Business Mission
to the UAE
April 14-16, 2019

Energy, Water & Environment

Opportunities and challenges for strategic partnerships with Italian companies in the evolving UAE energy sector

Business Mission
to the UAE
April 14-16, 2019

Mr. Jamal Alhammadi

VP - Clean Energy & Diversification

Business Development & Ex - Clean Energy & Diversification

Dubai Electricity & Water Authority



هيئة كهرباء ومياه دبي

Dubai Electricity & Water Authority



HIS HIGHNESS SHEIKH KHALIFA BIN ZAYED AL NAHYAN

PRESIDENT OF THE UNITED ARAB EMIRATES

WE WORK TO ACHIEVE THE DIRECTIVES OF OUR WISE LEADERSHIP, TO MAKE THE UAE THE BEST COUNTRY IN THE WORLD



HIS HIGHNESS SHEIKH MOHAMMED BIN RASHID AL MAKTOUM

VICE PRESIDENT AND PRIME MINISTER OF THE UAE AND RULER OF DUBAI

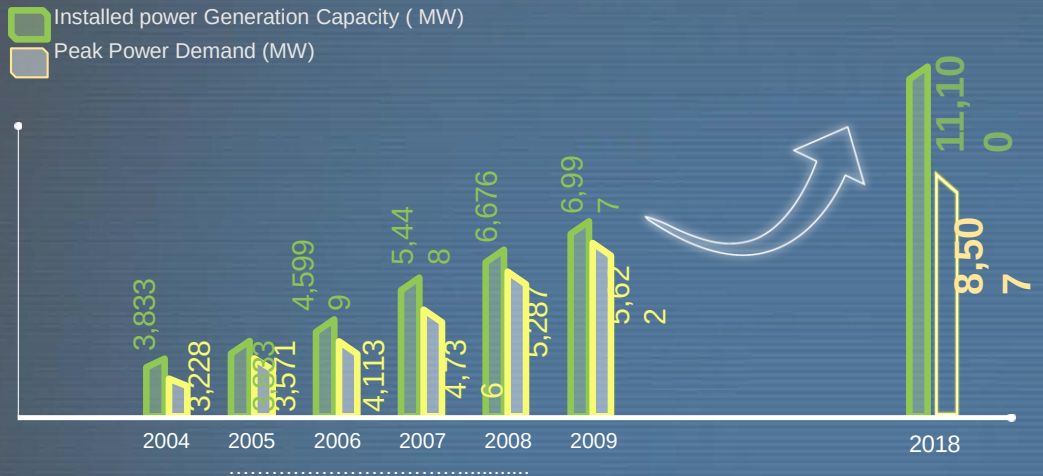
WE WORK TO ACHIEVE THE OBJECTIVES OF THE UAE CENTENNIAL 2071, THE UAE VISION 2021, AND DUBAI PLAN 2021 TO SECURE A HAPPY FUTURE AND A BETTER LIFE FOR FUTURE GENERATIONS



DUBAI ELECTRICITY AND WATER AUTHORITY ……ASUCCESS STORY AND WORLD CLASS ACHIEVEMENTS

Robust Infrastructure

INSTALLED CAPACITY(MW)

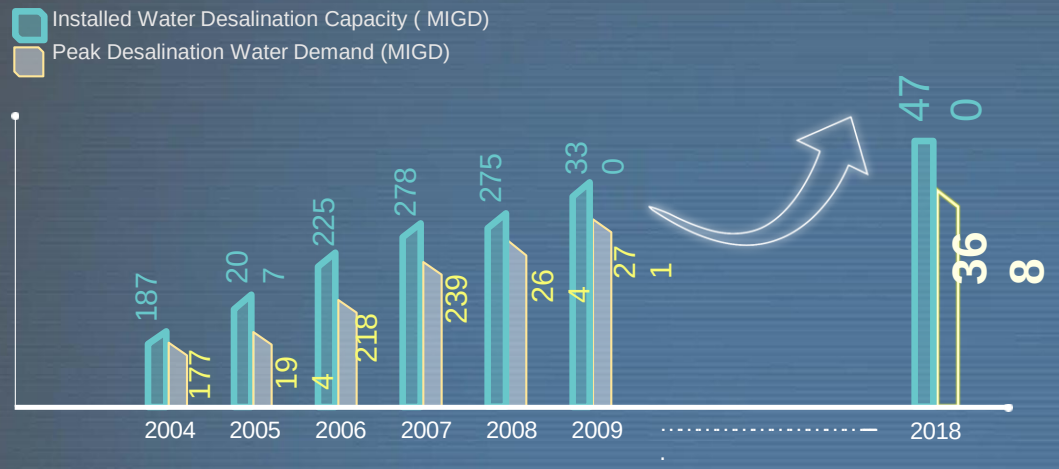


11,100

MW

DUBAI ELECTRICITY AND WATER AUTHORITY ……A SUCCESS STORY AND WORLD CLASS ACHIEVEMENTS

Robust Infrastructure



INSTALLED WATER DESALINATION (MIGD) CAPACITY

470

MIGD

By 2018: Peak demand for water reached 368 MIGD

DUBAI ELECTRICITY AND WATER AUTHORITY .....

A SUCCESS STORY AND WORLD CLASS ACHIEVEMENTS

86
Billion AED

Total (Investments) 2019-2023

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

CUSTOMERS

More than
844,000

190

LOCAL & INTERNATIONAL AWARDS

In last 3 years



WORLD BANK GROUP

Doing Business 2019

Getting Electricity

100% 1 UNITED ARAB EMIRATES

2 Korea Republic

3 Hong Kong SAR, China

4 Malaysia

5 Germany





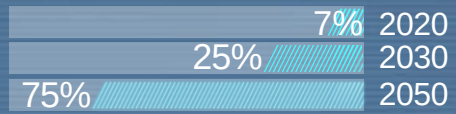
The UAE, represented by DEWA, has maintained its number **1** rank globally in Getting Electricity for the **second consecutive year,** with a **full mark** in all indicators, As per World Bank's Doing Business **2019** report

OUR OBJECTIVE IS TO HAVE 75% FROM CLEAN ENERGY BY 2050 THROUGH THE DUBAI CLEAN ENERGY STRATEGY 2050





THE DUBAI CLEAN ENERGY STRATEGY 2050





42,000 MW

CLEAN AND RENEWABLE ENERGY BY 2050

The lowest levelised cost of electricity



WORLD RECORD FOR

4 TIMES (IPP)

Phase 1 (13 MW PV)	11 cent/KWh
Phase 2 (200 MW PV)	5.62 cent/KWh
Phase 3 (800 MW PV)	2.99 cent/KWh
Phase 4 (250 MW PV)	2.4 cent/KWh
Phase 4 (700 MW CSP)	7.3 cent/KWh

MOHAMMED BIN RASHID AL MAKTOUM SOLAR PARK

LARGEST SINGLE-SITE SOLAR PARK IN THE WORLD (127 Km^2)



REDUCE OVER **6.5** MILLION TONNES OF CARBON EMISSIONS PER YEAR

TOTAL INVESTMENTS **50** BILLION AED

TOTAL CAPACITY **5000** MW BY 2030

CURRENT PROJECTS

5th phase	4th phase	3rd phase	2nd phase	1st phase
900 MW	950 MW	800 MW	200 MW	13 MW
PV	PV	PV	PV	PV
Starting from 2021 in stages	Starting from 2021 in stages	Starting from 2018 in stages	2017	2013

2863 MW

MOHAMMED BIN RASHID AL MAKTOUM SOLAR PARK

19th March 2018

The laying of the foundation stone of the 4th phase of the Mohammed Bin Rashid Al Maktoum Solar Park

Phase 4(700 MW CSP + 250 MW PV)





MOHAMMED BIN RASHID AL MAKTOUM SOLAR PARK

Facts about Phase 4 (950 MW)



- The **world's tallest Solar Tower**, at **260** meters.
- **Largest storage capacity in the world.**
- Total **investments** of around **AED 16 billion**.
- Powering about **320 ,000 residences**.
- This phase includes 3 units (18 Km^2) using the **CSP Parabolic trough** with a total capacity of 600MW (200MW each) and a **CSP Solar Tower** with a capacity of 100MW and 250 MW from **PHOTOVOLTAIC PANELS** (**PV**).

SOLAR INNOVATION CENTRE

Level 4:

- Viewing Gallery

Level 3:

- Cafe`

Level 2:

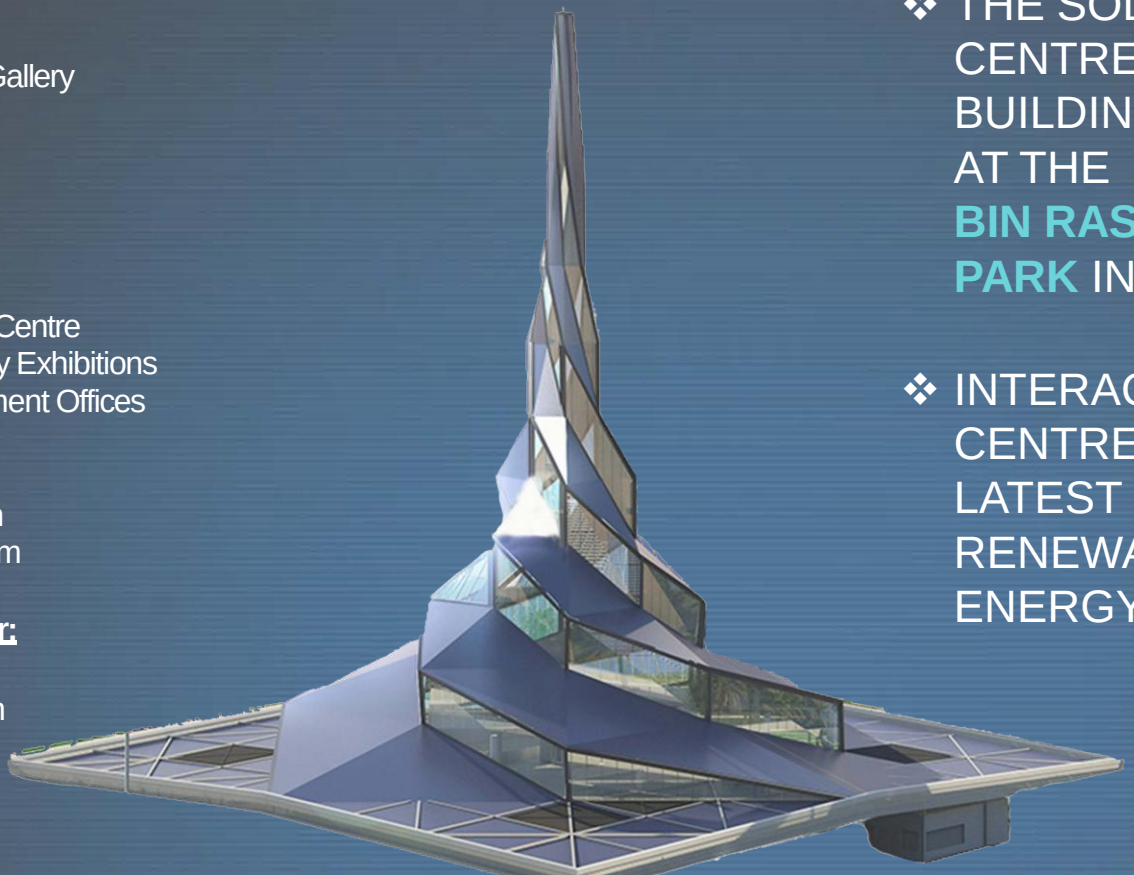
- Learning Centre
- Temporary Exhibitions
- Management Offices

Level 1:

- Exhibition
- Auditorium

Ground floor:

- Entrance
- Reception
- Gift Shop



- THE SOLAR INNOVATION CENTRE (SIC) IS AN ICONIC BUILDING, WHICH IS SITUATED AT THE SHEIKH **MOHAMMED BIN RASHID Al Maktoum SOLAR PARK** IN DUBAI.

