PERFORMANCE ASSESSMENT - EXPERIENCES FROM INDIA

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SECRETARY GENERAL, ICID
11 APRIL 2018

Central Water Commission

Total utilizable water resources 1123 BCM

Ground Water
433 BCM

Surface water
690 BCM

Current utilization
450 BCM (65%)

Current utilization
243 BCM (58%)

Total water availability
1869 BCM

Total Precipitation
4000 BCM

Total utilizable water resources
1123 BCM

Water Availability

Spatial Variation of Rainfall

Average Annual Rainfall

Rainfall in mm

Average 1,176
Max. 11,000 Mawsynram, Meghalaya
Min. 100 Western Rajasthan

Temporal Variation of Rainfall

Rainfall in mm
### Water Requirement Projection

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Total Water Requirement for Different Uses (in BCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uses</td>
</tr>
<tr>
<td>1.</td>
<td>Irrigation</td>
</tr>
<tr>
<td>2.</td>
<td>Domestic</td>
</tr>
<tr>
<td>3.</td>
<td>Industries</td>
</tr>
<tr>
<td>4.</td>
<td>Power</td>
</tr>
<tr>
<td>5.</td>
<td>Others</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

Population Estimate: 1.3 Billion to 1.5 Billion

Assumptions:
- Increase in efficiency in irrigation from present level of 35% to 60% by 2050
- Increase in productivity for rainfed agriculture from 1 to 1.5 and irrigated agriculture from 3.0 to 4.0 t/ha

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### Irrigation Development

- Total Cultivable Land: 181.98 Mha
- Ultimate Irrigation Potential: 139.89 Mha
- Potential Created (Mar 12):
  - Major & Medium: 47.97 Mha
  - Minor: 65.56 Mha
- Gross Sown Area: 195.25 Mha
- Gross Irrigated Area: 91.53 Mha
- Net Sown Area: 140.80 Mha
- Net Irrigated Area: 65.26 Mha

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### Need for Performance Assessment

- To answer Why, What and How to improve the efficiency of the project
- To setup a benchmark to evaluate the projects against them for prioritisation of improvement measures, if any.
- To adjust the project to new demand scenario emerging out of long term developments.
- To find the design and planning deviations affecting the performance of the project to an optimum level.
- Leverage the new technologies available now for better management of the project.

### Components of WUE as per CWC

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Values (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir Efficiency</td>
<td>55% - 95%</td>
</tr>
<tr>
<td>Conveyance Efficiency</td>
<td>Full Lined system 70% - 75%</td>
</tr>
<tr>
<td></td>
<td>Partially Lined system 65%</td>
</tr>
<tr>
<td></td>
<td>Unlined system 60%</td>
</tr>
<tr>
<td>On farm application</td>
<td>Sprinkler/Drip Irrigation 85%</td>
</tr>
<tr>
<td></td>
<td>Basin/Furrow Irrigation 60%</td>
</tr>
<tr>
<td>Drainage Efficiency</td>
<td>IPU/IPC 85%</td>
</tr>
<tr>
<td></td>
<td>Overall WUE 60-65%</td>
</tr>
</tbody>
</table>

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### Efficiency Values

- Reservoir Efficiency: 95% - 98%
- Conveyance Efficiency: Fully Lined system 70% - 75%, Partially Lined system 65%, Unlined system 60%
- On farm application Efficiency: Sprinkler/Drip Irrigation 85%, Basin/Furrow Irrigation 60%
- Drainage Efficiency: IPU/IPC 85%
- Overall WUE: 60-65%
**Components of Performance Assessment for improving WUE**

- **Input resource assessment**: The yield patterns achieved against those assumed in the design, especially the temporal distribution.
- **Distribution system capabilities**: Constraints of implementation, unauthorised extensions, new demands, state of the system.
- **On farm usage**: Cropping patterns, application methods, present agro-climatic environment.
- **Management**: Systems in place, social structures and management methods needing improvement/introduction.
- **Key takeaway**: These are all interrelated. Attacking any single aspect will not yield the desired results.

