switchmed

Funded by the European Union

MED TEST III in Lebanon

Progressing resource-efficient and competitive industries

Project summary and achievements

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Funded by the European Union, with co-funding from the Government of Italy and the Government of Catalonia, the SwitchMed Programme is implemented under the lead of the United Nations Industrial Development Organization (UNIDO) in partnership with the United Nations Environment Programme (UNEP) Economy Division and MedWaves, the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP) regional activity centre for Sustainable Consumption and Production (formerly known as SCP/RAC). The initiative is carried out closely with the European Commission's Directorate-General for Neighbourhood and Enlargement (DG NEAR).

Each implementing organization contributes specialized experience and tools to partner with the eight beneficiary countries on policy development, capacity building, business support services, demonstration activities and networking.

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For more information on the UNIDO activities within the SwitchMed initiative, please get in touch with us at: u.dolun@unido.org

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The SwitchMed Programme

Launched by the European Union (EU) in 2014, the regional SwitchMed Programme has demonstrated the potential for a green and circular economy in eight countries of the southern Mediterranean region. To upscale the transition to Sustainable Consumption and Production (SCP) practices in this region, SwitchMed has demonstrated business models that can reduce the inefficient use of resources and the environmental footprint of existing economic activities. It has done so through industry demonstrations, policy development, networking opportunities, and support for start-ups and green entrepreneurs.

Under the lead of the United Nations Industrial Development Organization (UNIDO), the SwitchMed industry component has, during the MED TEST II (2014-2018) and MED TEST III (2018-2023) projects, realized over 165 industry pilots demonstrating pathways for more resource-efficient and circular production models in the southern Mediterranean industry.

SwitchMed has become one of the region's most relevant resource efficiency initiatives, building local capacities and demonstrating the industry's potential for resource-efficient and circular business models.

Through successfully demonstrating circular business and production models, the pilots have inspired industry actors with innovative production models that involve reusing, refurbishing, re-manufacturing, and recycling products to optimise productivity and recirculation. By embracing these resource-efficient practices, businesses in the region can effectively adapt to the ever-changing global market and environmental conditions. These practices are essential for achieving sustainability and economic objectives in the regional industry and building resilient supply chains.

The MED TEST III project has upscaled the implementation of resource efficiency and cleaner production in the Lebanese industrial sector by working along three strategic lines of interventions.

The MED TEST III project in Lebanon

Lebanon is going through a critical economic and financial crisis. Some of the major challenges include the collapse of the banking sector, which has resulted in the loss of credit facilities. Additionally, a three-digit increase in inflation is causing a significant reduction in the purchasing power of consumers. Moreover, the Lebanese currency has depreciated by more than 98% in 2023.

In this context, the industrial sector, like other economic actors, struggles to survive and grow. Prolonged power cuts have forced businesses to rely on power generators for energy supply, and water scarcity is increasing due to excessive extraction, pollution, and low rainfall, leading to rising costs for water. Companies also face difficulties importing raw materials and other important industrial inputs priced in foreign currencies due to the loss of bank credit lines.

The current challenges have highlighted the need for more resource-efficient production practices. To address these challenges the MED TEST III project in Lebanon has addressed some of these challenges by helping companies in identifying more efficient ways of using resources, improving their operational efficiency to reduce costs, and in adopting a circular economy perspective to tackle the emerging issue of waste. The MED TEST III project in Lebanon was implemented in close collaboration with the Ministry of Industry (MoI) and Ministry of Environment (MoE), and in alliance with the Association of Lebanese Industrialists (ALI) and the Association of North Metn Industrialists (ANMI).

The MED TEST III project worked in three main areas of intervention:

Providing technical assistance on Resource-Efficient and Cleaner Production (RECP)

Building on the experience from the preceding MED TEST II project (2014-2018), and considering the current context in Lebanon, the MED TEST III project concentrated efforts in providing technical assistance for RECP audits. These audits are an integral part of the UNIDO TEST methodology, which was widely introduced to industries in the food and beverage sector under the MED TEST II project.