- INTERACTIVE INNOVATION CENTRE EQUIPPED WITH THE LATEST TECHNOLOGIES IN RENEWABLE AND CLEAN ENERGY

RESEARCH & DEVELOPMENT CENTRE

The Centre includes:

- Outdoor/Indoor testing facilities.
- 3D printed LAB (The R&D Centre includes DEWA's lab, which was built using 3D printing technology).
- PVRO (Photovoltaic Reverse Osmosis) – Water desalination using solar energy.



R&D MAIN AREAS

- SOLAR POWER
- ENERGY EFFICIENCY
- SMART GRID INTEGRATION
- WATER

DUST SOILING AND CLEANING PROJECTS

1. Robotics and advanced cleaning methodologies using Artificial Intelligence. The robot moves automatically with the help of wheels and sensors.



2. Evaluate Anti-soiling coating (20 types) in 4 Groups: Group 1: without cleaning

Group 2: dry cleaning monthly

Group 3: water cleaning using sponge Group 4: S cleaning

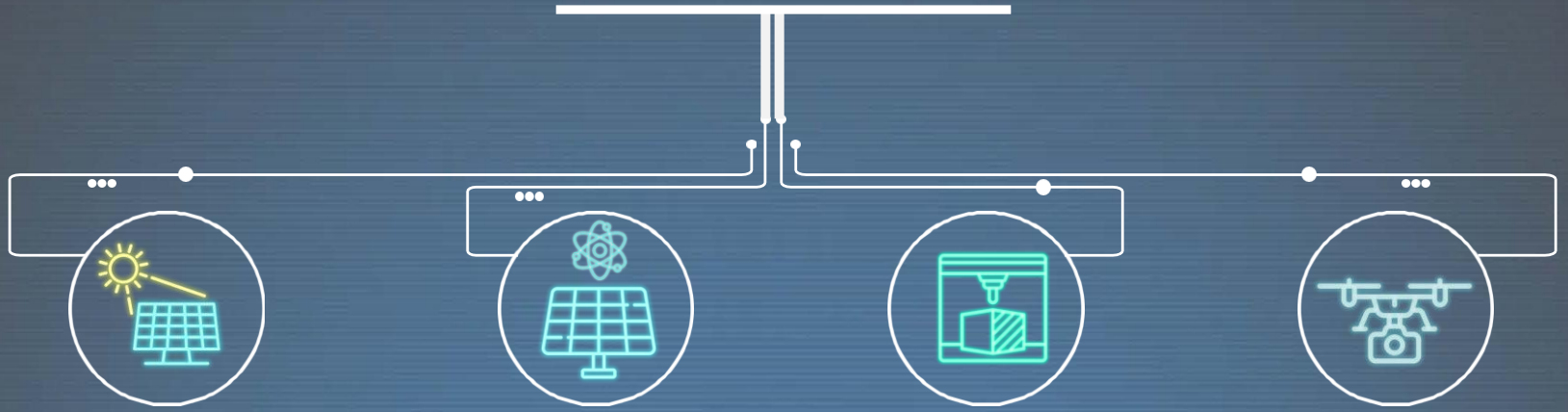


3. Soiling investigation on PV and glass surfaces

- Dust composition and adhesion at five locations in Dubai.
- Soiling Rate of different mounting structures (multi-tilt, fixed tilt, 1-axis, 2-axis tracking systems)



OTHER RESEARCH PROJECTS



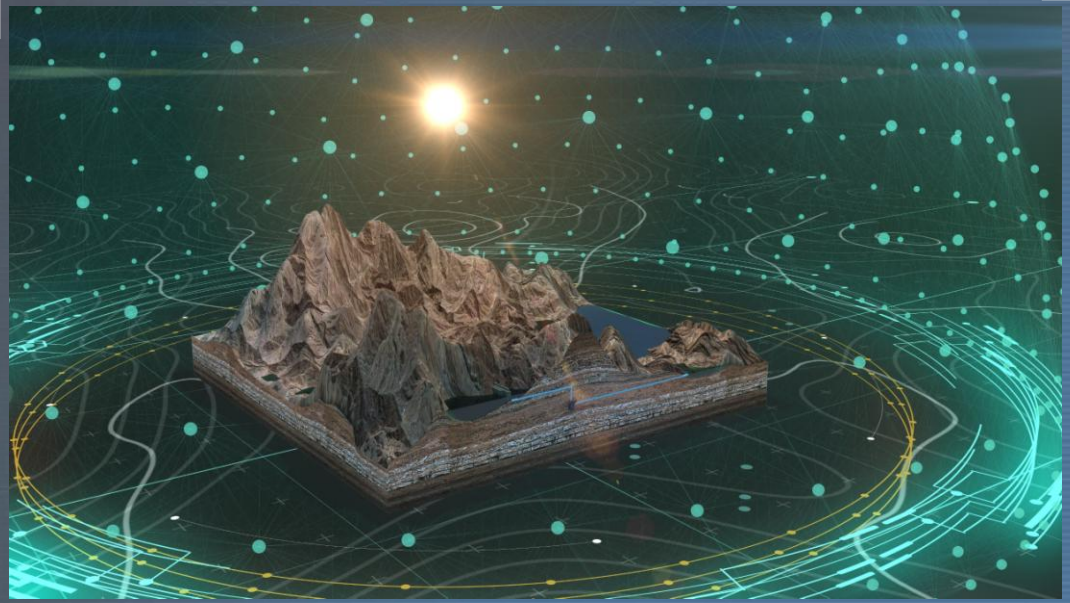
SOLAR TESTING FACILITY (30 TYPES)

TESTING SOILING ON SOLAR PV PANELS

MANUFACTURING OF SPARE PARTS USING 3D PRINTING

DRONES & ROBOTICS

HYDROELECTRIC PUMPED STORAGE STATION IN HATA



TOTAL CAPACITY

250
MW

THE FIRST OF ITS KIND IN THE ARABI

SMART GRID STRATEGY





CONNECTING SOLA

شمس دبي
Shams Dubai

SHAMS DUBAI

EV GREEN CHARGER

INFRASTRUCTURE AND ELECTRIC VEHICLE CHARGING STATIONS

MORE THAN **200** EV GREEN CHARGER



DUBAI ELECTRICITY AND WATER AUTHORITY …..A SUCCESS STORY AND WORLD CLASS ACHIEVEMENTS



90%

FUEL UTILIZATION EFFICIENCY

6.5%

WATER LINE LOSSES

From Lowest global

3.3%

ELECTRICITY LINE LOSSES

Lowest global

2.39 min

CUSTOMER MINUTES LOST

Lowest global

DUBAI ELECTRICITY AND WATER AUTHORITY …..A SUCCESS STORY AND WORLD CLASS ACHIEVEMENTS

SMART ADOPTION

We achieved the achievement one year ahead of schedule (80% by 2018)





CUSTOMER HAPPINESS

FURTHER DECOUPLING ELECTRICITY GENERATION AND WATER DESALINATION

100%

OF DESALINATED WATER WILL BE PRODUCED BY USING A MIX OF CLEAN ENERGY



BY **2030**

ALLOWING DUBAI TO EXCEED GLOBAL TARGET TO USE CLEAN ENERGY TO DESALINATE WATER

DEWA SUPPORTS 10X INITIATIVE



PROPEL DUBAI TOWARDS THE FUTURE MAKING IT 10 YEARS AHEAD OF OTHER GLOBAL CITIES THROUGH GOVERNMENT INNOVATION

DISRUPTING THE ROLE OF
UTILITIES BY
LAUNCHING

“DIGITAL DEWA”

THE DIGITAL ARM OF DUBAI ELECTRICITY AND WATER AUTHORITY



OUR 10X INITIATIVE WILL FOCUS ON 4 PILLARS TO DELIVER AN NEW UTILITY EXPERIENCE FOR DUBAI AND THE WORLD :

STORAGE

SECOND PILLAR

ENERGY STORAGE

INNOVATIVE ENERGY STORAGE TECHNOLOGIES



RENEWABLE

FIRST PILLAR

SOLAR ENERGY

ADVANCED SOLAR ENERGY TECHNOLOGIES



OUR 10X INITIATIVE WILL FOCUS ON 4 PILLARS

TO DELIVER AN NEW UTILITY

DIGITAL

DIGITAL SERVICES

FOURTH PILLAR

TO PROVIDE 24/7 WORLD CLASS SERVICES DELIVERY THROUGH A FUTURISTIC DIGITAL PLATFORM

MORO



AUTONOMOUS

Artificial Intelligence

THIRD PILLAR

EXPANDING AI SOLUTIONS TO MAKE DUBAI THE FIRST CITY TO PROVIDE WATER AND ELECTRICITY SERVICES BASED ON AI



حكومة دبي
GOVERNMENT OF DUBAI

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

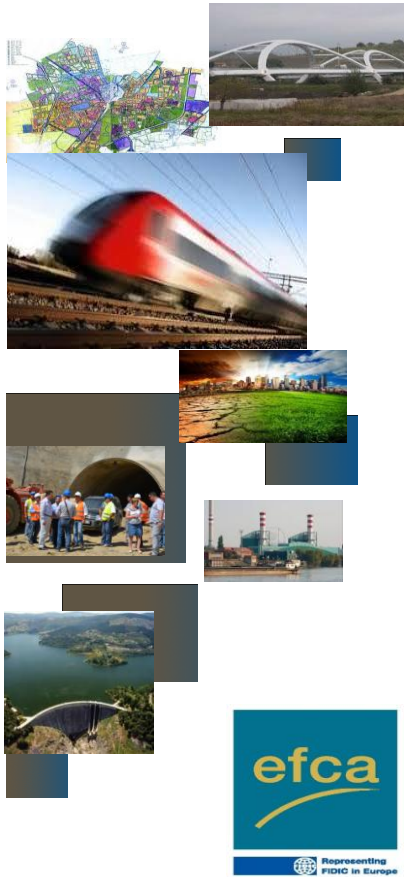


Business Mission
to the UAE
April 14-16, 2019

Gabriele Scicolone

President of OICE

(Italian Engineering Association)



oice
Association of Italian Engineering, Architectural and Technical-Economic Consulting Organizations
CONFINDUSTRIA