**Improving WUE through Optimal Reservoir Performance**

- **STORAGE**
  - Inflow + Sediment
  - Seepage from bed and sides
  - Evaporation from surface
  - Power releases
  - Uncounted withdrawal from resource

**Improving WUE through better Conveyance and Distribution systems**

- **CONVEYANCE SYSTEM UNDER WRD/WUA CONTROL**
  - A. Inappropriate design, siltation
  - B. Evaporation loss from canal surface
  - C. Transpiration from Hyacinth
  - D. Seepage from bed, sides
  - E. Unaccounted withdrawal as a loss
  - F. Management based (operational) losses
  - G. Diversions for other use
  - H. Inappropriate outlet design
  - I. Unaccounted outlet/field channel losses/over irrigation

**Improving WUE of better management of On-Farm Application**

- **FIELD APPLICATION/ CROP PRODUCTIVITY**
  - Soil Moisture required for leaching
  - Soil Moisture required for seeding
  - Soil Moisture required for growth
  - Soil Moisture required for yield
  - Soil Moisture required for harvest
Performance Assessment Studies - Findings

Andhra Pradesh (Krishna Basin) - 10 nos.
- Tungabhadra Right Bank High Level Canal (TB-RB-HLC)
- Tungabhadra Right Bank Low Level Canal (TB-RB-LLC)
- Rajul Banda Diversion Scheme (RBD)
- Kurnool Cuddapah Canal (KC Canal)
- Srikakulam Right Bank Canal (SRBC)
- Nageswara Sagar (NSS)
- Krishna Delta
- Koll Sagar
- Gajuladivine Dam (Medium)
- Bhiravantippa (Medium)

Andhra Pradesh (Godavari Basin) - 6 nos.
- Nizam Sagar
- Sri Rama Sagar (SRSP Complex)
- Kaddam (SRSP Complex)
- Godavari Delta
- Gandipalem (Medium)

Performance Assessment Studies - Findings

Synthesis of Findings - Reservoirs
- Nearly all projects are integrated in terms of configuration, resource, use
- Changing scope of the projects
- Altered hydrology
- Un-assured withdrawals from reservoirs
- Lost active capacity of the reservoirs
- Dam safety concerns
- Evaporation and seepage losses from the reservoirs
- Leakage and uncontrolled withdrawals
- Excessive spills
- Inability of the head works to supply 'Full Supply Discharge'

Integrated Aspects in Tungabhadra Sub Basin

Case Studies – List of Projects

- Andhra Pradesh (Krishna Basin) - 15 nos.
  - Tungabhadra Right Bank High Level Canal (TB-RB-HLC)
  - Tungabhadra Right Bank Low Level Canal (TB-RB-LLC)
  - Rajul Banda Diversion Scheme (RBD)
  - Kurnool Cuddapah Canal (KC Canal)
  - Srikakulam Right Bank Canal (SRBC)
  - Nageswara Sagar (NSS)
  - Krishna Delta
  - Koll Sagar
  - Gajuladivine Dam (Medium)
  - Bhiravantippa (Medium)

- Andhra Pradesh (Godavari Basin) - 6 nos.
  - Nizam Sagar
  - Sri Rama Sagar (SRSP Complex)
  - Kaddam (SRSP Complex)
  - Godavari Delta
  - Gandipalem (Medium)

- Andhra Pradesh (Other Basins) - 3 nos.
  - Narayanpur Anicut
  - Valero Dam
  - Uttar Pradesh (Ganga Basin) - 6 nos.
    - Matatila
    - Pilibhit Dam
    - Ahirra Dam
    - Ohati Dam
    - Naughar Dam
    - East Baigul

- Uttar Pradesh (Yamuna/Ganges) - 2 nos.
  - Nagai Lift project (WJC)
  - Augmentation Canal (WJC)

- Punjab – 2 nos.
  - Upper Bari Doab Canal (Ranjit Sagar Dam)
  - Ghoulbaha Project

- Andhra Pradesh (Somasas)
Maharashtra:
GWDT Allocation: 623 MCM (22 TMC)
CA – 10484 Sq. Km.

Karnataka
GWDT Allocation: 404 MCM (14.27 TMC)
CA – 3688 Sq. Km.

Andhra Pradesh:
GWDT Allocation: 1784 MCM (63 TMC)
CA – 7521 Sq. Km.

Sri Ram Sagar Reservoir
Manjira dam
Tiruna dam
Choukinala dam
Karanjia dam
Singur dam
Manjira Barrage
Ghanpur Anicut
Nizam Sagar Anicut
Nizam Sagar
Command
Dy. 1 to 49 (56152 ha)
Nizam Sagar
Command
Dy. 50 to 72 (21769 ha)
Nizam Sagar
Command
Dy. 73 to 82 (15699 ha)
CA below Nizam Sagar – 9151 Sq. Km.