For the MED TEST III project, 15 industrial companies, ranging from large to small enterprises, from the food and beverage, chemical, plastic, and printing sectors joined the project. The food, beverage and chemical sectors are of particular strategic relevance to the country, and are vital for supporting Lebanon's food security and import substitutions.

Working with a multidisciplinary team of national and international experts, the companies received orientation on TEST methodology and on specific RECP opportunities of relevance to each case, together with technical assistance to help them to become more competitive through lower production costs and decreased environmental footprint.

Whey valorization initiative

The MED TEST III project provided specialized technical assistance to develop cost-effective, resource-efficient and circular whey solutions. Whey is the liquid effluent that is generated from the cheese and Labneh (strained yoghurt) production. In most cases the dairy companies discharge whey with no adequate treatment, which creates pollution.

The MED TEST III project collaborated with industry partners to develop whey valorization alternatives tailored to the needs of Lebanese dairy companies, particularly small and medium enterprises (SMEs).

From this initiative, three new whey-based products have been developed using innovative, cost-effective, and less energy-intensive methods compared to other added-value whey products. These products include whey-based fruit juices, whey-based Ayran (diluted yoghurt) and whey-based spreadable cheese. They have been piloted and extensively tested in sensory evaluation campaigns.

Starting with two demonstration companies, six more companies from Lebanon and the region have been motivated to incorporate whey in their products. Additionally, the project went further with one of the initial pilot companies to conduct a feasibility study for the full introduction of whey-based spreadable cheese production, which included a national market study of spreadable cheese consumption.

Policy gap assessment to mainstream RECP and sustainability principles in industrial zones

In consultation with relevant stakeholders from the public and private sectors, a policy gap analysis and a roadmap were developed to identify gaps and opportunities to mainstream and monitor RECP strategies in Lebanese industrial zones in line with the principles of the International Framework of Eco-Industrial Parks (EIP).

The TEST approach

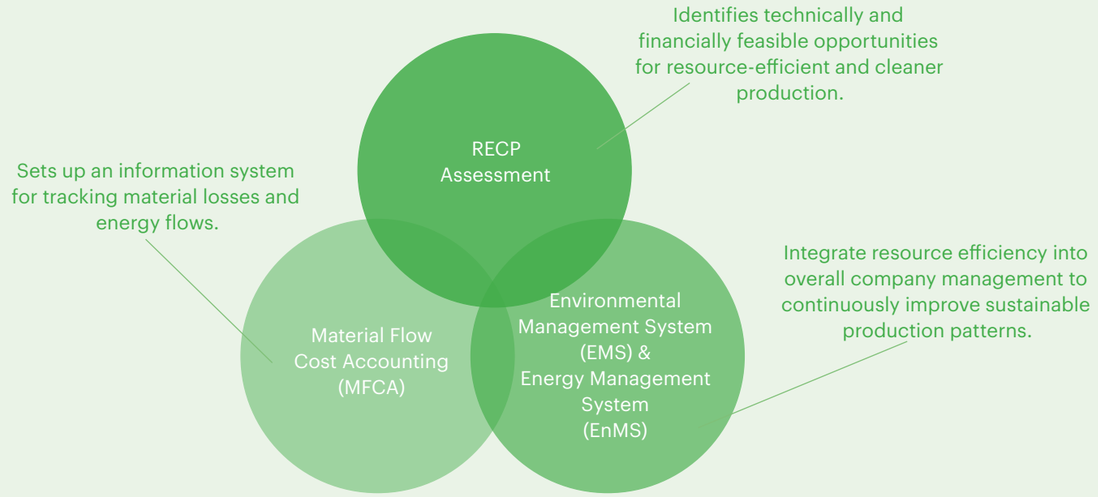
The TEST methodology, developed by UNIDO, offers a systematic approach to identifying and exploiting the most feasible opportunities for resource efficiency and continuous improvement in using materials, water and energy within a company. This methodology combines essential tools for sustainable production, namely, Resource-efficient and Cleaner Production Assessment (RECPA), Material Flow Cost Accounting (MFCA) and Environmental and Energy Management Systems (EMS/EnMS). As a result of these tools' customised integration and implementation, best practices, new skills and an innovative management culture are adopted. The TEST methodology supports any company in transitioning towards more sustainable production business models.