Business Mission to the EAU

Roundtable Energy, Water, Environment

Gabriele Scicolone
President

efca
Representing FIDIC in Europe

FIDIC

OICE in a nutshell

- Created in 1965 OICE is member of FIDIC, EFCA and the Confederation of Italian Industry
- 400 associates
- Members' yearly turnover amounts to 3 billion €uros
- 46% of revenues abroad
- Members companies employ about 20.000 engineers, architects, geologists and economists

OICE operates in 4 major areas:

- Representing engineering interest in Italy and worldwide
- Promoting engineering culture
- Promoting Internationalization and participation of Italian companies in International Projects
- Providing advisory services for members

Internationalization activities

Supporting Italian engineering companies in internationalization activities, specifically:

- Promoting the presence of engineering companies in governmental missions across the world
- Organizing specific business visits in selected foreign countries
- Supporting Associates in cooperating with EU Institutions and International Banks: WB, EBRD, ADB, AfDB, EBI, AIIB, Regional Financial Institutions
- Promoting networking and partnerships with international players in the target countries



CIVIL ENGINEERING



TERRITORIAL PLANNING



TRANSPORT ENGINEERING



ARCHITECTURE



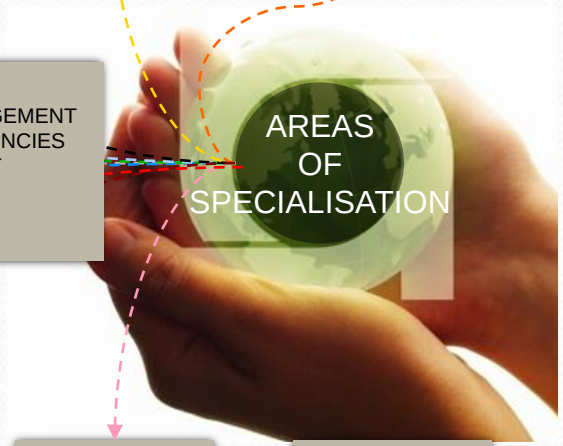
URBAN PLANNING



MARITIME ENGINEERING



PROGRAMME AND PROJECT MANAGEMENT
ADVISORY TO GOVERNMENTS/AGENCIES
RESEARCH & DEVELOPMENT
TRAINING



AGRICULTURE



ENERGY



ENVIRONMENT ENGINEERING



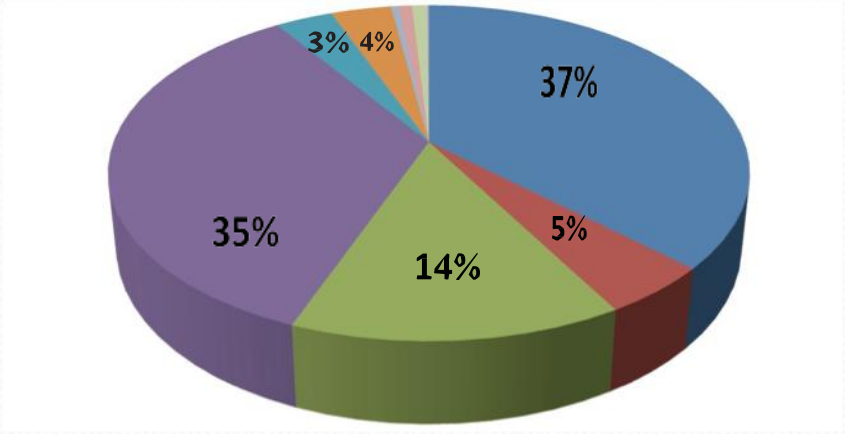
HYDRAULIC ENGINEERING



PLANT ENGINEERING

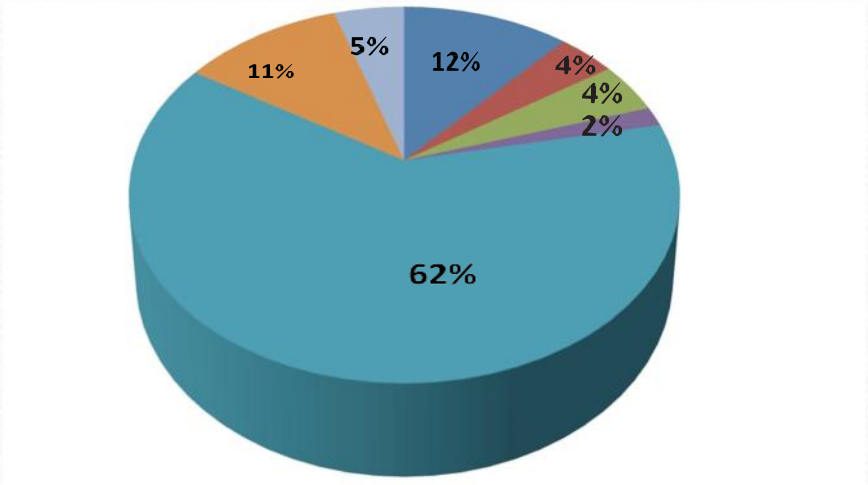


Production value, by area, 2017



- Italy
- Asia
- UE
- Sub-saharan Africa
- Other European
- Mediterranean Africa

Foreign production value, by sector, 2017



The right context for cooperation

- Macro economic and geopolitical scenario
- Positive impact of technology and innovation, which enhance possible cooperation
- Leading sectors: Energy&Environment, transportation and construction
- Asia considered by OICE companies as paramount for foreign activities
- Asia (Middle East, Central Asia, South East) major area of interest for the next 3 years
- Italian strong presence on MENA markets



EAU and Italy

- Strong political and economic cooperation
- Main market for Italian Export within MENA area
- EAU investments projects pipeline
- Strategic hub for business
- Special Italian expertise: energy&environment, water, tourism&hospitality, real estate, transport infrastructures
- EAU-Italy cooperation on third countries
- EXPO: Milan 2015-Dubai 2020





GREECE
THESSALONIKI METRO

ALBANIA
WATER PLANTS BOVILLA - TIRANE









MONTENEGRO
PLAN FOR THE REFORM OF THE MONTENEGRIN COASTAL REGION











ITALY
DIAMOND TOWER, FIT-OUT OF THE NEW BNP PARIBAS HEADQUARTERS

ITALY

A14- SECTION 6B WIDENING TO THE 3ND LANE - DESIGN AND WORK SUPERVISION



ITALY
INTESA SAN PAOLO BANK HEADQUARTER





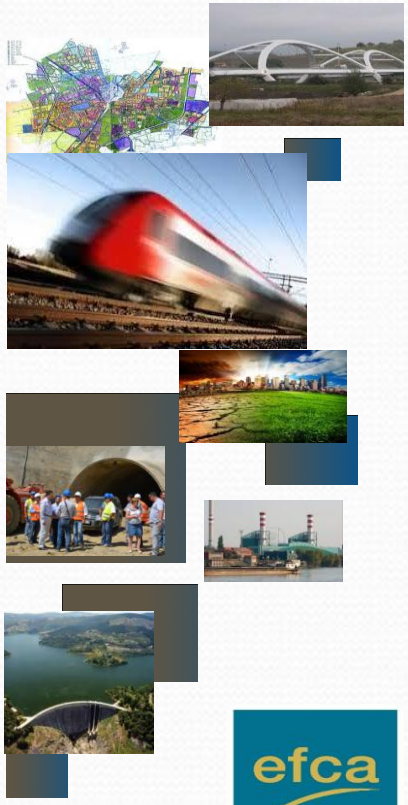
EGYPT
TECHNICAL ASSISTANCE FOR IMPROVING THE CONNECTION BETWEEN THE SUEZ CANAL WITH GREATER CAIRO

LIBYA
BUSINESS DISTRICT OF BENGASI IN LIBYA





KUWAIT
GENERAL STRATEGIES FOR KUWAIT PORTS AUTHORITIES AND DEVELOPMENT OF ITS PORTS OPERATIONS



Association of Italian Engineering, Architectural and Technical-Economic Consulting Organizations

CONFINDUSTRIA

Thank you for your attention

Gabriele Scicolone

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Business Mission
to the UAE
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Energy, Water & Environment

Opportunities and challenges for strategic partnerships with Italian companies in the evolving UAE energy sector

sace simest
•gruppo cdp•

ENERGY-WATER-ENVIRONMENT
Opportunities and challenges for strategic partnerships with Italian companies in the evolving UAE energy sector

Dubai, April 15th 2019

Hotel Grand Hyatt

History and company profile

- SACE is the Italian Export Credit Agency, that jointly with Simest forms the **Export and Internationalization Hub** of Cdp, the state owned entity that promotes the development of the Italian industrial system
- Sace Simest support Italian companies with a **wide range of insurance and financial products**: export credit, investment protection, financial guarantees, surety bonds, factoring, equity investments and soft loans
- with a € 114 billion transaction portfolio, Sace Simest facilitate the **financing of large projects** involving an **Italian procurement**, providing foreign buyers with competitive finance/ payment terms



1977 — Establishment of SACE as the Italian ECA

2004 — SACE is transformed into a SpA wholly owned by MoF

2004 — SACE enters the short-term credit insurance market

2005 — SACE enters the surety market

2010 — SACE enters the factoring market

2014 — SACE is acquired by Cassa Depositi e Prestiti (Cdp)

2016 — Cdp approves the transfer of 76% of SIMEST's shares to SACE

sace simest
•gruppo cdp•

UAE a strategic area for Sace Simest

- **UAE represents a focus market** for our activities due to huge Governments investing in infrastructures, urban development and industrial diversification
- **Sace Simest was the first ECA to open an office in Dubai**, a strategic hub for reaching out business opportunities all over the MENA regional hub for the GCC and North Africa countries
- UAE selected among **pioneer markets** to promote our **"Push Strategy"**

Sace Simest in the UAE

OUTSTANDING COMMITTMENTS	PIPELINE	EQUITY INVESTMENTS
2018	2018	2018
€ 850 Mln *+111% vs 2017*	**$ 5,0** mld	**# 5** €3 mln

Sace Simest: enhancing trade and investment opportunities in the UAE



هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

$ 310 mln

Credit Line to the Dubai Electricity & Water Authority (DEWA) for the construction of a desalination plant by Fisia Italimpianti, (Salini-Impregilo).



هيئة كهرباء ومياه الشارقة
Sharjah Electricity & Water Authority

Cooperation on **Waste and Water treatment, Renewables and Energy** with SEWA on tied and untied facilities



إكسبو EXPO 2020
دبي، الإمارات العربية المتحدة
DUBAI, UNITED ARAB EMIRATES

$1.0 billion

Letter of Interest to UAE Department of Finance to support up to $1.0 billion for projects connected to the Expo 2020 site involving Italian suppliers

Mohammed bin Rashid al Maktoum Solar Park



World's largest single-site solar
AED50bn (USD13.6bn) project
Independent Power Producer model.
Power generation capacity of 1,000MW by 2020 and 5,000MWby 2030,
Reducing 6.5mn tonnes of emissions annually.
The project is going to be developed in 3 stages:

- 13MW operating starting 2013
- 200MW operating starting 2017
- 800MW starting 2020

Energy performance



DEWA as a Super ESCO (Energy Service Company), it enables the energy performance contracting market in Dubai by developing energy efficiency projects targeting more than 30,000 buildings by executing building retrofits, increasing penetration of district cooling, building capacity of local ESCOs for private sector and facilitating access to project finance.

