency of the drying process, Flue gas Heat Recovery, Installation of heat recovery from water blowdown.

66 sugar mills in Pakistan

*Source: Sustaining Growth: Cleaner Production in Pakistan, National Productivity Organization and Cleaner Production Institute, 2016*
Water Opportunities in Sugar Mills

- Installation of water shut off valves on water hoses
- Installation of water flow meters on water inlets
- Reuse of evaporator cooling water
- Reuse of mill cooling water
- Installation of water flow meters
- Reuse of wastewater in floor washing
- Reuse of steam turbine cooling water
- Reuse of compressor cooling water
- Reuse of turbo bearing cooling water on ash spraying system
- Condensate recovery
- Installation of recycling system for less polluted streams and water shut-off valves
- Installation of flow meters and water shut-off valves
- Cooling tower installation
- Reuse of turbine, gear & generator cooling water
- Vacuum pump cooling water

- Optimum use of imbibition water
- Monitoring and measurement of raw water

- Pump packing leakage

66 sugar mills in Pakistan

Sustaining Growth: Cleaner Production in Pakistan, National Productivity Organization and Cleaner Production Institute, 2016
Water Opportunities in Sugar Mills

<table>
<thead>
<tr>
<th>Measure</th>
<th>Water savings potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reuse of Turbines’, Gear’ &amp; Generator’s Cooling Water</td>
<td>34%</td>
</tr>
<tr>
<td>Cooling Tower installation</td>
<td>33%</td>
</tr>
<tr>
<td>Condensate recovery</td>
<td>22%</td>
</tr>
<tr>
<td>Reuse of Mills’ Cooling Water</td>
<td>8%</td>
</tr>
<tr>
<td>Vacuum Pump Cooling Water</td>
<td>6%</td>
</tr>
</tbody>
</table>

66 sugar mills in Pakistan

Sustaining Growth: Cleaner Production in Pakistan, National Productivity Organization and Cleaner Production Institute, 2016)
# Materials Efficiency in Sugar Mills

<table>
<thead>
<tr>
<th>Materials</th>
<th>Saving potential rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricants</td>
<td>44%</td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td>40%</td>
</tr>
<tr>
<td>Soda Ash</td>
<td>34%</td>
</tr>
<tr>
<td>Quick Lime</td>
<td>30%</td>
</tr>
<tr>
<td>Caustic Soda</td>
<td>28%</td>
</tr>
<tr>
<td>Polyelectrolytes</td>
<td>25%</td>
</tr>
<tr>
<td>Others</td>
<td>not assessed</td>
</tr>
</tbody>
</table>
One Steel, Newcastle Rod Mill

• Making energy a core business issue with:
  – new organizational structures and management systems that integrate energy efficiency in core business processes
  – the development of energy efficiency tools to assist in the identification and evaluation of energy efficiency opportunities
  – a cultural change program that aims to engage and motivate staff to use energy more efficiently.

• 11 opportunities realized in first year, resulting in 6% energy savings (~68,000 GJ/yr)

• Significant co-benefits
  – Oxygen sensor in reheating furnace increased capacity by 0.2 %, valued at A$300,000
  – Energy efficient compressors have reduced operational risks due to higher reliability and ease of maintenance
Small Scale Re-Rolling Mills

• 29 small scale mills
  – Total energy savings: 87,819,968 MJ
  – Total GHG reduction: 131,738 tCO₂

• 16 companies
  – Investment: 7.24 million USD
  – Annual savings: 9.14 million USD
Shining Engineers & Founders

- Grey iron foundry, using cupola furnaces
  - Replaced cupola and change to Divided Blast Cupola (DBC) operation
    - Reduced reject from 7 to 5%
    - Coal use reduced by 30%
    - Eliminated need for alloying ferro-nickel and ferro-manganese
    - Cost savings ~USD13/ton product
    - Investment of ~USD15,000 recovered within 1 year
EAF Steel Sector (Vietnam)

Viet Nam EAF steel sector

2 are within good practice range (2.1-2.4 GJ/t)