The adoption of sustainable production strategies is rooted in the concept of the "learning organization", which requires the commitment and engagement of the various stakeholders who influence resource efficiency (customers, suppliers, production managers, workers, etc.) in line with the internal management processes of a business.

At the core of the TEST methodology lies the RECP tool, a step-by-step assessment for improving production systems' resource efficiency and environmental performance. The core output of this tool is a portfolio of financially feasible solutions, including good housekeeping, operational control improvements, process and product modifications, and eco-innovative technologies.

Within the TEST methodology, elements of MFCA are employed to strengthen priority-setting based on non-product output costs and to establish ad hoc information systems for critical material and energy flows, as well as key processes. This step is essential for monitoring significant resource losses and consumption. An MFCA-based information system is also crucial for calculating economic improvements resulting from implemented RECP measures and programmes, thereby evidencing their impact on medium to long-term decisions. It also enables enterprise staff accountability and the reporting of demonstrated company performance against baselines and targets.

The core elements of the Environmental Management System (EMS) and Energy Management System (EnMS) are used in TEST to integrate resource efficiency into the company's overall management systems. This provides operating criteria, Standard Operational Procedures (SOPs) and the internal resource structure for ensuring that resource efficiency programmes are implemented, sustained and further developed.



Results from the MED TEST III demonstration projects

Under the MED TEST III project, **the industry demonstrations for resource-efficient production** targeted companies from Lebanon's food and beverage, chemical, plastic, and printing sectors. Food and beverage (F&B) and chemical sectors were considered priority amidst the economic and social crisis in Lebanon, particularly the F&B companies from dairy and traditional Arabic products from sesame processing, due to their role in national food security, while the chemical sector contributed to import substitution. Following an open call for participants supported by the Ministry of Industry, the Ministry of Environment, the Association of Lebanese Industrialists, and the Association of North Metn Industrialists, 51 companies expressed interest and were evaluated through initial screening, of which 15 were selected for demonstration projects.

The industry demonstrations in Lebanon identified a total of 145 resource efficiency measures. Among these, 116 measures, corresponding to approximately 80% of the total, were approved by the management of the demonstration companies and incorporated into their action plans for implementation. The resource efficiency measures identified for the fifteen participating demonstration companies could potentially save 28,000 m^3 of water; 22,700 MWh of energy; 256 tons of materials, and 9,556 tons of CO_2 equivalent annually. As for economic savings, the identified measures have an average Payback Period (PBP) of approximately 1.6 years and could potentially save the participating companies €3.4 million in annual production costs.

The table below summarises some of the financial aspects of the identified resource efficiency measures:

Name	Employees (full-time)	Investment Euro	Savings Euro per year	Average pay-back-period years	% of water savings per year	% of energy savings per year	% of material savings per year
Food and beverage sector							
Al Kanater s.a.l.**	65	429,795	312,055	1.4	37%	30%	-
Liban Lait s.a.l.**	387	2,236,673	1,054,321	2.1	-	58%	-
Marina Frozen Fries s.a.l.**	50	187,195	281,548	0.7	-	29%	-
Tanmia Agricultural Development Company**	200	1,000,993	469,829	2.1	3%	71%	-
AL Tagziah**	190	59,336	47,851	1.2	-	-	-
Rim Mills*	12	112,465	60,299	1.9	38%	15%	-
Junet*	52	61,347	34,794	1.8	14%	32%	-
Mounir Bisat Factories*	26	61,660	49,477	1.2	-	29%	-
Msallem Food Tech*	106	74,792	52,675	1.4	10%	30%	2%
Tasty Dairy*	5	22,640	11,224	2.0	9%	29%	-
Tayyebat*	61	340,103	159,341	2.1	3%	14%	-
Chemical sector							
Joseph B. Amatoury s.a.r.l.*	55	2,280	10,260	0.2	14%	14%	0.4%
Société d'Oxygène et d'Acétylène du Liban (SOAL)*	80	182,236	62,539	2.9	69%	30%	0.4%
Plastic sector							
PETCO s.a.l. for food and beverage**	72	542,712	571,513	0.9	-	21%	1%
Printing sector							
Arab Printing Press (APP)**	120	11,676	53,354	0.2	-	19%	-
Total	**1481**	**5,325,902**	**3,231,081**	**1.65**			