Inability of the project to deliver designed demands
- Inflows in many reservoirs are dwindling
- Periodic review of hydrology with basin as a unit is necessary
- Withdrawals from reservoirs are not reliable – cannot assure equity

Evaporation and Seepage loss as % of Gross Storage
- Medium reservoirs have high seepage and evaporation losses

READJUSTED ALLOCATION OF WATERS WITHIN ANDHRA PRADESH

Recent Period 75% Dependable inflows as percent of design 75% dependable inflows/allocation

Withdrawals in a 75% dependable year as % of design withdrawals

Evaporation Loss as % of gross storage
Seepage loss as a percent of gross storage
Leakage from earthen portion
Excessive Spills

Percent of time Reservoirs spilled during 1995-96 to 2005-06

- Excessive spills coupled with lower withdrawals suggest wrong operational policy
- Operational priorities for complementary/contradictory releases are also not reported

Reported Reservoir Filling Efficiencies

- Reported Reservoir filling efficiencies in a dependable year are questionable

Inability of Head Works to Supply FSD

- Wrong approach for selection of canal reach for estimation of efficiency
- Inadequate capacity of head regulators to deliver FSD
- Many of the head regulators not functioning/tampered
  - Missing shutters/control devices
  - Require extensive repairs
- High seepage rate in many selected canal reaches
- Reduced carrying capacity of canal reaches
- Non-uniformity of seepage loss rate

Synthesis of Findings – Conveyance and Distribution Systems
Synthesis of Findings – Conveyance and Distribution Systems

- PIM Act not enacted/ functional in some states
- Canal Operational Concerns
  - High leakages, over withdrawals, thefts common
  - Assurance on supplies non-existent
  - Information on farm delivery not recorded
  - Warabandi/canal roster not adhered to
  - Sometimes only one watering is given

Canal Carrying Capacity as % of Design Capacity of Various Canal Reaches

Canal loss rate in various canals in cumec/million sq m

Design loss rate:
- Rock 0.91, Black Cotton Soil – 1.83, Alluvium Soils – 2.74, Decayed rock or gravel – 3.0 cumec/million sq m

Reported Canal Conveyance Efficiencies
Water Availability : Farmers feed back

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Availability of irrigation water at required time</th>
<th>Farmers</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>221</td>
<td>42.7</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>296</td>
<td>57.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>517</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table: Availability of irrigation water at required time

Synthesis of Findings – On-Farm Application

➢ Cropping pattern in most of the dams is not changed, only crop area changed to suit water availability (SRBC is an exception)
➢ Wherever groundwater coexists, cropped area is stabilized
➢ Diversification from paddy to irrigated dry crops suggested without any assurance on farmers income/alternate livelihood
➢ Drainage is not a real issue except in case of Delta area projects
➢ Waterlogging is a concern in some of the canal commands
➢ Created irrigation potential does not match CCA – PPA/Localized command area is proposed for irrigation potential creation;
➢ Utilized irrigation potential matches creation in some of the years suggesting gap in potential due to development is reduced
➢ However, gap in potential increases in the years of low flow, suggesting reduced cropped area due to non availability of water in canals
Matrix of Findings

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Score</th>
<th>Attributes</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Project is inter-state</td>
<td>23/30</td>
<td>12 PCC introduced but not yet implemented</td>
<td>20/30</td>
</tr>
<tr>
<td>2 Project is integrated</td>
<td>22/30</td>
<td>13 PCC has taken place</td>
<td>0/30</td>
</tr>
<tr>
<td>3 Hydrology is disturbed</td>
<td>17/21</td>
<td>14 PCC is being implemented</td>
<td>4/30</td>
</tr>
<tr>
<td>4 Project is not able to meet requirements</td>
<td>15/20</td>
<td>15 CD &amp; CM are not in order</td>
<td>17/20</td>
</tr>
<tr>
<td>5 Active live storage is affected</td>
<td>16/24</td>
<td>16 Water measuring devices are not in place</td>
<td>35/30</td>
</tr>
<tr>
<td>6 Project has dam safety concerns</td>
<td>25/28</td>
<td>17 Actual cropping pattern deviates from design cropping pattern</td>
<td>6/19</td>
</tr>
<tr>
<td>7 Evaporation losses from reservoir are excessive</td>
<td>7/20</td>
<td>18 Irrigation from other source is substantial</td>
<td>23/27</td>
</tr>
<tr>
<td>8 Seepage losses from reservoir are excessive</td>
<td>5/19</td>
<td>19 Diversification from paddy is recommended</td>
<td>16/29</td>
</tr>
<tr>
<td>9 Head work is not capable of taking FSD</td>
<td>19/29</td>
<td>20 Drainage is not adequate</td>
<td>7/28</td>
</tr>
<tr>
<td>10 Head regulators are not supplying FSD</td>
<td>18/25</td>
<td>21 New field/intermediate and link drains required</td>
<td>5/29</td>
</tr>
<tr>
<td>11 Canal capacities do not meet design</td>
<td>23/25</td>
<td>22 Water logging salinity/alkalinity is a concern</td>
<td>5/29</td>
</tr>
</tbody>
</table>

