Water Management and Auditing
Virtual Water Approach

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The Right to Water, a Human Right

The period 2005-2015 was the International Decade for action ‘Water for Life’
Water for Food

Breakdown of freshwater use
- Irrigation: 70%
- Domestic use: 8%
- Industry: 22%

Water requirements for food production (km$^3$/year)

- Increases, over 2002 water requirements, needed to eradicate poverty by 2030 and 2050 respectively.

Increase, over 2002 water requirements, needed to meet the 2015 hunger target.

Water withdrawal ratios by continent

- Agriculture
- Industries
- Municipalities

Projections vs. Historical
Challenges and Opportunities

- India’s share of resources
  - Water: 4%
  - Land: 2.5%
  - Population: 17%

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POPULATION IN MILLIONS</th>
<th>PER CAPITA AVAILABILITY</th>
<th>Cu m/year</th>
<th>Liter/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1027</td>
<td>1820</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>1210</td>
<td>1545</td>
<td>4230</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>1394</td>
<td>1340</td>
<td>3670</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>1640</td>
<td>1140</td>
<td>3120</td>
<td></td>
</tr>
</tbody>
</table>

Food Requirement by 2050: 450 MT

Evergreen Revolution

Improve Overall WUE by: 20%
(National Water Mission, GOI)
## Components of WUE as per CWC

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Values (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir Efficiency</td>
<td>95%-98%</td>
</tr>
<tr>
<td>Conveyance Efficiency</td>
<td></td>
</tr>
<tr>
<td>Fully Lined system</td>
<td>70%-75%</td>
</tr>
<tr>
<td>Partially Lined system</td>
<td>65%</td>
</tr>
<tr>
<td>Unlined system</td>
<td>60%</td>
</tr>
<tr>
<td>On farm application Efficiency</td>
<td></td>
</tr>
<tr>
<td>Sprinkler/Drip Irrigation</td>
<td>85%</td>
</tr>
<tr>
<td>Basin/Furrow Irrigation</td>
<td>60%</td>
</tr>
<tr>
<td>Drainage Efficiency</td>
<td>80%</td>
</tr>
<tr>
<td>IPU/IPC</td>
<td>85%</td>
</tr>
<tr>
<td>Overall WUE</td>
<td>60-65%</td>
</tr>
</tbody>
</table>

How to reach
Linkage between different water sources in an irrigation system
# Water Use Efficiency - Projects of AP & TS

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Project</th>
<th>Reservoir</th>
<th>Canal</th>
<th>On-Farm</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KDS</td>
<td>100</td>
<td>87.4</td>
<td>46.18</td>
<td>40.36</td>
</tr>
<tr>
<td>2</td>
<td>GDS</td>
<td>100</td>
<td>83.21</td>
<td>46.09</td>
<td>45.05</td>
</tr>
<tr>
<td>3</td>
<td>KC Canal</td>
<td>NA</td>
<td>62.25</td>
<td>45.15</td>
<td>28.10</td>
</tr>
<tr>
<td>4</td>
<td>NSP</td>
<td>100</td>
<td>55.96</td>
<td>38.93</td>
<td>21.80</td>
</tr>
<tr>
<td>5</td>
<td>Nizamsagar</td>
<td>75.95</td>
<td>87</td>
<td>45.32</td>
<td>39.43</td>
</tr>
<tr>
<td>6</td>
<td>RDS</td>
<td>100</td>
<td>82.83</td>
<td>51.51</td>
<td>42.66</td>
</tr>
<tr>
<td>7</td>
<td>Somasila</td>
<td>72.16</td>
<td>56.3</td>
<td>31.84</td>
<td>18.00</td>
</tr>
<tr>
<td>8</td>
<td>SRSP</td>
<td>95.05</td>
<td>77.98</td>
<td>57.28</td>
<td>44.66</td>
</tr>
<tr>
<td>9</td>
<td>TBPHLC</td>
<td>42.51</td>
<td>80.90</td>
<td>58.32</td>
<td>47.13</td>
</tr>
<tr>
<td>10</td>
<td>TBPLLCC</td>
<td>100</td>
<td>72.13</td>
<td>44.80</td>
<td>32.23</td>
</tr>
<tr>
<td>11</td>
<td>Vamsadhara</td>
<td>100</td>
<td>90.50</td>
<td>58.47</td>
<td>52.91</td>
</tr>
<tr>
<td>12</td>
<td>Yeleru</td>
<td>28</td>
<td>50.00</td>
<td>28.42</td>
<td>14.21</td>
</tr>
</tbody>
</table>
Common reasons and recommendations for low WUE from studies of 30 irrigation systems (CWC, 2010)