*Exchange rate as 1 Euro = 0.9328 USD
**Exchange rate as 1 Euro = 1.0449 USD

The whey valorization initiative from the MED TEST III project introduced a new perspective to a rather problematic "waste" stream in many dairy companies. The objective of this initiative was to develop new set of whey-based products for the Lebanese market, targeting a three-folded objective: affordable and nutritious food for Lebanese families, low investment and operational cost for dairy SMEs, and reduction of environmental impact on water bodies.

Under the lead of a national food specialist, supported by an international dairy expert, and collaborating with two pilot companies, Skaff Dairy and Liban Lait s.a.l., the products were designed and tested under conditions that apply to dairy companies in Lebanon. The two pilot companies were engaged in the formulation of the new products, the preparation of batch trials at their manufacturing sites utilizing their laboratory facilities and materials. Technical staff from quality and production areas participated actively increasing capacities and acquiring knowledge. Five students from the Lebanese University were also engaged during the technical activities as a result of synergies with this academic center through the national food expert.

The project team elaborated a total of 55 formulations, obtaining nine formulations that were produced at pilot scale for sensory campaigns where more than 100 persons tried and evaluated the acceptability of the products, obtaining positive acceptance. The technical assistance also defined the production process, needed facilities, and analysis of potential economic benefits, which have been collected and published in business case studies. The results of this initiative were disseminated through a regional online seminar with participants from Lebanon, Jordan, Palestine, Tunisia, and Egypt, creating a ripple effect by attracting more companies to innovate solutions for whey, building on the pilot experience.

Finally, the market study for spreadable cheese in Lebanon revealed that 49% of the Lebanese population are consumers of spreadable cheese, with a total market size of 4,915 tons per year equivalent to an estimated market value of 51.8 million USD (retail price). A technical and financial feasibility study was conducted for Skaff Dairy which envisions to enter the market with a new spreadable cheese made from whey. The company plans to invest in a new production line and already started to look for financing opportunities to launch the new product on the market.

Regarding mainstreaming of RECP and sustainability principles into industrial zones, the MED TEST III project paved the way through the policy gap assessment and roadmap. The assessment revealed overlaps among key stakeholders that have critical roles in creating an enabling environment for more eco-friendly industrial zone development. The roadmap recommended actions that can address this situation and mainstream the concept of RECP and sustainability principles in existing and new Industrial Zones. A set of possible actions, to be carried out by national organizations at various levels, can help tackle regulatory aspects, governance, capacity, and infrastructure, as well as incentives and economic instruments, voluntary or procedural instruments, and communication instruments. An introductory training on the opportunities and tools to establish or transform industrial zones into EIPs was provided by an international EIP specialist to relevant stakeholders from the public and private sectors and from the civil society.

7 national experts participated and enhanced capacities in TEST/RECP methodology.

49 company team members with increased awareness on applying RECP practices in their companies.

3 product categories applying circular economy principles were innovated for the dairy sector to reincorporate previously wasted whey, with the participation of **2** pilot companies.

7 dairy companies in total have innovated or are in process of innovating whey-products based on the pilot experiences.

Synergies with the Lebanese University through the national food expert facilitated **4** Master's degree students to conduct applied research in dairy production.