Six Specific Areas of Concern

- **Storage**: Consistent and continuous efforts in improving the performance of storage infrastructure within the basin context to improve availability of flows at canal head(s);
- **Conveyance**: Better design and improved conveyance and distribution system in both engineering and management sense;
- **On-Farm Application**: Improving on-farm efficiencies through better practices, improved drainage and ensuring other quality inputs leading to better production and productivity;
- **Participation**: Gradually decreasing the role of administration in managing the canal systems and promoting the role of beneficiaries in asset management in an accountable and sustainable manner;
- **Crop Management**: Crop diversification, adoption of low water intensive crops, better farm management practices, micro-irrigation systems and quality inputs to improve productivity;
- **R&D**: Continued research and development, and periodic monitoring and evaluation through water auditing and benchmarking.
Attaining 60% WUE

Assessment of Gap in Efficiencies

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Conveyance Efficiency</th>
<th>On-Farm Efficiency</th>
<th>Project Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To be achieved</td>
<td>Gap</td>
<td>To be achieved</td>
</tr>
<tr>
<td>Large Storage systems</td>
<td>90%</td>
<td>0.47%</td>
<td>96.87%</td>
</tr>
<tr>
<td>Diversion</td>
<td>85%</td>
<td>2.23%</td>
<td>70.59%</td>
</tr>
<tr>
<td>Delta</td>
<td>95%</td>
<td>4.48%</td>
<td>63.16%</td>
</tr>
</tbody>
</table>

- Attaining 60% efficiency would be a difficult task
- As a short term solution, CADWM Programme component on ‘Correction of System Deficiencies’ may be reviewed using MASSCOTE approach of FAO;
- Long run solution to improve Conveyance would be to shift to basin approach under IWRM
- Improving On farm efficiency – conservation and integration of all sources of water within command, harvest rainfall, diversification to low water intensive varieties, adopting improved methods of cultivation - SRI / SSI, shift to MIS-DRP and sprinkler for new projects

India’s Share in World Resources

- Land Resources - 2.45%
- Renewable Water Resources - 4%
- Population - 18%

Per Capita Water Availability (National Average)

<table>
<thead>
<tr>
<th>Year</th>
<th>Water Availability (Cubic metre per capita per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>5177</td>
</tr>
<tr>
<td>1991</td>
<td>2200</td>
</tr>
<tr>
<td>2011</td>
<td>1820</td>
</tr>
<tr>
<td>2011</td>
<td>1545</td>
</tr>
<tr>
<td>2025</td>
<td>1340</td>
</tr>
<tr>
<td>2050</td>
<td>1140</td>
</tr>
</tbody>
</table>

Water Stress Line 1700 cu. m. per person per year
Water Scarcity Line 1000 cu. m. per person per year
Number of Large Dams in Country = 4857

Water Resources: 4%
Land Resources: 2.5%
Population: 18%

Food Requirement by 2050: 450 MT

Improve Overall WUE by 20% (National Water Mission, GOI)

Evergreen Revolution

Challenges and Opportunities
Water for domestic demand

Linkage between different water sources in an irrigation system

Identification of key processes in an irrigation and drainage scheme

Water Use Efficiency - Projects of AP & TS

<table>
<thead>
<tr>
<th>S. No.</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>82.25</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>
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<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>80.39</td>
<td>58.32</td>
<td>47.13</td>
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<tr>
<td>10</td>
<td>TBPLLC</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>80.50</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 for low WUE

1. Damaged structures
2. Silting in the canal system
3. Poor maintenance
4. Weed growth in the canal system
5. Seepage in the system
6. Over-irrigation
7. Untrained farmers
8. Changing the cropping pattern

