# Water reuse in textile sector

## Tiruppur, India

**water scarcity impact**

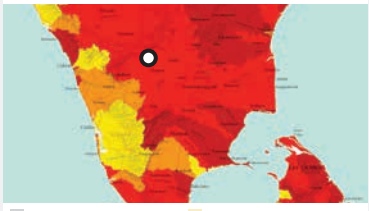
| | |
|---|---|
| Reduced withdrawal | ● |
| Reduced consumption | |
| Improved water quality | ● |
| Increased productivity | ● |
| Net basin benefit | ● |

**volumetric impact**
**876 000 $m^3$/yr**

**capital cost**
**$84 000 000**

**estimated unit cost of water**
**>500 ¢/$m^3$**

**Water Stress**
Tiruppur, India



Arid & low water use
Low (<10%)
Low to med (10-20%)
Med to high (20-40%)
High (40-80%)
Extremely high (>80%)
No data available

**Water Stress Map:**
Gassert, F., M. Landis, M. Luck, P. Reig, and T. Shiao. 2013. "Aqueduct Global Maps 2.0."

**Confidence level**
Low Medium High

**Water Scarcity Impact Key**
Main Minor

**Credits**
We wish to acknowledge the input of Sajid Hussain, of Tamilnadu Water Investment Company Ltd in the preparation of this case study.

### Project Overview

Tiruppur is a mid-sized industrial town located in the upper hydrological basin of the Cauvery River. The basin suffers from water scarcity due to erratic seasonal rainfall, limited reservoir capacity and a high demand on the already limited resource. The city is a hub of textile industry accounting for 80% of India's knitwear production and generating over $1 billion of exports per year.

The water supply to the textile industry is abstracted from the River Bhavani, over 50km away, whilst effluent industry is discharged to the Noyyal River. The river and groundwater system suffers from severe water quality issues as a result of effluent discharges from industry. This in turn has affected the agricultural potential of downstream lands. To address this the Indian High Court mandated zero liquid discharge from the textile industry. To comply with the decision, nine existing effluent treatment plants were upgraded with a combined reverse osmosis and thermal evaporation system, which enables 96% of the effluent to be treated and returned as freshwater. As a result the demand on the municipal water supply has been reduced by 876 000$m^3$/year. The intervention has been driven by the court order and has resulted in very high capital and operating costs.

### Key Elements

- Court mandated environmental improvements.
- Finance from government grants, soft loans and industry for the upgrade and operation of existing effluent treatment plants.
- Installation of a combined Reverse Osmosis and Thermal Evaporation treatment system.
- Additional revenue streams established through the sale of reclaimed water and extracted dye salts.

### Key Outcomes

- Water demand on the River Bhavani reduced from 1 200 000$m^3$/yr to approximately 300 000$m^3$/yr.
- 96% of the effluent recovered for re-supply as freshwater to the industry.
- Capture of dye salts from effluent stream for reuse by the industry.
- Zero discharge of effluent to the Noyyal river with consequent impact on water quality.
- Payback period of 15 years.
- Operating cost of $4/$m^3$/yr.
- Withdrawals are reduced, but this is offset by the zero return flows, although benefit to the basin is accrued from improved water quality. This has been achieved at a very high financial cost.

Tiruppur, India

### Intervention Features

- Wastewater reuse in textile industry
- Condensate recovery and reuse
- Improvement in water quality

### Project Levers

Nine effluent treatment plants operated by Tamil Nadu Water Investment Company (TWIC) treat 922 000m³/yr of effluent from 200 textile industry units. These plants were upgraded with Reverse Osmosis and Thermal Evaporation processes enabling re-use of 96% of the effluent. The upgrades were financed with a combination of public and private finance.

**(1) Reverse osmosis:**

Conventional physicochemical or biological treatments do not remove salts or salinity, the primary source of pollutants in the industrial effluents. In addition the Noyyal River is perennial with limited dilution capacity. Reverse osmosis (RO) technology is used to remove the pollutant load from the effluent. This enables 75% of the incoming effluent to be reclaimed with the concentrated waste diverted for further processing.

**(2) Evaporator-condensate recovery:**

The concentrate waste from the RO is processed in Mechanical Vapour Recompression (MVR) and Multi-Effect Evaporators. This enables a further 19% of the incoming effluent to be reclaimed. This process is energy intensive but is necessary to meet the zero liquid discharge requirements.

**(3) Recovered salt reuse:**

The textile industry utilises significant amount of salts within the dyeing process. The water reclamation process regenerates these salts as a byproduct allowing their reuse by industry, previously these were used only once and discharged in the effluent. The sale of these byproducts provides an additional revenue stream to the water reclamation process.

**(4) Solar evaporation of concentrated liquor:**

A small percentage of the incoming effluent is left as concentrated salt laden liquor from the Multi-Effect Evaporator. This is processed in solar pan evaporators to dispose of the water to achieve the zero liquid discharge. The crystallised salt deposits are further recovered for reuse.

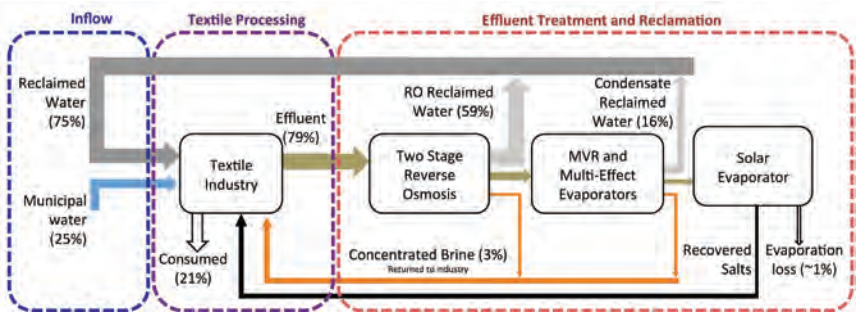
**(5) Sale of the reclaimed water and recovered salts:**

The water treatment plants operate as independent commercial entities and charge the textile plants for the treatment of the industrial effluent as well as supply of reclaimed water and dye salts.

### Outcomes and Challenges

Washing, bleaching and dyeing processes are very water intensive; this project enabled the industry to substantially reduce its demand on scarce water resource with 75% of the total water demand now met by reclaimed water, although at a significant financial and energy cost. The reduction in abstraction by 876 000m³/yr has improved the availability of water for other users and has been specifically welcomed by the local farmers. The cessation of discharges of industrial effluent has reduced the return flow to the Noyyal River. However, as this flow was highly polluted this has the effect of increasing the availability of the remaining flow for other users.

The court ordered cessation of industrial effluent discharges into the Noyyal River was a challenge as it required a solution that maximised the recovery of water for reuse within the industry. The implemented solution is energy intensive with significant financial costs to the industry which has affected their profitability and competitiveness.




Above: Process flow diagram (© Siraj Tahir, Arup)