Enhancing resource efficiency in the food and beverage sector

A case study from Msallem Food Tech

Msallem Food Tech is a family-owned business and is located in northern Lebanon, specifically in the region of Koura. The company has 106 full-time employees and has two factories. One factory produces pickles, fresh potato cuts, spices paste and rose water, while the other factory produces high-quality olive oil. Msallem Food Tech is an export-oriented company and strives to provide its customers with the best quality products, and to continuously improve its production technologies.

The company joined the MED TEST III project with the main objective of reducing its production costs particularly related to energy. An RECP assessment was conducted in the plant producing pickles, fresh potato cuts and rose water.

The MED TEST III project in Msallem Food Tech factory identified, total annual savings of €52,675* related to energy, water and materials with an estimated investment of € 74,792* and an average payback period is just 1.4 years.

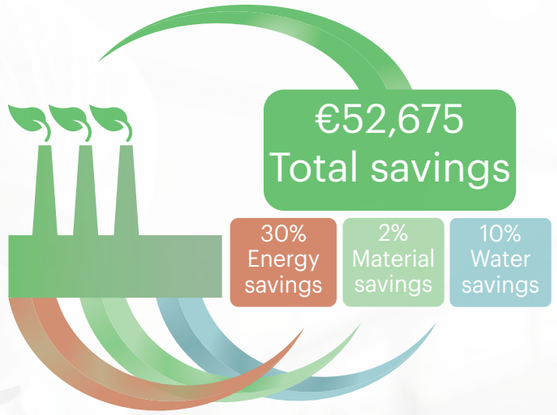
The identified measures will allow the factory to reduce its total energy consumption by approximately 30%. This would be achieved by improving the combustion efficiency of the diesel generators, insulating the steam network, upscaling the existing Photo Voltaic (PV) system and enhancing the combustion of its biomass boiler. In the latter respect, the olive pomace used as biofuel for the boiler, would need to be converted into pellets with a lower moisture content, an intervention that would reduce the specific consumption of pomace and also displace 80% of the diesel used to supply the thermal applications.

Concerning materials, Msallem Food Tech would implement an innovative measure consisting of reusing the mother brine solution used in pickles production over one additional cycle. The recovered mother brine solution which is mainly constituted of salt, containing acids and other materials in lower percentages, would need to be pasteurized before reuse. This intervention will result in annual savings of 73 tons of materials associated to the preparation of mother brine, and 779 m³ of water, both representing a reduction of 26% in mother brine solution use per year, in turn representing 2% of total material input.

Apart from the water savings achieved in the recycling of the mother brine solution, the company also has the potential to reuse part of the rinsing water from the production of pickles and both measures combined would save 10% of water annually.

*Exchange rate as 1 Euro = 0.9328 USD

Identified annual savings in Msallem Food Tech



Grahpic: UNIDO

> Our experience with the MED TEST III project has been very positive thanks to the thorough evaluation of our resource efficiency opportunities provided by the project team. We intent to implement the recommended measures, not only for energy saving purposes, but also for cutting costs in terms of brine and water use and improving our overall resource usage
>
> Mr. Wissam Msallem
> Owner and general manager
> Msallem Food Tech

Improving resource efficiency in the chemical sector

A case study from Société d'Oxygène et d'Acétylène du Liban (SOAL)

Société d'Oxygène et d'Acétylène du Liban (SOAL) is a supplier of various industrial and medical gases such as liquefied Carbon dioxide (CO_2) and Nitrous Oxide (N_2O) as well as gaseous Oxygen (O_2), Nitrogen (N_2), Argon (Ar), Acetylene and other gases. Its highly automated production plant employs 80 full-time employees (without distribution channel employees). SOAL's vision is to achieve unrivalled efficient performance, for which it pursues an operation of a high technology standard and respect to the environment. This strategy has motivated SOAL to join the MED TEST III project.

An RECP assessment was conducted revealing opportunities to further improve the company's use of resources. The MED TEST III project identified total annual savings of €62,539 related to energy, water, and materials efficiency with an estimated investment of €182,236. The average payback period for the identified measures is about three years.