### Common recommendations for improvement of WUE

- Rehabilitation and restoration of damaged/silted canal system
- Proper and timely maintenance of the system
- Selective lining of the canal and distribution system
- Realistic and scientific system operation
- Revision of cropping pattern, if needed
- Restoration/provision of appropriate control structures
- Efficient and reliable communication system
- Conjunctive use of ground and surface water
- Regular revision of water rate
- Encouragement for formation of Water Users’ Association
- Training to farmers
- Micro-credit facilities
- Agricultural extension services
- Encouragement to farmers for raising livestock

### 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
    - 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 from water logging, salinity and alkalinity.
- Regulation of water prices
- Project planning & implementation
- Data base and information needs (WRIS)
- Capacity building, research and training needs

### NWP 2012 - Guidelines for Improving WUE

- Increase water use efficiency by 20%
- Water Footprints and Water Auditing (assessment of water use), need to be developed.
- Continuous water balance and water accounting studies
- Methods to encourage water saving (Ex. Micro Irrigation)
- Conjunctive ground water use
- Participatory Approach: Users of water should be involved in monitoring the pattern of water use

### 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.
1.3 billion ton food is lost or wasted every year (FAO)

The engineers of I&CAD Department should install special water measurement structures like RBC flumes as a standard procedure in all their new irrigation projects; the same applies for their modernization projects of existing schemes.

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.

Direct seeding / MSRI / AWD for rice in harmony with soil microbial technologies in maximizing the water use efficiency.
Fig. Location of the 10 Medium Projects in Andhra Pradesh and Telangana States

Baseline studies of Medium Irrigation Projects on Water Use Efficiency in Andhra Pradesh and Telangana States
Stakeholder Workshops

Detailed Investigations

Irrigation Infrastructure Application
To irrigate and fertigate the plant instead of soil

AP Micro Irrigation Project: launched in 2003

**Micro Irrigation**

To irrigate and fertigate the plant instead of soil

**Additional benefits**
- Water saving: 149 TMC
- Energy saving: 417 million unit
- Labor saving
- Employment avenues

**Micro Irrigation in Canal Commands**

- Sump is required to store water during non-pumping hours
- Capacity depends upon
  - Duty of the water
  - Area under each sump
  - Operating time of irrigation system

### National Task Force on MI in 2003

**Target:** 0.25 M ha with Rs11,760 million in 5 yr
**Achieved:** 1.1M ha with Rs 41,700 million in 10 yr

### AP Micro Irrigation Project: launched in 2003

**Target:** 0.25 M ha with Rs11,760 million in 5 yr
**Achieved:** 1.1M ha with Rs 41,700 million in 10 yr

### More Information

**Crop Ground Truth Application**

**Micro Irrigation Pays**

1. **Total Area Covered**: 1.0427 M ha
   - **Drip**: 0.7617 M ha
   - **Sprinkler**: 0.2810 M ha
2. **MI system cost**
   - **Total**: Rs 41.708 Million
   - **Farmers contribution**: Rs 10.427 Million
3. **Annual cost (CRF 0.2055)** based on
   - **Total**: Rs 8.571 Million
   - **Farmers contribution**: Rs 2.143 Million
4. **Additional yield**
   - **Total annual cost**: Rs 15.640 Million
5. **Payback period based (II/IV)**
   - **Total**: 2.7 years
   - **Farmers**: 0.7 year
6. **Every rupee on MI yields (IV/III)**
   - **Total annual cost**: Rs 1.8
   - **Farmers annual cost**: Rs 7.3

**Additional benefits**
- Water saving: 149 TMC
- Energy saving: 417 million unit
- Labor saving
- Employment avenues

**Layout of LIMIP**

- **Water Distribution Network of LIMIP**
- Sump is required to store water during non-pumping hours
- Capacity depends upon
  - Duty of the water
  - Area under each sump
  - Operating time of irrigation system
Adaptation to climate change: An integrated science-stakeholder-policy approach for water and agricultural sectors

**STUDY AREA**

<table>
<thead>
<tr>
<th>DC</th>
<th>MIRA'LAGUDA</th>
<th>DC</th>
<th>KARSARAOPE</th>
<th>No.</th>
<th>WUA Name and No.</th>
</tr>
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Area: 8497 ha

**PROJECT PARTNERS**

NIBIO | GIZ | FILE | MESSRE

**Adaptation to climate change:**

- Importance of CC & WUE
- Interaction with Scientists and line dept officials
- Exhibition of technologies
- Farmers Feedback

**Farmers Day Programs**

**SCHOOL CHILDREN AWARENESS AND TRAINING**

25-05-2018
Way Forward

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

Thank You