UAE Water Security Strategy



In September 2017, Ministry of Energy & Industry unveiled the UAE Water Security Strategy 2036, which aims to ensure sustainable access to water during both normal and emergency conditions.

The strategy focuses on:
Water Demand Management Programme
Water Supply Management Programme
Emergency Production and Distribution Programme
Policy development / legislation

Case studies - Energy

Enel Green Power – South Africa

- **Export Credit Facility of € 160 mln entirely covered by SACE** granted by a pool of international banks to the South Africa subsidiary of EGP for the construction of a photovoltaic plant with an installed capacity of 313,5 MW realised by the Italian consortium formed by Terni Energia and Enertronica



Ministry of Energy – Egypt

- **SACE has guaranteed Italian sub-supplies for € 160 million** linked to the construction of a turnkey CCGT power station of 4,800 MW in Beni Suef, 120 km South of Cairo, within an EPC contract of €2.0 assigned to a consortium formed by Siemens AG and El Sewedy Electric



National Grid - UK

- **Export Credit Facility of € 520 mln 90% covered by SACE** granted by a pool of international banks for the design, supply and installation of a submarine cable interconnecting UK and Norway energy grids with a capacity of 1400 MW, part of an enlarged project valued at €2.0 bn



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•gruppo cdp•

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Matteo Codazzi

CEO of CESI

LIMITED USE

CESI

Shaping a Better Energy Future

CESI is a leading player in engineering, testing and power systems consulting for the electricity sector worldwide



CESI is very well entrenched in the





CESI-GCC Member states Workshops On Energy Trading Abu Dhabi and Bahrain



CESI-AFESD Pan-Arabic Masterplan Interconnections Electricity and Gas

CESI is very well entrenched in the Middle East



CESI has a solid track record supporting the (r)evolution of the UAE power system

UAE

- **Population:** 9.4 millions
- **GDP :** 382,7 billion $
- **Electricity demand:** 121 TWh
- **Installed Capacity:** 37,3 GW
- **Transmission network:** 13.158 km
- **RES penetration:** <1%



CESI Main References in the Area

1. *DEWA* – **UAE**
   Consultancy services for Shams Dubai
2. *DEWA* – **UAE**
   Transmission Operational Department support for RES integration
3. *ADWEA* – **UAE**
   Smart Metering Strategy Review Abu Dhabi
4. *ADWEA* – **UAE**
   Quality Assurance and Control with Transco Abu Dhabi
5. *AFESD* – **Arab League**
   Strategic Pan Arabic Masterplan
6. *GCCIA* – **GCC**
   Consultancy on strategic interconnection projects

for GCCIA

Key CESI Clients in the Area

GCC Electrical Testing Laboratory
المختبر الخليجي لفحص المعدات الكهربائية

ARAB FUND FOR ECONOMIC & SOCIAL DEVELOPMENT

هيئة مياه وكهرباء أبوظبي
Abu Dhabi Water & Electricity Authority

Flagship Project

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

Client: DE

Consultancy service for implementation and management of distributed renewable resources generators into DEWA Grid

- Assist DEWA in launching distributed renewable connection projects
- setting up the new organisation structure for handling Distributed Renewable Connections;
- support DEWA in defining the most appropriate technical standards for the connection
- make recommendations for a successful implementation program

Grid reinforcement and renewables are the two major drivers to the UAE power sector development



Fostering partnerships with UAE is increasingly attractive for the italian power and utility industry

Business Mission
to the UAE
April 14-16, 2019

Giuseppe D'Alessandro

Director

Eemax Engineering

Prot. ADRGCMA-100.1143.075-IE-035
Bologna, 15 march 2019, Italy

EEMAXX

Company profile
Business Model

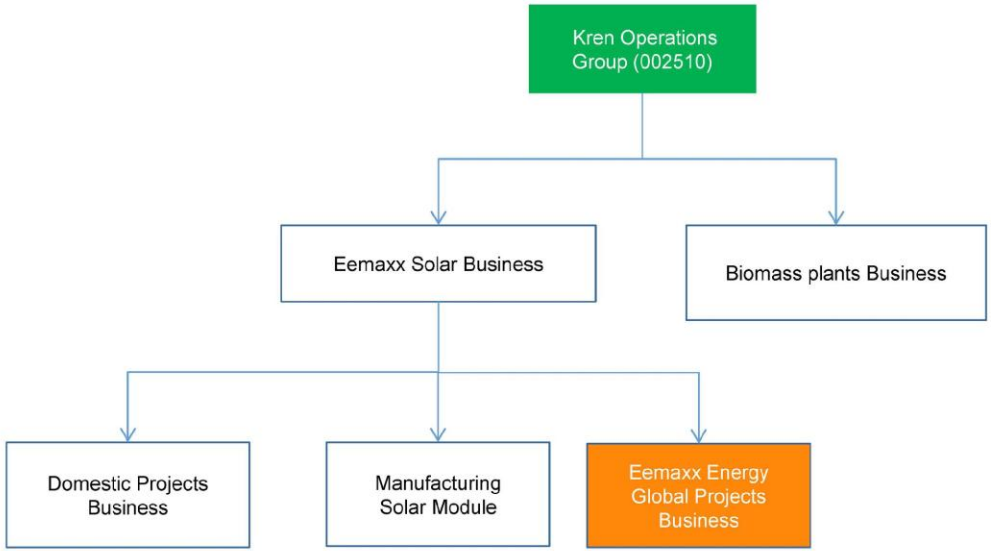
Kren Operations Group, Ltd.
www.eemaxx.it



AGENDA

- Company Profile
- Business Model
- Energy Markets
- Global Service Network
- Project References

Kren Operations Eemaxx and its Global Projects Business



Our Service Portfolio - Overview

1. • Project Development
2. • EPC
3. • Interconnection
4. • Project Asset Management, Operation & Maintenance
5. • Distributed Energy and Market Parity






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Business Model

EEMAXX

BUSINESS MODEL

PROJECT DEVELOPMENT	EPC, CONNECTION, PAC	BRIDGE/CONSTRUCTION FINANCING	PROJECT FINANCING	OPERATION & MAINTENANCE
• Development or purchase of projects.. • The strategy is to create an SPV for each project..	• It is the EPC's responsibility to provide a connection to the network, sign the Provisional Acceptance certificate (PAC) and the Final Acceptance Certificate (FAC)	• Eemaxx provides services aimed at the construction of PV plants: supply, production, assembly and construction	• In addition to the Bridge Financing and Construction Funding, Eemaxx has the financial capacity and a global network to finance complete projects	• The company can take part in the Operation and Maintenance (O & M) activities of the PV plants together with its service partners



Six Energy
Location: Emilia Romagna, Italy
Location Type: Roof Top
Project Scale: 2,3 MWp



Location: Campania, Italy
Project Type: Roof Top
Project Scale: 1,8 MWp



Products, Certificates and Warranty



- Our manufacturing plant has been certified according to the following standards:
  - ✓ ISO 9001:2008 Certificate of Quality Management System
  - ✓ ISO 14001:2004 Certificate of Environment Management System
  - ✓ OHSAS 18001:2007 Certificate of Safety Management System
- Our production lines are under rigorous statistical process control
  - ✓ Strict online and before shipment quality control are conducted by using advanced inspection equipment.
- Our PV modules have been awarded with independent VDE, CSA, TUV, UL, CEC and CGC certifications
- We always strive to make better products and spare no efforts to improve the quality and performance of our cells and modules

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References

- Over the past three years, Eemaxx has completed PV projects in:
  - Italy – 48 MW

- We are currently developing project pipeline for 2018-2019 in:
  - Mexico – 235 MW
  - Italy – 73,5 MW on the roof tops
  - Italy – 41 MW on the industrial areas and waste plants
  - Dubai – 5 MW
  - Senegal – 50 MW
  - Guinee – 100 MW
  - Guinee-Bissau – 100 MW

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  - Guinee – 100 MW
  - Guinee-Bissau – 100 MW

Irradiation and Lands



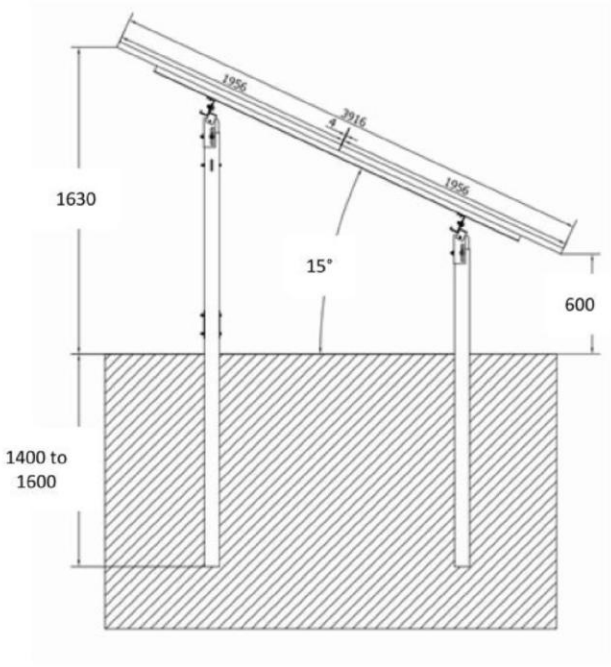
EEMAXX

Sub station



Position Plan





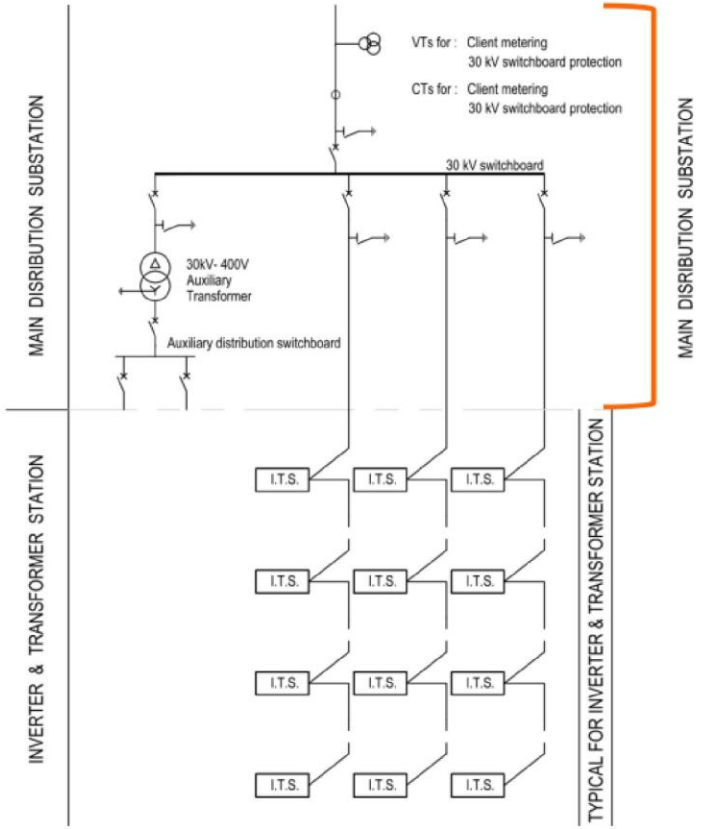
Structures



Structures



Electric plants







PV and Storage







Capacity: PV 40 kW + BESS 320 kWh
+ Diesel 415 kVA
Electricity saved each year: 84,096 kWh
Estimated annual savings: US$ 56,000

