Industrial

# Reducing water and energy consumption in a chemical plant

## Adana, Turkey, Asia

**water scarcity impact**

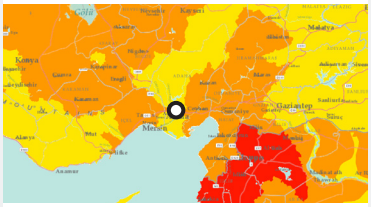
| | |
|---|---|
| Reduced withdrawal | ● |
| Reduced consumption | |
| Improved water quality | |
| Increased productivity | ● |
| Net basin benefit | |

**volumetric impact**
**151 500 $m^3$/yr**

**capital cost**
**$53 000**

**estimated unit cost of water**
**<5 ¢/$m^3$**

**Water Stress**
Adana, Turkey



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:**
F. Gassert, P. Reig, T. Shiao, M. Luck and M. Landis, 2015. "Aqueduct Global Maps 2.1."

**Confidence level**
Low Medium High

**Water Scarcity Impact Key**
Main Minor

**Credits**
We wish to acknowledge the input and support of Dr. Emrah Alkaya (TTGV) and Prof. Dr. Göksel N. Demirer (METU) in preparation of this case study.

### Project Overview

The chemical industry is extremely important for the Turkish economy, accounting for approximately 10% of the total exports. Access to the neighbouring European Union (EU) market requires compliance with the tight EU environmental regulations. The industry is also heavily reliant on the availability of energy, water and resources and vulnerable to Climate Change.

A pilot project was launched in the Advansa SASA chemical plant in Adana to assess benefits of sustainable production practices within the industry including measures to reduce soft cooling water use. The facility is one of the largest polyester plants in the world, with a production capacity of 750 tonnes of polyester per day. It uses 2.2 million $m^3$ of water per year which is abstracted from the local aquifer.

The project was delivered by the Technology Development Foundation of Turkey (TTGV) in collaboration with the Middle East Technical University (METU) as part of the "National Eco-efficiency (Cleaner Production) Programme" financed by the United Nations Industrial Development Organisation (UNIDO).

### Key Elements

- Environmental performance evaluation of the chemical plant and benchmarking of water use against EU standards.
- Devising a cost benefit action plan using multi-criteria assessment approach.
- 11 out of 19 water-cooled heat transfer pumps replaced with air cooled centrifugal pumps.
- The project was funded 48.6% from UNIDO and remainder by Advansa SASA.

### Key Outcomes

- Reduction of water used for cooling by 151 500 $m^3$ per year (from 2 200 000 to 2 050 000 $m^3$ per year).
- Overall reduction in energy and maintenance costs as well as reduced $CO_2$ emissions.
- The project influenced national and industry sector policies, on sustainable development in response to climate change and market competitiveness risks.

Adana, Turkey

## Intervention Features

¬ Water audit ¬ Installation of air cooled heat pumps

## Project Levers

### (1) National Eco-Efficiency Programme

"The National Eco-efficiency Programme" of UNIDO was delivered by TTGV as the industrial component of the "MDGF_1680: Enhancing the Capacity of Turkey to Adapt to Climate Change" programme – a joint United Nations programme financed by the Millenium Development Goals Fund (MDGF). The programme aimed to demonstrate the benefits of sustainable production in different sectors, identify gaps in knowledge and existing legislation and raise awareness through training programmes for national experts.

### (2) Environmental and Water Audit of Plant

Despite the challenges of performing a full environmental audit on a large plant (1 200 employees), a full water flow diagram was produced, and related operational costs were calculated. The results were benchmarked against exemplary production practices from EU best practice to identify underperforming components of the process. Seven assessment criteria were applied to determine the most cost effective opportunities for process improvement – environmental benefits, technical applicability, economic viability, ease of implementation, long-term sustainability, operation /maintenance requirements, and cross-media effects.

### (3) Installation of air cooled heat pumps

The investigations revealed that the two largest cooling towers, operating partially with directly extracted ground water and partially with on-site softened water, were not used efficiently. Replacement of the water cooled heat exchange pumps with air cooled pumps significantly reduced the softened water used in the two towers.

### (4) Quick Return Investment

The total annual cost savings from the installed air-cooled pumps were $105 000 against a total project cost of $50 000. The payback period was less than six months.

## Outcomes and Challenges

Soft cooling water use in the heat transfer system was reduced from 1.09 to 0.58 $m^3$ per tonne product manufactured. This was a reduction of 151 400 $m^3$ per year. In addition, savings were recorded from reduced energy consumption, $CO_2$ emissions and maintenance costs. For example, the substitution of the pumps resulted in a 41 000 kWh per year of energy savings due to their increased efficiency and indirectly reduced carbon emissions by 24 000 kg $CO_2$ per year.

The results from this project can be replicated or used for comparison in the chemical industry sector. Key for its success was the environmental audit approach and benchmarking against best practice. The project also identified the business case for the adoption of environmental standards and the need for policy changes which promote the economic and environmental benefits of sustainable practices.

Above: Production unit with installed air cooled heat pumps
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