

## Trainer Instructions: Cooling Towers

From: *Energizing Cleaner Production – a Guide for Trainers, UNEP/InWEnt, 2007*

<b>Title</b>	<b>COOLING TOWERS</b>
<b>Objective</b>	To obtain an understanding of cooling towers, including the types of cooling towers, how to assess their performance and the main areas for energy conservation.
<b>Minimum duration and approach</b>	<ul style="list-style-type: none"> <li>▪ 1 session (1.5 hours), including the quiz and workshop exercise</li> <li>▪ Recommended approach: spend up to 1 hour on the PowerPoint presentation, and then ask participants to do the quiz and workshop exercise individually or in pairs in about 20 minutes (they can be combined because the workshop exercise is very short). Leave 10 minutes for going through the answers.</li> <li>▪ Presentation: 38 slides</li> <li>▪ Textbook chapter: 17 pages</li> </ul>
<b>Contents</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Types of cooling towers</li> <li>▪ Assessment of cooling towers</li> <li>▪ Energy efficiency opportunities</li> </ul>
<b>Assessment of participants</b>	<ul style="list-style-type: none"> <li>▪ Pose questions during the presentation. Ask participants to explain the difference between natural draft and mechanical draft cooling towers at the end of the “types of cooling towers” part.</li> <li>▪ Take the quiz with 10 multiple choice questions.</li> <li>▪ Carry out the workshop exercise. Ask the participants the following: <p style="margin-left: 20px;"><i>Calculate the cooling tower (CT) capacity in tons of refrigeration (TR) using the following data:</i></p> <ul style="list-style-type: none"> <li>- <i>Water flow rate through CT: 120 m<sup>3</sup>/h</i></li> <li>- <i>Specific heat of water: 1 kCal/kg °C</i></li> <li>- <i>Inlet water temperature: 37 °C</i></li> <li>- <i>Outlet water temperature: 32 °C</i></li> <li>- <i>Ambient wet bulb temperature (WBT): 29 °C</i></li> </ul> <p style="margin-left: 20px;">If participants have difficulties completing the workshop exercise, then it may be helpful to give them the formula they should use: <i>Cooling tower capacity = (flow rate x density x specific heat x temperature difference) / 3024</i></p> </li> </ul>
<b>Other comments</b>	<ul style="list-style-type: none"> <li>▪ Cooling towers use motors, fans and pumps. For this reason it is recommended to have this session after the sessions “electric motors”, “fans and blowers”, and “compressors and compressed air systems.”</li> <li>▪ Case study options from <a href="http://www.energyefficiencyasia.org">www.energyefficiencyasia.org</a> or other sources could</li> </ul>

	be included in this session to illustrate how other companies reduce energy consumption and costs.
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