Intelligent micro-grid system





Capacity : 30 kW / 100 kWh
Type: PV + Storage + Diesel



Capacity : 100 kW / 200 kWh
Type: PV + Storage + Diesel

Summary

EEMAX

Project Description

- Technical characteristics:
  - blocks of 2,480 MWp, 2 MWac,
  - Ratio DC/AC = 1,24
  - Power @ POC = 200MWac
  - Grid connection Point about 1.5 km
  - Sandy ground
  - Lands 424Ha
- Grid connection:
  - Voltage: 90 kV – 30 kV
  - Frequency 50 Hz
  - SOIGEA for measuring the power factor at the PDL (metering point) for reagent control

Technical data

NOCT*	[°C]		45 ± 2
Tilt	[°]		15°
Azimuth (from Nord)	[°]		180°
Shading Angle	[°]	or GCR [%]	17°
Installed power	[kWp]		200000
Module nameplate power	[Wp]		330
Number of Pv modules per string			20
Inverter Type and power	[kVa]		925
Battery Type and power	[kW]		300

– * Nominal temperature of the operating cell

Business Mission
to the UAE
April 14-16, 2019

Carlo Vergano

Project Manager

ROWS UAE Pavillon Duplomat



Prezi Slides

https://prezi.com/view/yBuEdYbgAbXNmA4TsEUW/

Business Mission
to the UAE
April 14-16, 2019

Massimiano Tellini

Head Circular Economy

Intesa Sanpaolo



Circular Economy

The 21st century economic paradigm for a positive development

Massimiano Tellini
Global Head – Circular Economy

innovationcenter.circulareconomy@intesasanpaolo.com

INTESA SANPAOLO
INNOVATION CENTER



Vision

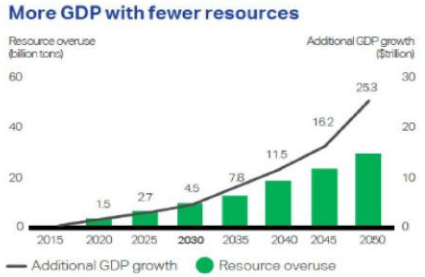
Innovation as a force for good

Mission

Exploring business models of the future to discover new assets and skills that support the long-term competitiveness of the Group and its customers as we become the driving force of the New Italian Economy

INTESA SANPAOLO
INNOVATION CENTER

CE Impact: Growth, Savings and Investments

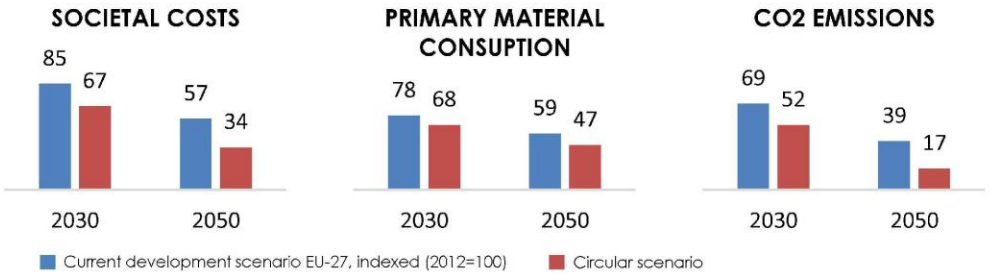


Global - Growth

$ 4.5 tn additional economic growth in GDP by 2030[1] linked to the scarsity of natural resources and the population growth

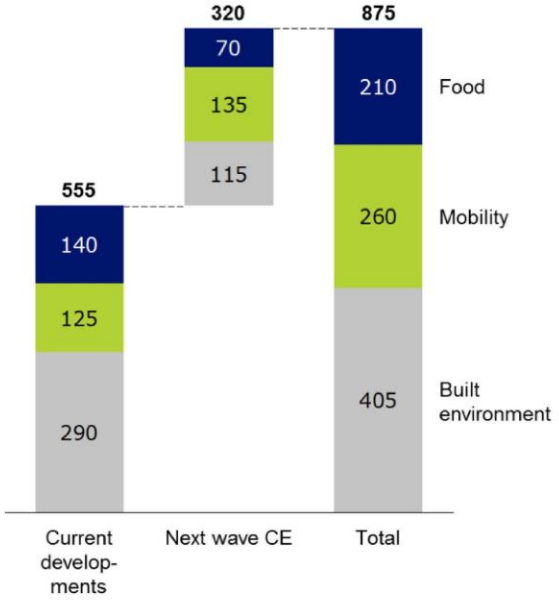
Europe - Savings

€ 1.8 tn of savings by 2030[2] in Food, Mobility and Built Environment industries



Europe - Investments

€ 875 bn of circular investments expected by 2025[3]



Sources: «Waste to Wealth», J. Rutqvist & P.Lacy, Accenture (2015)
«Towards the Circular Economy», World Economic Forum (2014)
«Achieving Growth Within», SistemiQ,SUN, Ellen MacArthur Foundation (2017)

Linear Risks

The exposure to the effects of linear business practices will negatively impact an organization's ability to continue its growth path

Risk factors	Linear business practices: Utilise non-renewable resources	Linear business practices: Prioritise sales of new products	Linear business practices: Fail to collaborate	Linear business practices: Fail to innovate or adapt
Market	Scarcity of primary resources Volatility of resource prices	Bans on trade of waste Volatility of resource prices	Limited opportunities to expand to new markets	Scarcity of resources Volatility of resource prices
Operational	Internal process failures	Worker safety issues	Supply chain inefficiencies	Inability to hire new talent
Business	Changing demand for sustainable solutions Decreasing cost of renewables	Disruptive new business models Decreasing margins from commoditisation	Disruptive new technologies	Disruptive new technologies Disruptive new business models
Legal	Fines for legal violations More stringent environmental laws	Requirements for extended producer responsibility	Fines for legal violations	More stringent environmental laws

*Current risk assessments and disclosures do not comprehensively account for **'Linear Risks'**, and as a result **financial portfolios** are loaded with investments exposed to these risk factors **without being properly considered in the risk assessment process**.*

Source: «Linear Risks report», FinanCE Group (2018)

Intesa Sanpaolo and the Ellen MacArthur Foundation



- Dame Ellen MacArthur is a successful solo long-distance yachtswoman. In 2005 she broke the world record for the fastest solo circumnavigation of the globe, thus gaining international renown
- Her Foundation is the world most influential and authoritative player on Circular Economy
- They work with Entrepreneurs, Government and Universities to accelerate system shift towards CE

Since December 2015, Intesa Sanpaolo Group is the only **Financial Services Global Partner** of the Ellen MacArthur Foundation





CE100 is a global platform for companies, innovators and regions to accelerate the transition to CE

Intesa Sanpaolo: an Impact Bank







On January 28th, Intesa Sanpaolo publicly renewed its commitment to creating a positive impact on both society and the environment.

Carlo Messina, **CEO of Intesa Sanpaolo**, highlighted the support to **Circular Economy** as a **key strategic pillar** to achieve this goal.

He was supported by renowned global leaders such as **Andrew Morlet, CEO of Ellen MacArthur Foundation** and **Robert Kapito, President and Director of BlackRock**, who both held speeches at the Intesa Sanpaolo event.

ISP CE Plafond

Eligibility criteria to access the € 5 bn credit facility dedicated to circular initiatives

1. Product life extension	2. Renewable resources	3. Resource efficiency/effectiveness	4. Recyclable products	5. Enabling technologies
Solutions that extend the product life or that **increase cycles of use** of goods and/or materials	Production processes fueled by and / or products made of **renewable or recycled resources**	Products / services that optimize **efficiency or effectiveness** of **resources consumption**	Products that can **fully recycled or composted**	**Innovative technologies** to enable circular models











Developed in partnership with

ELLEN MACARTHUR FOUNDATION

INTESA SANPAOLO INNOVATION CENTER

The Distinctive Position of Intesa Sanpaolo

Origination of Long Term strategic relations with key stakeholders for creating meaningful impact



Recognition of a Global distinctive positioning

EUROPEAN COMMISSION

EU Commission "Circular Economy Financing Expert Group"

WEF "Platform for Accelerating the Circular Economy"

WORLD ECONOMIC FORUM

Alliance for the Circular Economy and Circular Manifesto

Members of the Alliance are **Intesa Sanpaolo Enel, Bulgari, Eataly, Costa Crociere, Ferragamo, Novamont** and **Fater**.



In 2018, Intesa Sanpaolo has been core partner in the development and launch of the **Italian Position Paper on Circular Economy**.

Circular Economy Project - Reputational Passport [1]

5% increase of the reputational capital of the Bank

22% rise of the reputational capital of the Innovation Center

[1] «Reputation Manager tool», DRE and CRO Areas (2017)

To continue this conversation…

Circular Economy Team



innovationcenter.circulareconomy@intesasanpaolo.com

"The Circular Economy represents a huge opportunity to reconnect Business & Society, re-thinking financial instruments to support the re-design of the industrial ecosystem"

…thanks!