<table>
<thead>
<tr>
<th>Common reasons for low WUE</th>
<th>Common recommendations for improvement of WUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Damaged structures</td>
<td>Rehabilitation and restoration of damaged/silted canal system</td>
</tr>
<tr>
<td>ii) Silting in the canal system</td>
<td>Proper and timely maintenance of the system</td>
</tr>
<tr>
<td>iii) Poor maintenance</td>
<td>Selective lining of the canal and distribution system</td>
</tr>
<tr>
<td>iv) Weed growth in the canal system</td>
<td>Realistic and scientific system operation</td>
</tr>
<tr>
<td>v) Seepage in the system</td>
<td>Revision of cropping pattern, if needed</td>
</tr>
<tr>
<td>vi) Over-irrigation</td>
<td>Restoration/provision of appropriate control structures</td>
</tr>
<tr>
<td>vii) Un trained farmers</td>
<td>Efficient and reliable communication system</td>
</tr>
<tr>
<td>viii) Changing the cropping pattern</td>
<td>Reliable and accurate water measuring system</td>
</tr>
<tr>
<td></td>
<td>Conjunctive use of ground and surface water</td>
</tr>
<tr>
<td></td>
<td>Regular revision of water rate</td>
</tr>
<tr>
<td></td>
<td>Encouragement for formation of Water Users’ Association</td>
</tr>
<tr>
<td></td>
<td>Training to farmers</td>
</tr>
<tr>
<td></td>
<td>Micro-credit facilities</td>
</tr>
<tr>
<td></td>
<td>Agricultural extension services</td>
</tr>
<tr>
<td></td>
<td>Encouragement to farmers for raising livestock</td>
</tr>
</tbody>
</table>
National Water Policy (2012)

• Priority on use of water
• NWP on impact of climate change
• Enhancing water availability for different use
• **Demand management**

Project appraisal and environmental impact assessment for water uses to inter-alia include:

i) analysis of **water foot prints**
ii) **recycle and reuse** including return flows
iii) **incentivizing economic use** of water
iv) **adaptation to water saving means**
v) performance monitoring and
vi) reclamation of commands

• Regulation of water prices
• Project planning & implementation
• Data base and information needs
• Capacity building, research and training needs
Water Auditing

Water auditing is a systematic & scientific examination of water accounts of the irrigation projects.

**Main Objectives**
- To compare the water use efficiency with the targeted one for further improving the performance.
- To check the water losses for saving and conserving water.
- To identify the best management practices.
- To generate healthy competition among various projects/units.

- Checking water use against planning.
- Amount of water available for supply.
- Water delivered to users.
- Water losses – leakages, unaccounted losses.
- Suggestions and improvements to plug leakages.
**WATER FOOTPRINT**

Water Footprint is quite simply the volume of water used. At the individual level, this is expressed in litres. But at the national level, this becomes complex - The water footprint of a nation is equal to the use of domestic water resources, minus the virtual water export flows, plus the virtual water import flows.

**VIRTUAL WATER**

The term ‘virtual water’ was introduced by Tony Allan in the early 1990s. It is defined as the volume of water required to produce a commodity or service.
Virtual water

3000 litres water
1 kg rice
About 15% of the water used in the world is for export, in virtual form.

- 67% of the global virtual water trade is related to international trade of crops
- 23% is related to trade of livestock and livestock products
- 10% is related to trade of industrial products.
If water is priced at 1 paisa liter (15 cents per cu m), it costs Rs. 1,20,000 (US$2000) for growing paddy in one ha area.
Water Saving Crop Production Technologies

Direct seeding / MSRI / AWD for rice in harmony with soil microbial technologies in maximizing the water use efficiency.
Matching Irrigation Demand and Canal Supply

The engineers of I&CAD Department, officials of Agriculture and Ground Water Department should be offered trainings on a regular basis on irrigation modernisation, crop irrigation requirements including effective rainfall contribution, water budgeting, latest aspects of water measurement and regulation, participatory approaches in water management and women’s participation in AWM.
AWD Tubes, Flumes, Water Meters
WCAT0025
Water Depth-MLG:
2 cm
Ambient Temperature : 30.00 °C
Relative Humidity : 56.00 %
Micro Irrigation

