Water Demand Management
-Singapore’s Experience

Chua Chor Pheng, Deputy Director
Water Supply Network Department PUB
Country Information

Singapore

- Land Area: 704 km²
- Population: 4.85 mil
- Average Annual Rainfall: 2,400 mm
- Average Water Demand: 1.3 mil m³/day

Water for All: Conserve, Value, Enjoy
OVERVIEW

“My to deliver and sustain a clean and healthy environment and water resources for all in Singapore.”

“To ensure an efficient, adequate & sustainable supply of water”

“A Statutory Board constituted under the Public Utilities Act 2001 to provide integrated water supply, sewerage and drainage services

Water for All: Conserve, Value, Enjoy

“Clean Water”

Clean Land

Clean Air

Public Health
PUB Manages the Complete Water Cycle
From sourcing, collection, purification and supply of drinking water, to treatment of used water and turning it into NEWater, drainage of storm water
Integrated Water Resource Management

**4 Taps**

**FOUR TAPS**

Local catchment
Imported water
NEWater
Desalinated water

“Water for All”

**3P Approach**

“Conserve Water”
“Value Our Water”
“Enjoy Our Waters”

“Conserve, Value, Enjoy”

Water for All: Conserve, Value, Enjoy
**Local Catchments Waters**

- **Half of Singapore** is already water catchment
- Catchment area will be increased from half to two-thirds by 2011

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**Legend**
- Unprotected Water Catchment
- Protected Water Catchment
- Proposed Water Catchment

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**First Tap**

- MacRitchie Reservoir
- Kranji Reservoir
- Bedok Stormwater Pond

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**Water for All: Conserve, Value, Enjoy**
Local Catchments: Marina Barrage

Creating a reservoir in the city

- Urban catchment comprising a seventh of Singapore
- Located at the edge of the Central Business District
- 3-in-1 function: water storage, flood control, lifestyle attraction
- Officially opened by the Prime Minister on 31st Oct 08
Expanding the First Tap

Punggol – Serangoon Reservoir Scheme

The 16th and 17th reservoirs of Singapore
Imported Water from Johor

- **Two water agreements with Johor, Malaysia**
  - 1961 to 2011
  - 1962 to 2061
Third Tap

NEWater

Legend
- NEWater pipeline
- NEWater Plant
- Service Reservoir

Tot Capacity: 122 MGD

- 9 mgd in Jan 2003, Kranji
- Expanded to 17 mgd

- 5 mgd in Feb 2004, Seletar

- 7 mgd in Jan 2003, Bedok
- Expanded to 18 mgd

- 32 mgd in Mar 2007, Ulu Pandan

Changi
5th NEWater Plant
60 mgd by 2010
Fourth Tap

**Desalinated Water**

- To augment and diversify our water resources
- SingSpring Pte. Ltd., under a 20 year DBOO arrangement with PUB
- One of the largest seawater RO plants
- Supply of 30 mgd for 20 years
- Opened on 13 Sep 05
Water Demand Management
**Increasing Water Demand**

Population (in millions):
- 1950: 1
- 2008: 4.8

Daily water consumption (in thousand cubic metres):
- 1950: 142
- 2008: 1262

4.8 Times

8.9 Times
Conserving our Waters

**Water Demand Management**

**UFW Control**
- Network Management
- Measures To Control UFW
- Leak Control
- Accurate Metering

**Water Conservation**
- **Pricing**
  Reflect the strategic importance and scarcity value of water
- **Water Conservation Strategy**
- **Voluntary**
  3P approach
  Promote ownership of water conservation
- **Mandatory**
  Cut down on excessive flow and wastage of water

**Percentage Water Conservation**

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<tr>
<td>%</td>
<td>10.6</td>
<td>9.5</td>
<td>7.7</td>
<td>6.7</td>
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<td>6.2</td>
<td>5.9</td>
<td>4.9</td>
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Integrated Network Management System

Good Customer Service & Reliability of Supply

- Accurate Metering
- Good Quality Network & Efficient Management
- Customer Relationship Management
- Leakage Control
- Strict Legislation