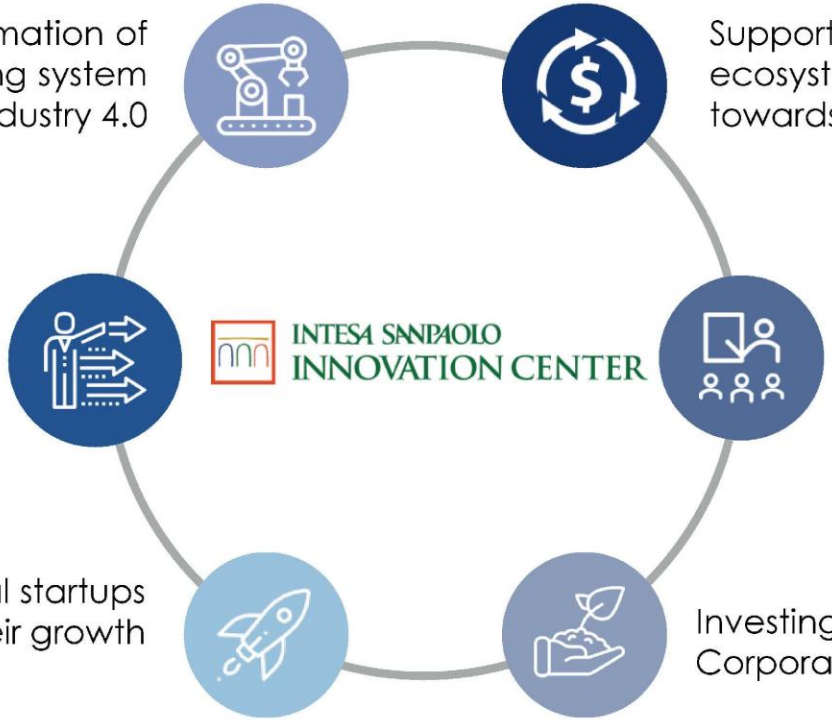
Appendix

Intesa Sanpaolo Innovation Center: Main objectives

Speeding up the transformation of the Italian manufacturing system toward Industry 4.0

Supporting the manufacturing ecosystem along its transformation towards the Circular Economy

Promoting the Group identity as innovation leader



Developing laboratories and Competence Centers

Identifying high potential startups and promoting their growth

Investing through NEVA FINVENTURES Corporate Venture Capital

The Linear Economy: Take > Make > Dispose

A model embedded with critical risks

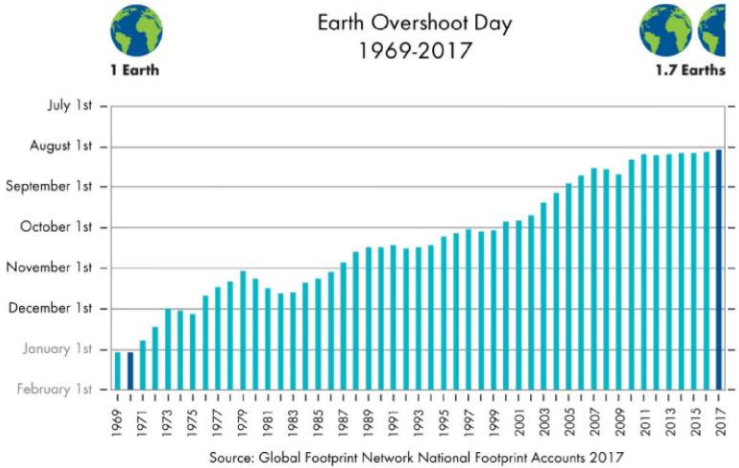
Materials are **extracted**, **manufactured** into products, **sold** to customers, and ultimately **disposed off**.

Materials use increase



OECD

*Over **50% of GHG emissions** are related to virgin materials management activities*



Linear Risks

Utilse **non-renewable resources** (scarce)

Prioritise **new products** (planned obsolescence)

Fail to **collaborate**

Fail to **innovate** or **adapt**

Market risks (price volatility)

Operational risks (supply chain inefficiencies)

Business risks (consumer trend)

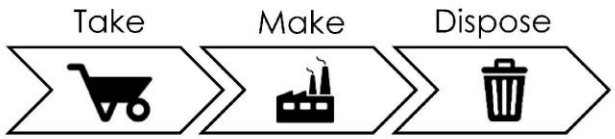
Legal and regulatory risks

Sources: «Global Material Resources Outlook to 2060», OECD (2018)
«Linear Risks report», FinanCE Group (2018)

Transition towards the Circular Economy

A new future-proof value creation model

Linear Economy → Circular Economy



RE-THINK

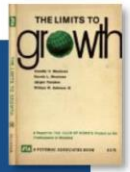
RE-DESIGN



- Volume optimization with **no account of impact** of production
- **What happens at the end** of the product's use?
- Products **are not designed** to be reused, repaired and recycled
- **Waste** generation: technical and biological nutrients all mixed up

If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years.

The Club of Rome, The Limits to Growth (1972)



The Circular Economy Principles

Decouple economic growth from the consumption of finite natural resources

Underpinned by a transition to **Renewable Energy Sources**, the circular model is based on three principles:

Design out waste and pollution

Keep products & materials in use

Regenerate natural systems



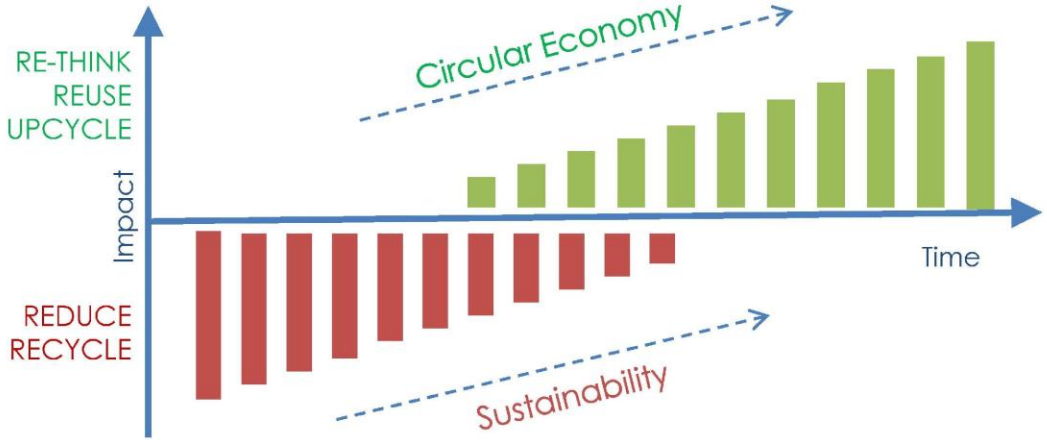
Today's economy is massively wasteful. Most of the materials we use, we lose, the things we make are consistently under-utilised, and our efforts to fix it treat the symptoms, not the cause.

Andrew Morlet, CEO of the Ellen MacArthur Foundation

The Limits of Sustainability

Sustainability lacks of a **systemic approach**, which - on the other hand - is a main pillar of the Circular Economy





Source: John Elkington, Harvard Business Review (2018)

Globalize the Circular Economy

A global need to share data and coordinate industrial policies and trade - *Nature*



A **global strategy for the circular economy** must include:

- a **global database** to capture links between resource uses
- a **global platform** for sharing knowledge about the circular economy
- **international alliances** to promote large-scale experimentation
- **standards** for performance measurement, reporting, accounting and future products
- ways to enforce **regulations**, settle **disputes** and implement **sanctions** on a global scale

Source: Yong Geng, Joseph Sarkis & Raimund Bleischwitz, Nature (2019)

ReSOLVE: a Circular Framework



Regenerate

- Shift to renewable energy and material
- Reclaim, retain and restore health of ecosystems
- Return recovered biological resources to the biosphere

NOVAMONT

Production of biodegradable and compostable bioplastics to promote sustainable consumption



Share

- Share assets (e.g. cars, rooms, appliances)
- Reuse/secondhand
- Prolong life through maintenance, design for durability, upgradability, etc.

airbnb

Short-term renting of rooms and houses to increase utilization rate of spaces



Optimise

- Increase performance/efficiency of product
- Remove waste in production and supply chain
- Leverage big data, automation, remote sensing and steering

Saxa Gres
THE CIRCULAR FACTORY

Production of a porcelain with up to 30% materials coming from urban waste



Loop

- Remanufacture products or components
- Recycle materials
- Digest anaerobic
- Extract biochemicals from organic waste

SERMEC

Remanufacturing processes for components applied to the Driveline, Powertrain & Chassis technology of modern vehicles



Virtualise

- Books, music, online shopping, autonomous vehicles, etc.

amazon kindle

Replacement of physical books with electronic ones on Kindle devices



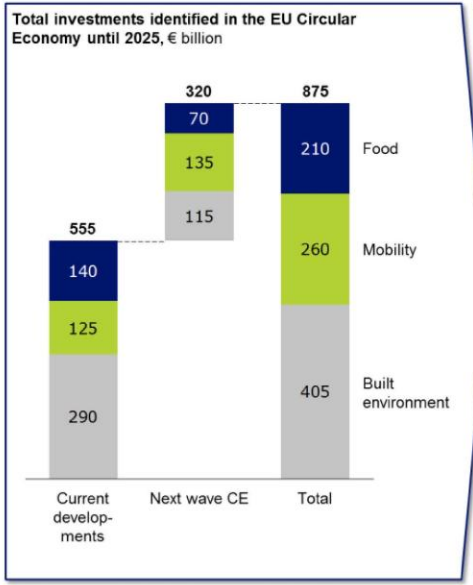
Exchange

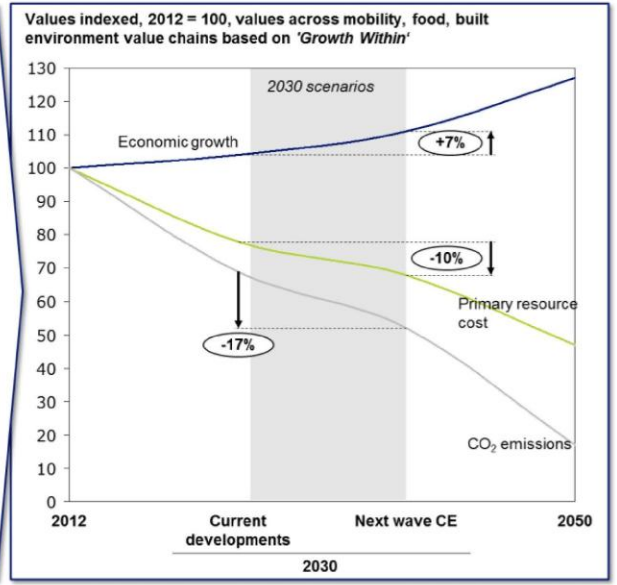
- Replace old with advanced non-renewable materials
- Apply new technologies (e.g. 3D printing)
- Choose new product/service (e.g. multimodal transport)

ARUP

Introduction of 3D printing and modular design in the built environment sector

CE Impact: € 875 bn Investments in Europe by 2025





MOBILITY: € 135 bn

- ☐ modally integrated shared mobility systems
- ☐ transitioning to circular car designs
- ☐ ramping up the reverse value chain for vehicles through focusing on remanufacturing

FOOD SYSTEM: € 70 bn

- ☐ fully regenerative agricultural practices
- ☐ closing organic nutrient loops
- ☐ scaling high-productivity indoor urban farming opportunities
- ☐ developing next-wave protein sources

BUILT ENVIRONMENT: € 115 bn

- ☐ designing and constructing buildings based on circular principles
- ☐ closing loops on building construction and demolition materials
- ☐ building circular cities



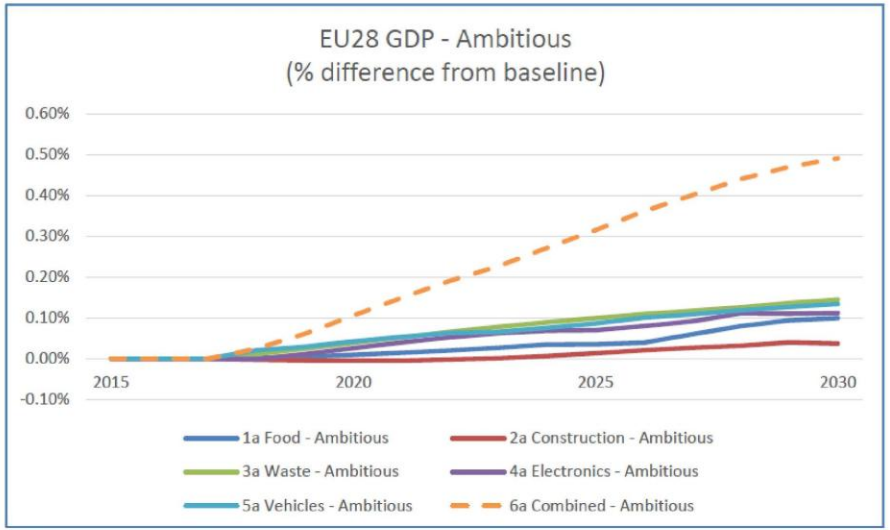
The business community is able to not only think in terms of short-term shareholder profits, thanks to the rethinking of neo-liberal capitalism which was long overdue. […] A long-term view in light of the fourth industrial revolution, and the Circular Economy can be done.