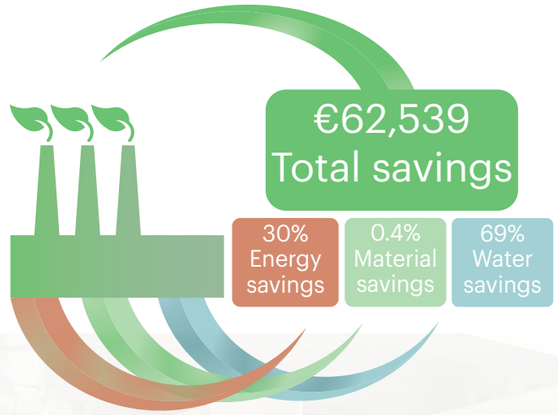
The identified measures have the potential to reduce energy consumption by 30%, thanks to a set of Good Housekeeping measures to improve the combustion efficiency of the onsite electricity generators and the electrical network power factor. The measures also include the installation of a PV solar system of 150 kWp with a 15KWh lithium-ion battery storage, which would reduce SOAL's annual electricity consumption by around 23%. The measures combined, would reduce greenhouse gas emissions by 128 tons of CO_2 equivalent per year.

On the other hand, SOAL's acetylene production plant presented significant water saving opportunities. Three measures were identified, involving the reuse of cooling water of acetylene cylinders and the compressor and recovering and reusing water from previous batches used to cool the acetylene reactor by settling the water into the appropriate basins. These measures will enable SOAL to reduce water consumption and, subsequently, wastewater generation of this plant by 69%. Additionally, the final disposal of Calcium Hydroxide, a by-product of acetylene production, generates high costs for SOAL. Hence, a measure to recover this material by a rate of 85% has been identified allowing diverse potential uses.

The project also assisted the company to find potential international suppliers to manage (or potentially recycle) cylinders that are currently stored by SOAL in an effort to avoid an inadequate final disposal, as no certified service is available in the country to ensure the safe management of these recipients.

*Exchange rate as 1 Euro =0.9328 USD

Identified annual savings in SOAL



Grahpic: UNIDO

> The cooperation with the UNIDO team has contributed to reaching a higher level of our stated objectives related to efficiency in the use of resources, mainly the efficient use of water and electricity and the reduced pollution from wastewater along with the recovery of valuable materials from it
>
> Mr. Fouad Haddad
> Chief Executive Officer
> SOAL

MED TEST in Lebanon

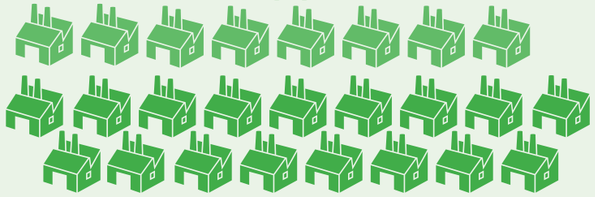
Since 2014, UNIDO has demonstrated resource-efficient production in Lebanon, showcasing its advantages for companies, the industry, and the society. Through the two successive MED TEST projects, it has become evident that this approach is relevant for businesses and Lebanon's long-term goal of reducing reliance on imported resources and promoting a national green growth pathway. The figures below provide evidence of the success from these initiatives.

27 Service Providers qualified on the UNIDO TEST Methodology

Total industry pilots undertaken

MED TEST II
8

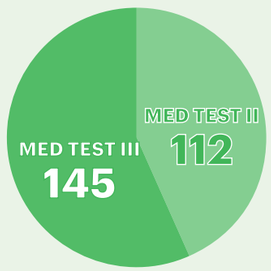
MED TEST III
15



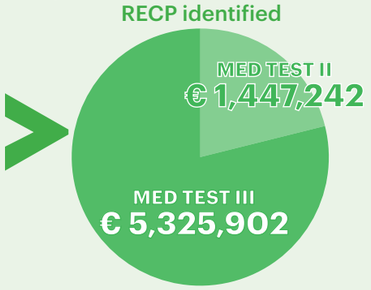
= **23**
demonstration companies

Impacting **2,607 jobs** (number of employees from the 23 demonstration companies)