Outcomes:
- Low UFW

Water for All: Conserve, Value, Enjoy
Good Quality Network & Efficient Management

New Network

• Good planning & design – sizing of pipes, location of valves, alternate supplies, etc
• Strict supervision & control on workmanship
• Use Good quality / corrosion resistant material
  – Connections : Copper
  – Mains (100 – 300 mm) : cement-lined DI
  – (≥ 700 mm) : cement-lined steel

Existing network

• Servicing and maintenance of valves / hydrants
• Mains Renewal Programme
  - Unlined CI mains and GI connections (in 80s / 90s)
  - Old problematic CI Mains (2000 – 2004)
• Ongoing pipe replacement programme
Active Leakage Control

Dynamic Leak Detection Programme

– Divide Singapore into ~ 300 zones
– Frequency of checks based on age/material type of mains & leak history
– Use of advanced leak detection equipment including leak localisers
– Cover 10 – 20 km length of pipes / day

Dry weather flow by other PUB in charge of drains and waterways

Water for All: Conserve, Value, Enjoy
Accurate Metering

100 % metering for usage and billing

Type of meters in use

• Electromagnetic meters at waterworks
• Class C volumetric meters at households
• Compound meters to capture both low and high flows in non-domestic premises

15 mm meter
(Replace every 15 yrs or > 4,000 m3)

Compound meter
(Replace every 2-7 yrs)

Electromagnetic meter
(Check every month)
Strict Legislation – Deter Illegal Draw-Offs

- Very Few Cases
- Strict Enforcement
- Public Utilities Act

- Prosecution in court - Max Penalties:
  - $50,000 fine or;
  - 3 years jail term or;
  - both fine & jail term
Customer Relationships Management

• Quick Response to Public Reports
  – 24 x 7 Contact / Operations Centre:
    ✓ PUB – One
    ✓ WSOC

PUB-One

• One-stop contact centre for Board’s services

WSOC (Water Service & Operations Centre)

• Quick response service van crew
UFW - Sustainable Work Processes Involving Everyone

Effective Management, Staffing & Training

Planning & Design
- Proper positioning of valves
- Optimise network design

Mainlaying
- Use good quality pipes
- Good worksmanship

Network management
- Maintenance of network
- Replace old/leaking mains
- Proper Records - AIMS

Network Optimisation
- Optimise system pressure
- Reduce likelihood of leaks

Enforcement
- High penalty
- Very few cases

Proper accounting through Metering
- Use good quality and accurate meters
- Size meters according to usage

Leakage Control
- Dynamic leak detection
- 24/7 contact centre

Water for All: Conserve, Value, Enjoy
ACHIEVEMENT: Low Unaccounted-For-Water (about 5%)
Water Conservation Strategy

Pricing
Reflect the strategic importance and scarcity value of water

Voluntary
3P Approach
Promote ownership of water conservation

Mandatory
Cut down on excessive flow and wastage of water
## Pricing

### Water Tariff Structure

<table>
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<tr>
<th>Tariff Category</th>
<th>Consumption Block (m³ per month)</th>
<th>With Effect from 1 July 2000</th>
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<tbody>
<tr>
<td></td>
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<td>Tariff (cents per m³)</td>
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<tr>
<td>Domestic</td>
<td>1 to 40</td>
<td>117</td>
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<tr>
<td></td>
<td>Above 40</td>
<td>140</td>
</tr>
<tr>
<td>Non-Domestic</td>
<td>All Units</td>
<td>117</td>
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</tbody>
</table>

**WCT**: Water Conservation Tax - Broad-based tax levied by the Government
MANDATORY
Installation of Water Saving Devices

Since 1983
- Self-Closing Delayed-Action Taps
- Constant Flow Regulators

Since 1997
- Low Capacity Flushing Cisterns

9 litre flushing cistern  4.5 litre flushing cistern

Water for All: Conserve, Value, Enjoy
Mandatory Water Efficiency Labelling Scheme

- Mandatory WELS (MWELS) wef 1 July 09
- Type of water fittings under Mandatory WELS
  - Basin taps & mixers
  - Shower taps & mixers
  - Sink/bib taps
  - Dual flush low capacity flushing cisterns (LCFC)
  - Urinals & urinal flush valve
- Low flow showerheads and clothes washing machine will be looked into separately in future.