• Energy intensity significantly higher than international good practice
  • Low scrap quality
  • Insufficient process monitoring
  • Lacking slag analysis
    ➔ compounded by limited basic furnace and metallurgical knowledge

9 use 20-80% more energy than good practice


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EAF Steel Sector (Vietnam)

Energy Reductions

- 7 improved, 4 thereof reduced energy by 6-21%

GHG Reductions

- 8 improved, 6 thereof reduced GHG emissions by 10-30%


RECP Introductory Training
<table>
<thead>
<tr>
<th>Production step</th>
<th>Process</th>
<th>Blast furnace-basic oxygen furnace</th>
<th>Smelt reduction - basic oxygen furnace</th>
<th>Direct reduced iron-electric arc furnace</th>
<th>Scrap-electric arc furnace</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Final</td>
<td>Primary</td>
<td>Final</td>
<td>Primary</td>
</tr>
<tr>
<td>Material</td>
<td>preparation</td>
<td>Sintering</td>
<td>1.9</td>
<td>2.2</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Pelletizing</td>
<td>0.6</td>
<td>0.8</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Coking</td>
<td>0.8</td>
<td>1.1</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Iron making</td>
<td>Blast furnace</td>
<td>12.2</td>
<td>12.4</td>
<td>17.3</td>
<td>17.9</td>
</tr>
<tr>
<td></td>
<td>Smelt reduction</td>
<td></td>
<td></td>
<td>11.7</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>Direct reduced iron</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steelmaking</td>
<td>Basic oxygen furnace</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.3</td>
</tr>
<tr>
<td></td>
<td>Electric arc furnace</td>
<td></td>
<td></td>
<td>2.5</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>Refining</td>
<td>0.1</td>
<td>0.4</td>
<td>0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Casting &amp; rolling</td>
<td>Continuous casting</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Hot rolling³</td>
<td>1.8</td>
<td>2.4</td>
<td>1.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>16.5</td>
<td>18.2</td>
<td>19.5</td>
<td>21.2</td>
</tr>
<tr>
<td>Cold rolling &amp; finishing</td>
<td>Cold rolling</td>
<td>0.4</td>
<td>0.9</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Finishing</td>
<td>1.1</td>
<td>1.4</td>
<td>1.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18.0</td>
<td>20.6</td>
<td>21.0</td>
<td>23.6</td>
</tr>
<tr>
<td>Alternative:</td>
<td>Casting &amp; rolling</td>
<td>0.2</td>
<td>0.5</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Alternative total:</td>
<td></td>
<td>14.8</td>
<td>16.3</td>
<td>17.8</td>
<td>19.2</td>
</tr>
</tbody>
</table>

http://www.iipnetwork.org/
# State of Art Clean Technologies

## Process | State of the Art Clean Technologies
---|---
**Sinter Plant** | - Sinter Plant Waste Heat Recovery  
- Sinter Plant Waste Reuse (e.g. district heating)  
- Dust Emissions Control  
- Exhaust Gas Treatment through Denitrification, Desulphurization and Activated Coke Packed Bed Absorption  
- Exhaust Gas Treatment through Selective Catalytic Reduction  
- Exhaust Gas Treatment through Low Temperature Plasma  
- Improvements in Feeding Equipment  
- Segregation of Raw Materials of Pellets  
- Multi-Slit Burner in Ignition Furnace  
- Equipment to Reinforce Granulation  
- Biomass for Iron and Steel Making  
- Exhaust Gas Treatment through Additive Injection and Bagfilter Dedusting

**Coke Making** | - SCOPE21: Super Coke Oven for Productivity and Environmental Enhancement towards 21st Century  
- Coke Dry Quenching  
- Coal Moisture Control  
- High Pressure Ammonia Liquor Aspiration System  
- Modern Leak Proof Door  
- Land Based Pushing Emission Control System  
- Coke Plant Automation and Process Control  
- Heat Recovery from Coke Battery
# State of Art Clean Technologies

