Introduction

- Hot water is required for the comfort of people in buildings.
- Hot water supply must be adequate in order to meet the occupants’ demand.
- There are different ways of heating water. Depending on the resources available the technologies used can be:
  - Solar water heaters
  - Gas water heaters
  - Electric water heaters
  - Heat pumps
- On the other hand hot water preparation can be integrated with central heating systems.
Water Heating System in Houses

COLD WATER TANK

HOT WATER STORAGE TANK

HOT AND COLD WATER USAGE

SERVICE PIPE

AIR VENT

Fuel (Direct Heating)
Heat Losses from Pipes

DEAD LEGS:

Connections from the hot water source (or secondary flow) to the taps are known as dead-legs.
Dead Legs

- Dead legs occur in hot water systems where water does not move for a period of time.
- In central systems there are pipework linking the central supply with the draw-off points.
- Between draw-offs the water in the pipe will cool and the next draw off will involve running the cold water to waste before it reaches the tap, creating dissatisfaction, waste of water and heat.
- In these systems in order to keep consumption within reasonable limits dead legs of pipework serving hot-water taps are governed to following maximum lengths:

<table>
<thead>
<tr>
<th>Pipe diameter</th>
<th>Maximum Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
<td>12 m</td>
</tr>
<tr>
<td>25 mm</td>
<td>7.6 m</td>
</tr>
<tr>
<td>More than 25 mm</td>
<td>3 m</td>
</tr>
<tr>
<td>Spray taps</td>
<td>1 m</td>
</tr>
</tbody>
</table>
How to Avoid Dead Legs

To avoid dead legs in plumbing systems there are two common approaches;
1. Install a secondary return pipe.
2. Maintain the water temperature at all times with trace heating.

Trace heating takes the form of an electrical heating element run in physical contact along the length of a pipe.
**Estimation of hot-water storage**

Code of Practice 342 (Centralized Hot-Water Supply, UK)

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>Storage per person (litres)</th>
<th>Type of Building</th>
<th>Storage per person (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colleges &amp; Schools:</td>
<td></td>
<td>Hospitals:</td>
<td></td>
</tr>
<tr>
<td>Boarding Day</td>
<td>23</td>
<td>General Infectious</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>Maternity Nurses’ homes</td>
<td>45.5</td>
</tr>
<tr>
<td>Dwelling houses</td>
<td>45.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factories</td>
<td>4.5</td>
<td>Hostels</td>
<td>32</td>
</tr>
<tr>
<td>Flats</td>
<td>32</td>
<td>Offices</td>
<td>4.5</td>
</tr>
<tr>
<td>Hotels (Average)</td>
<td>35</td>
<td>Sports pavilions</td>
<td>36</td>
</tr>
</tbody>
</table>

By use of the table, a dwelling with 3 occupants will require 45.5 x 3 = 136.5 litres of hot water-storage.
Hot Water Storage

- Estimation of hot-water storage
  If the number of occupants is not known the following table may be used

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>VOLUMES OF HOT WATER (Litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASH BASIN</td>
<td></td>
</tr>
<tr>
<td>Hand wash</td>
<td>1.5</td>
</tr>
<tr>
<td>Wash</td>
<td>3</td>
</tr>
<tr>
<td>Hair wash</td>
<td>6</td>
</tr>
<tr>
<td>SHOWER</td>
<td>13</td>
</tr>
<tr>
<td>BATH</td>
<td>70</td>
</tr>
<tr>
<td>WASHING MACHINE</td>
<td>70</td>
</tr>
<tr>
<td>SINK</td>
<td></td>
</tr>
<tr>
<td>Wash up</td>
<td>15</td>
</tr>
<tr>
<td>Cleaning</td>
<td>5</td>
</tr>
</tbody>
</table>
Storage-Type Electric Water Heater

The following figure shows the typical dimensions used in Cyprus.
Storage-Type Gas-Fired Water Heater

1. Thermostat
2. Flue pipe
3. Cold water feed
4. Hot water outlet
5. Burner
6. Buffer
Instantaneous Gas Water Heater

- Exhaust pipe
- Heat exchanger pipes
- Burner
- Cold water
- Hot water
- Gas
Instantenous Electrical Water Heater
Solar Collector Assembly

Source: homepower.com
Thermosyphon-Type Solar Water Heater

Solar Water Heater

- Insulation
- Solar Collectors
- Thermosiphon Action

Components:
- Cold Water Tank
- Hot Water Cylinder
- Collectors
- Cold Water Feed
- Circulation of Water by THERMOSIPHON action

Diagrams show the flow of water through the system, with solar energy heating the water in the collectors, which then circulates through the hot water cylinder.
Forced Circulation Solar Water Heating

Solar Heating System
(Water Circulation with a Pump)

Coil used in indirect heaters

Source: http://www.pacificenergysales.com/for-homeowners/solar
Solar Collectors Integrated into the Inclined Roof Structure

Diagram: A diagram showing solar collectors integrated into an inclined roof structure. The solar collectors are connected to cold and hot water tanks via pipes. The cold water tank is fed by cold feed, and the hot water tank is connected to the solar energy source. The inclined roof structure is highlighted with an inset image of a real installation.
Hot Water Generation with Central Boiler

- Hot water can be generated by the central boiler plant and stored.
Hot Water Generation with Heat Pumps

- Cool air
- Warm air

- Single 1700W backup element
- 20 sq ft wrap-around condenser
- Large 80 gal. storage capacity
- Replaceable sacrificial anode

**HOW IT WORKS**