Frans Timmermans, First Vice-President European Commission

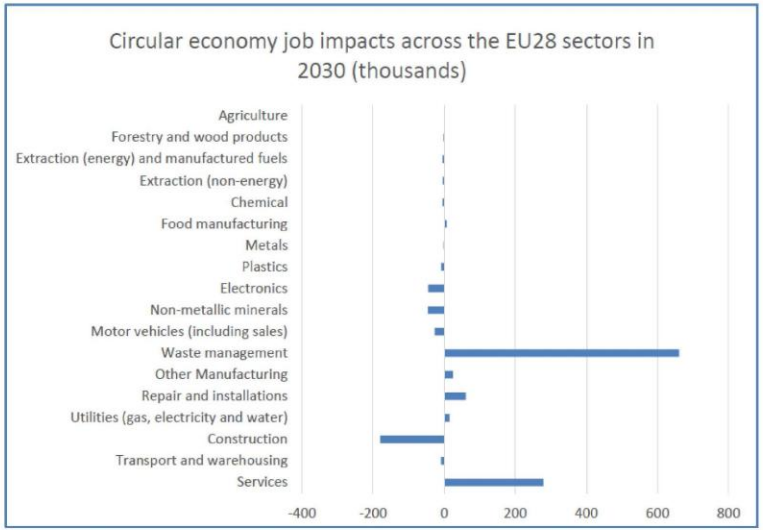
Source: «Achieving Growth Within», SistemiQ,SUN, Ellen MacArthur Foundation (2017)

CE Impact: EU Labour Market by 2030

+ 0,5% GDP
(compared to baseline)



+ 700K Jobs
(compared to baseline)

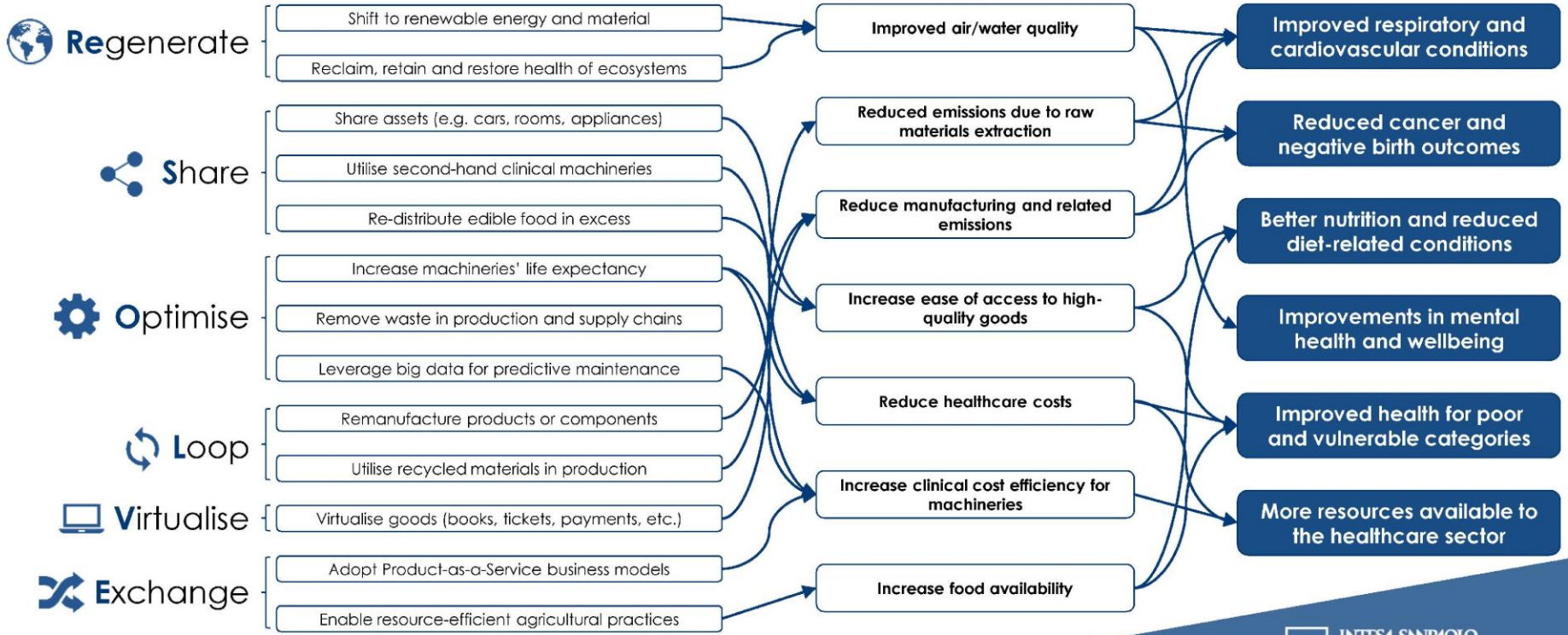


- Decrease in production activities, increase in **Recycle** and **Repair**
- Highest growth in **Waste management** and **Motor vehicles**
- Benefits on labour market to be **heterogeneously spread** across countries
- **Education** as key enabler to develop the required skillset

Source: «Impact of CE policies on EU labour market», European Commission (2018)

Circular Economy: a positive impact for global health

According to the **World Health Organization**, CE might have implications for health both directly, enabling clinical savings with circular procurement, and indirectly, improving environmental conditions and thus reducing diseases.



Adapted from «Circular Economy and Health», World Health Organization (2018)

Circular Economy, Cities and Food

CURRENT FOOD SYSTEM

- Environmental degradation
- The system is wasteful
- The system is not resilient and does not produce healthy outcomes

CIRCULAR FOOD SYSTEM

- Close loops of nutrients and other materials
- Cascading value from by-products
- Diversity of production
- The power of digitalization

Role of cities?

CITIES AND THE CIRCULAR ECONOMY FOR FOOD

Restorative and **regenerative urban food systems**

1. Provide a diagnosis of current urban food systems — 2018
2. Create the design for a regenerative system — 2019-21
3. Start implementing change with the consortium — 2019-21

Position Paper for WEF in Davos 2019

ELLEN MACARTHUR FOUNDATION

Advisory Board

Lead/Core Partners and Philanthropic Funders

INTESA SANPAOLO, SUEZ, VEOLIA, SITRA, IKEA, DANONE, CALOUSTE GULBENKIAN FOUNDATION, PORTICUS

Source: «Cities and the CE for Food» Project Brief, Ellen MacArthur Foundation (2018)

Circular Economy Standard

An Intesa Sanpaolo tool to measure a company's circularity along the value chain

Value chain	Input of the production process	Production process	Output, Distribution and Sale	Internal organization
Evaluation areas	**Resources** Use of renewable energy and biological or fully recyclable nutrients	**Design** Easy to decompose product development (design for disassembly)	**Product** Market for recyclable, regenerable products with extended useful life	**Infrastuctures** Adopting sustainable work environments and low impact transport
	Procurement Sustainable/circular suppliers and access to products or services through leasing, hiring, sharing or product as a service	**Recycling** Recovery and reintroduction into the production cycle of material resources and energy from scrap processing/waste	**Distribution** Delivery of goods and services to customers via sharing platforms or product as a service models	**HR** Education and awareness for employees on EC issues and sharing / collaboration incentives
	Equipment Use of energy safe equipment/machinery, low environmental impact, high safety and low input consumption	**Life extension** Repair / regeneration, resale and remanufacturing of intermediate and finished products	**Logistics** Reverse Logistics for future recycling, regeneration, remanufacturing and re-placing on the market	**Management** Managers updated and aware of new themes and decision-making processes in line with CE business models

Transforming the Linear Model

Reliance on finite natural resources is being overlooked by the financial sector

"Supporters of the circular economy believe it is the only option for the future. Natural resources are running out so it is also a sensible business decision. But not everyone perceives the risk as urgent.

What is still needed is a widespread explanation of how moving to a circular economy could reduce many of the world's sustainability issues – and just how untenable the decision would be to continue with a linear model." – *The Banker*



The Banker

The circular economy: how it transforms finance

Silvia Pavoni | 2/01/2019 9:00 am

As countries continue to consume more resources than they replace, is moving to a circular economy the answer? Some companies are already shifting into service provision so they can control sustainability, rather than selling products that end up in landfill. Silvia Pavoni looks at the business argument.



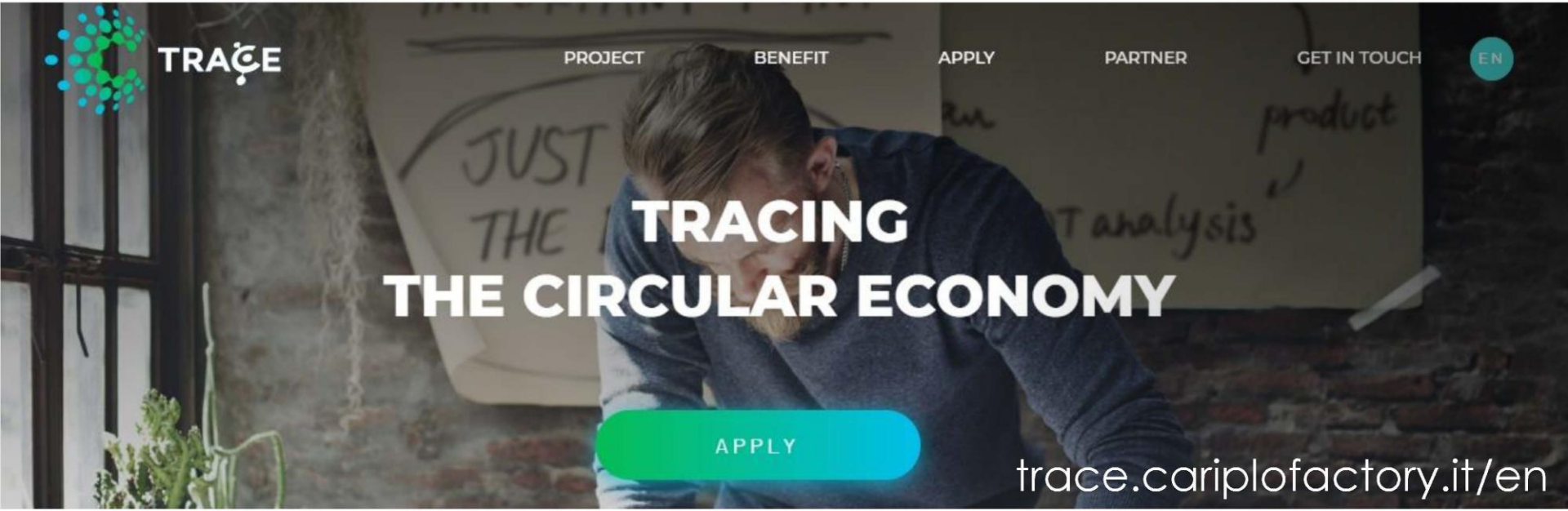
You need to bring it into every business and product lines, in your normal operations, so it becomes part of the culture of 75,000 employees that all start pulling on the same side of the rope rather than [leaving it to the] corporate social responsibility department, where you have 20 people doing something about it.