<table>
<thead>
<tr>
<th>Process</th>
<th>State of the Art Clean Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blast Furnace Iron Making</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Top Pressure Recovery Turbine</td>
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<td></td>
<td>• Pulverized Coal Injection System</td>
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<td></td>
<td>• Blast Furnace Heat Recuperation</td>
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<td></td>
<td>• Improve Blast Furnace Charge Distribution</td>
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<td></td>
<td>• Blast Furnace Gas and Cast House Dedusting</td>
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<tr>
<td></td>
<td>• Cast House Dust Suppression</td>
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<td></td>
<td>• Slag Odor Control</td>
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<tr>
<td></td>
<td>• Blast Furnace – Increase Hot Blast Temperature (&gt;1100 C)</td>
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<tr>
<td></td>
<td>• Blast Furnace – Increase Blast Furnace Top Pressure (&gt;0.5 Bar)</td>
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<tr>
<td></td>
<td>• Optimize Blast Furnace Process Control (Expert System)</td>
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<tr>
<td><strong>Blast Oxygen Furnace</strong></td>
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<tr>
<td></td>
<td>• Use BOF Exhaust as Fuel</td>
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<td></td>
<td>• Fully Enclose BOF</td>
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<td></td>
<td>• Control and Automation of Converter Operation</td>
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<tr>
<td></td>
<td>• Exhaust Gas Cooling System (combustion based)</td>
</tr>
<tr>
<td></td>
<td>• Dry Cyclone Dust Catcher</td>
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<tr>
<td></td>
<td>• Optimize BOF Refractory Life Time (laser contouring)</td>
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<tr>
<td></td>
<td>• BOF Bottom Steering</td>
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<tr>
<td></td>
<td>• Pressured Steam Aging for Steel Slag</td>
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</tbody>
</table>
Business Case

- Cost savings
- Productivity enhancements
- Quality improvements
- Organizational efficiency
- License-to-operate
Indonesia RECP Programme

• Networked initiative to foster RECP implementation *at scale* and *at speed* in Indonesia

- Sectors (food, textile & metal)
- Industrial Zones (Makassar & Batam)
- Micro-Industries (rice milling & TBC)
- Tourism Destinations (Sleman/Magelang & Lake Toba)

1. RECP Capacity & Network
2. RECP Implementation & Replication
3. RECP Policy & Strategy
4. RECP Technology & Innovation
5. RECP Finance & Investment
Programme activities in East Java

RECP Network

Food Processing
Food Processing

Training of Experts and Enterprises
Assessor Assessments
Self Assessments
RECP Assessors Training

• **Aim**
  – Equip trainee assessors with necessary methods and skills to undertake RECP assessments in enterprises

• **Modality**
  – Class room training (twice, three days each)
  – Practical assignment (RECP assessments in two demonstration enterprises)
  – Expert coaching and guidance
    • → UNIDO RECP Award

4 experts from East Java trained and being coached to execute RECP assessments
Assessor Assessments

• Enterprises
  – Obtain a catalogue of RECP options that will improve resource efficiency and reduce pollution with recommendations for implementation
  – Improve awareness, understanding and capacity to manage and minimize resource consumption and pollution generation

• Associate RECP Assessors
  – Gain practical experience in conducting RECP assessments in sector, under guidance of RECP expert team
  – Complete basic RECP assessment training and obtain recognition as RECP expert

First assessments undertaken in four sugar mills under PTPN X and PTPN XI
RECP Clubs

• Facilitate RECP uptake in groups of food processing enterprises
  – Self assessment
    • Utilize internal resources for RECP option identification, evaluation and implementation
  – Combined with enterprise training and coaching

Expressions of interest sought
An action partnership of organizations that commit to promote RECP and implement RECP within their activities and/or sphere of influence.

Vibrant network of Indonesian RECP professionals that work together to expand and improve the awareness, knowledge and application of RECP in Indonesia.

**RECP Network Indonesia**

- **Other Elements (TBD)**
- **Alliance/Partnership**
- **Expert Pool**

- **Local Practitioners Forums**
- **Bandung Declaration 8 Nov 2016**
Terima kasih banyak!

www.recpindonesia.org
www.recpnet.org

National Resource Efficient and Cleaner Production (RECP) Programme Indonesia

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Swiss Confederation

UNIDO

Kementerian Lingkungan Hidup dan Kehutanan

Centre for Assessment & Development of Green Industry & Environment