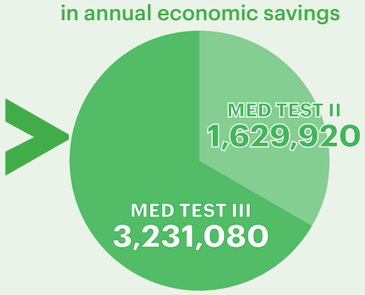
257
RECP measures identified



€6,773,144
private sector investment for RECP identified



That can generate
€ 4,861,000
in annual economic savings



The average payback period for the identified RECP measures

Identified water savings

81,477 m³ x year

Identified energy savings

37,482 MWh x year

Identified material savings

800 tons x year

Identified CO_2 savings

13,124 tons x year

The way forward for RECP in Lebanon

Mainstreaming resource-efficient production in Lebanon

Following the successful demonstration of the business case of RECP in Lebanon by the MED TEST projects, a number of RECP initiatives have been implemented in the country beyond the MED TEST III project's conclusion. These initiatives align with the roadmap for upscaling industrial resource efficiency in Lebanon and the national action plan for sustainable consumption and production in the industrial sector.

The high potential for resource efficiency in the Lebanese companies, as largely demonstrated by the MED TEST projects, has motivated the European Union to fund a new project with a budget of €3.7 million. This project, known as the "Private Sector Transition to Green and Circular Economy in Lebanon", or as the "2Circular" project, aims to significantly upscale RECP beyond the SwitchMed Programme. Since 2022, the 2Ciruclar project is implemented by UNIDO in partnership with the Ministries of Industry, Economy and Trade, Environment, and Finance and in collaboration with the Association of the Lebanese Industrialists and the Federation of the Chambers of Commerce, Industry and Agriculture.

The 2Circular project aims to increase the competitiveness and lower the environmental footprint of the food and beverage sector by:

1. Assisting 50 industrial companies in identifying and implementing resource efficiency solutions using UNIDO's TEST methodology.
2. Supporting the design, development and implementation of innovative circular business models along priority value chains in the food and beverage sector.
3. Facilitating SMEs ' access to finance and disbursing grants for champion companies in the RECP field.
4. Supporting the Ministry of Industry in leading the green and circular transition of the Lebanese industrial sector.

The MED TEST projects have also contributed to the development of a market for service providers in the RECP field. Besides the 27 experts that have been trained on UNIDO TEST methodology in the MED TEST projects, 30 new service providers will be qualified in the TEST methodology as part of the 2Circular project.

> "The SwitchMed program, and the subsequent expansion through the EU-funded "2Circular" project, are at the heart of the priorities of the Ministry of Industry as they support sustainable industrial development and strengthen the competitiveness and resilience of a key industrial sector by mainstreaming the adoption of resource efficient and cleaner production practices in industrial companies, fostering the transition of industry to circular business models in Lebanon."
>
> Mr. George Bouchikian
> Minister of Industry

On a related note, thanks to the MED TEST projects, the RECP concept is being introduced in academic curricula. The first RECP course in Lebanon has been delivered at the Faculty of Sciences of Université Saint-Joseph (USJ) to Master's degree students majoring in Industrial Technology. Other universities have also expressed interest to incorporate such courses in their curricula.

The circular whey valorization initiative developed in the MED TEST III project has captured the attention of companies not supported by the project to learn from UNIDO experience on how to develop innovative and environmentally responsible food and beverage products based on whey. Guided by a university professor from the Lebanese University that was trained on the TEST methodology, the companies are developing new whey-based products.

Finally, it is worth noting that the current socio-economic and financial crisis in the country, coupled with the removal of government subsidies on fuel, has led to increased interest among industrial companies in embracing the RECP concept. This has resulted in the integration of RECP as a mainstream solution in the industry, as it helps to reduce production costs and improve competitiveness in national, regional, and international markets.

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