Water Efficiency

- Zero Tick
- Good
- Very Good
- Excellent

Water consumption:
Type of product:
Brand:
Model:
Registration No.:

Actual water consumption may vary from test results.
Compliance of models at www.mwels.gov.sg

Shower taps and mixers
Basin taps and mixers
Sink/Bib taps and mixers
Low capacity flushing cisterns
Urinals and urinal flush valves

Water for All: Conserve, Value, Enjoy
Mandatory Installation
of
Dual Flush Low Capacity Flushing Cisterns (LCFCs)

With effect from Jul 2009, dual flush low capacity flushing cisterns shall be installed in all new domestic premises and domestic premises undergoing renovation.
Voluntary

Water Conservation Framework for Domestic Sector

Pricing

Domestic Sector

Water Efficient Homes

10-Litre Challenge

Public Education

3P Engagement

One-Stop Web Portal

Water Volunteer Groups

Water Efficiency Labelling Scheme

Enhanced Water Efficient Homes

Mandatory Requirements

Water for All: Conserve, Value, Enjoy

PUB
**Domestic**

Water Efficient Homes Programme (WEH)

- Launched in Feb 2003
- 3Ps – community driven programme
  - Grassroots leaders distribute FOC Water Saving Kits
  - DIY and adopt good water saving habits (e.g. washing machines, shorter shower)
- Mobile exhibitions at grassroots events
- Door to door visit to assist in installation of WSDs
- Can save up to 5% of monthly water consumption
- By 2006 - all 84 constituencies launched
- More than 910,000 water saving kits distributed & about 40% households installed
Water Conservation

Per Capita Domestic Consumption (1998-2008)

Public Surveys

Encouraged Me to Conserve Water

55% very much
6% somewhat
39% never
Voluntary Water Conservation Framework for Non-Domestic Sector

Non-Domestic Sector

Reduce
- Water Efficient Buildings

Replace
- NeWater/Industrial Water/Sea Water Substitution

Reuse
- Promote Recycling Thru’ Water Efficiency Fund

Pricing

Mandatory Requirements

Water for All: Conserve, Value, Enjoy
Singapore International Water Week 2010
Sustainable Cities – Clean and Affordable Water
About Singapore International Water Week

The global platform for water solutions

- Brings together policymakers, industry leaders, experts and practitioners
- Address challenges, showcase technologies, discover opportunities & celebrate achievements

Key programmes:

1. Water Leaders Summit
2. Water Convention
3. Water Expo
4. Business Forums
5. Lee Kuan Yew Water Prize

Organised by: Singapore International Water Week Pte Ltd, a company set up by PUB and Ministry of the Environment and Water Resources
Singapore International Water Week 2009

- More than 10,000 attendees from 82 countries including the Crown Prince of Orange, Ministers from Middle-East, Australia, China, Brunei, India, President ADB, VP World Bank, President/Chairman/CEOs of water companies

- 12,000 m² of covered exhibition space with more than 400 exhibiting companies from 41 countries including Siemens, CH2M HILL, Bv, CDM, Veolia, Suez

- 28 new products launched for the very first time in Asia or the world

- S$2.2 billion worth of business deals inked during the week

- 76 co-located events including 7th Ministers Forum on Infrastructure Development in the Asia Pacific Region, 6th International Water Association Leading Edge Conference

- 911 media stories were generated from Sep 2008 to July 2009
Singapore International Water Week 2010

Date: 28 June 2010 – 2 July 2010

Theme: Sustainable Water Solutions for Cities: Sustainable Cities – Clean & Affordable Water

Expecting 12,000 participants from all over the world

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Strategic Partners: IWA, IDA, ADB, Lee Kuan Yew School of Public Policy

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