To irrigate and fertigate the plant instead of soil

National Task Force on MI in 2003: 69 M ha potential
APMIP Target: 0.25 M ha with Rs11,760 million in 5 yr
Achieved: 1.0 M ha in 10 yr
State Level

APC & Principal Secretary Chairman

Commissioner of Horticulture Departmental Head

APMIP Cell headed by Project Officer
Supported by five senior level OSDs

Standing Committee

Technical Committee

Technical
Horticulture
Agriculture
Sugarcane
Sericulture
Change for Betterment
REEL GUN

Q = 18.5 lps
H = 4 kg/cm²
HP = 35

Technology Suitability
Evaluation of New Sprinkler System
# MICRO IRRIGATION PAYS

## I. Total Area Covered
- a) Drip: 0.7617 m ha
- b) Sprinkler: 0.2810 m ha

## II. MI system cost
- a) Total: Rs 41,708 Million
- b) Farmers contribution: Rs 10,427 Million

## III. Annual cost (CRF 0.2055) based on
- a) Total cost: Rs 8,571 Million
- b) Farmers contribution: Rs 2,143 Million

## IV. Additional yield
@Rs 15,000/ha minimum: Rs 15,640 Million

## V. Payback period based (II/IV)
- a) Total cost: 2.7 years
- b) Farmers contribution: 0.7 year

## VI. Every rupee on MI yields (IV/III)
- a) Total annual cost: Rs 1.8
- b) Farmers annual cost: Rs 7.3

### Additional benefits
- a. Water saving: 149 TMC
- b. Energy saving: 417 million unit
- c. Labor saving
- d. Employment avenue
New Initiatives

MICROIRRIGATION IN CANAL COMMANDS UNDER LIFT PROJECTS

LIMIP: GO Ms No. 34 issued on 09-02-2007

OBJECTIVE: To improve irrigation efficiency and to enhance productivity

Main features of GO:

- Under all major lift projects 100% ayacut is proposed for microirrigation
- Designed duty for LIMIP is 15000 acre per TMC
- Sumps of required capacity will be constructed by Irrigation Dept.
- Pumpsets will be installed to deliver water with pressure of 2.0 kg/ sq cm
- MI systems of farmers choice will be installed by APMIP
MICROIRRIGATION IN CANAL COMMANDS UNDER LIFT PROJECTS

- Sump is required to store water during non-pumping hours
- Capacity depends upon
  a) Duty of the water
  b) Area under each sump
  c) Operating time of irrigation system
Sugarcane under lift MI
Siphon Type Intake
Necessity of Reclaimed water

- Increased *water scarcity* and stress
- Increased populations and food insecurity
- Increased environmental pollution
- To increase recognition of the resource value of *waste water*, *excreta* and *grey water*
Wastewater Reclamation, Reuse and the Hydrologic Cycle

- Precipitation
- Irrigation
- Groundwater
- Surface water discharge
- Industrial use
- Municipal use
- Wastewater Treatment
- Industrial reuse
- Agricultural reuse
- Groundwater Recharge
Reuse of Reclaimed Water
Status of Waste Water Generation & Treatment in India

- Sewage generation: 61754 MLD
- Untreated Sewage: 38791 MLD
- Sewage Treatment Capacity: 22963 MLD
State wise generation of waste water in India (%)

- Total WW generation = 61948 MLD
Israel leads in efficient water use
Water distribution network
Farmers Day Programs

- Project Achievements
- Importance of CC & WUE
- Interaction with Scientists and line dept officials
- Exhibition of technologies
- Farmers Feedback
SCHOOL CHILDREN AWARENESS AND TRAINING
Our Future: YOUNG PROFESSIONALS, Students & Children

Training Workshop for Young Professional
13.30-17.00 hours, 13 October 2017
TOLTECA 1, WTC

Importance of Irrigation Water Management & ClimaAdapt Project Experiences
Way Forward

• Water is an Economic Good
• Water Measurement
• Demand Based Water Delivery
• Virtual Water Approach
• Incentivizing WUE
• Irrigation Asset Management
• Promoting PIM
• Respect Agriculture