Frans Van Houten, CEO of Philips

Source: Silvia Pavoni, The Banker (2019)

TRACE

Intesa Sanpaolo web platform to trace the Circular Economy

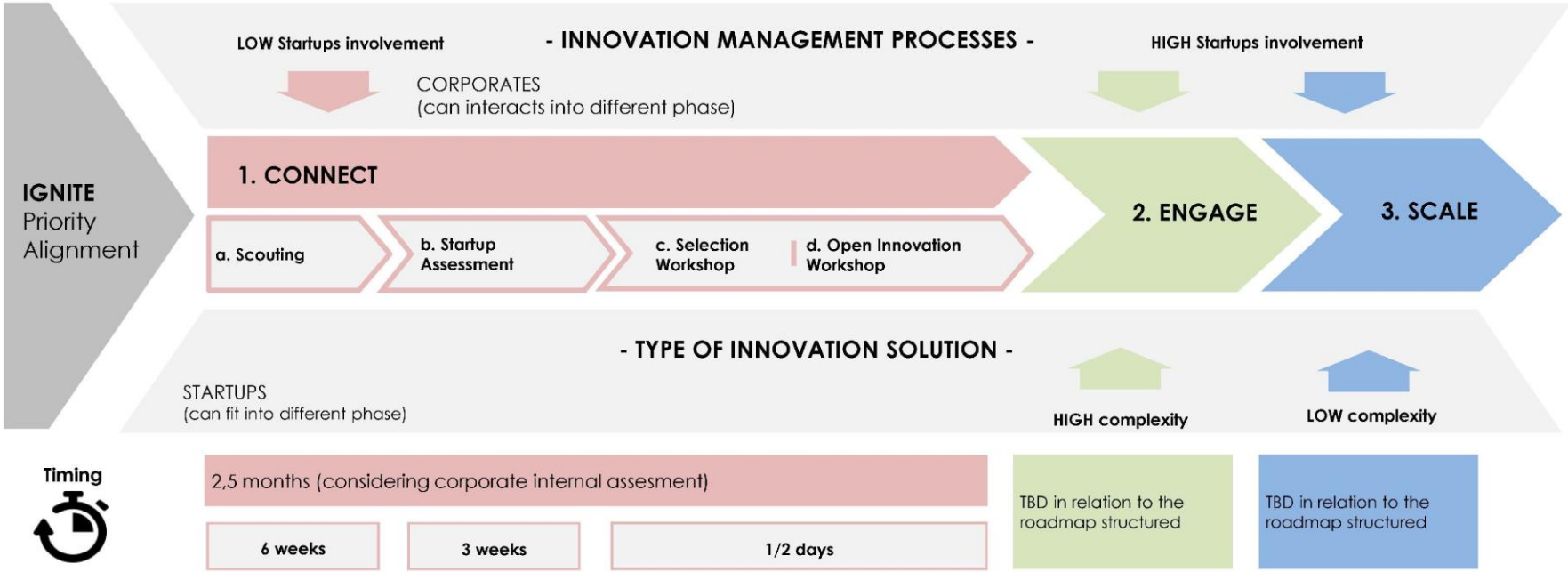


In partnership with

CARIPLO FACTORY
OPPORTUNITÀ INFINITE

INTESA SANPAOLO
INNOVATION CENTER

CE Lab: Open Innovation Process



In partnership with and powered by

CARIPLO FACTORY
OPPORTUNITÀ INFINITE

INTESA SANPAOLO INNOVATION CENTER



The Banker
GLOBAL FINANCIAL INTELLIGENCE SINCE 1926

COMMENT & PROFILES

Why more banks must support the circular economy

Carlo Messina | 1/03/2019 9:00 am

On March 1st, **Carlo Messina, CEO of Intesa Sanpaolo**, published an article on **The Banker** stating as follows: "***Circular Economy redefines the approach to value creation***. *It is a disruption to the business model that Intesa Sanpaolo is supporting and more banks should be doing the same*".

The financial sector, especially from a de-risking perspective, should play a crucial role in ***unlocking opportunities*** *while supporting clients in reorienting their business strategies.*

The current linear model embeds critical risks for businesses, which then scale to a systemic level through today's industrial processes. Circular Economy can ***mitigate linear risks*** *and create opportunities in terms of resource efficiency and profitability gains.*

3R Model: a Circular Perspective for Finance

Risks

- **Systematic risk decrease** and resiliency increase due to lower rely on virgin raw materials
- A **more stable economy**, able to control finite stocks and balance renewable resources flows
- CE as a driver for boosting the corporate banking market and **regenerate banks' credit portfolios** with safer counterparts

Revenues

- **New revenue patterns** provided by sharing economy, extended life products and product-as-a-service business models
- **Disruptive innovation in the asset management industry** with a new asset class and structured securities

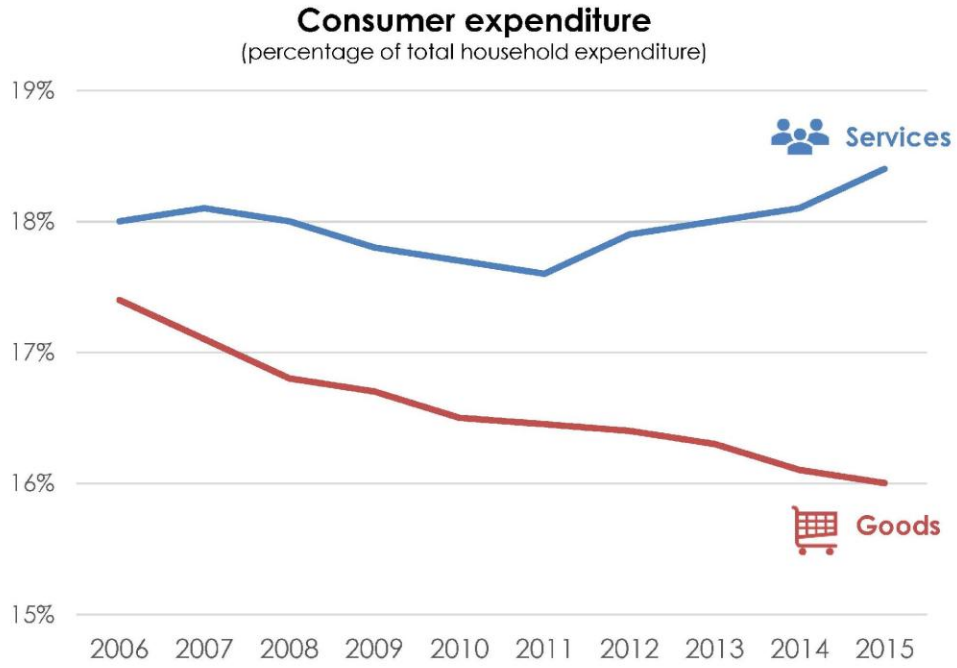
Reputation

- **Back to basics, financing the innovation**: support the growth of the real economy pursuing the wellness and the environment
- **Reputation capital**: increase the bank reputation thanks to a new strategic position in the market

Source: «3R Model», Prof. Claudio Zara, Bocconi University (2018)

Circular Economy and Servitization

Servitization is the way forward to achieve economic growth while having an environmentally sustainable approach



Circular Servitization cases

PHILIPS

Through **Light-as-a-Service**, Philips installs and mantains lighting at a fixed fee while retaining its ownership. This also prevents customers to made upfront investments in new hardware.

CAR 2GO

Car2Go provides a **Car Sharing** service that increases the utilization rate of vehicles and reducing costs for drivers. The company is fully transitioning its fleet towards electric cars.

Vigga™

Vigga is an online platform that offers **Dress-as-a-Services** for babies. This generates savings for families, that are no longer forced to keep buying new clothes for their fast-growing children.

Source: Bureau of Labor Statistics (US Market, 2016)

CE as a Strategic Driver of Value Creation



In 2018 Intesa Sanpaolo claimed in the 4 year Business Plan its **will to invest and incentivize the Circular Economy,** leveraging on two strategic initiatives: a **CE Plafond** for SMEs and Large Corporations and a **CE Fund** targeting startups and companies in need of equity for growth



ELLEN MACARTHUR FOUNDATION
Rethink the future

CE opportunity evaluation

INTESA SANPAOLO INNOVATION CENTER
Internal discussion on Italian CE potential

INTESA SANPAOLO

ISP planned to launch in 2018 a dedicated **Plafond to fund CE projects**

€ 1.2 Bn per year and a total of **€ 5 Bn in 4 years**

Through the CE Plafond, ISP aims to give the **most innovative** circular economy companies or **projects access to credit at the best possible terms.**

This decision is in line with the Group's objectives to support businesses that invest in moving toward this regenerative model.

ISP CE Lab, Milan

24th September 2018: launch of the CE Lab





INTESA SANPAOLO

INTESA SANPAOLO INNOVATION CENTER

Fondazione CARIPLO

CARIPLO FACTORY
OPPORTUNITÀ INFINITE

ELLEN MACARTHUR FOUNDATION

A Lab dedicated to the Circular Economy, open innovation and young talents, based in Milan at Cariplo Factory, has been inaugurated with the presence of Ellen MacArthur

ISP CE Lab: Framework

A multistakeholder framework to develop circular solutions with our clients

Focused on **3 strategic pillars** divided into **5 programs** designed to ensure the achievement and qualification of the strategic goal

Positioning & Dissemination

Position the CE Lab as a primary hotspot contributing to the dissemination of culture and knowledge of the Circular Economy as an instrument of public and private engagement as well as for business opportunities origination.

Business Activation

Joining forces and providing support for the design implementation and execution of innovative and transformative projects in the Circular Economy space.

Open Innovation

Engaging existing and prospect clients through the business units of the Group to scout opportunities and to facilitate matching from a strategic and technological perspective.

CE Community | **Italy CE Hotspot**

Experimenting Circularity

Scouting & Acceleration | **Matching**

Partnerships:

Bocconi Università Commerciale Luigi Bocconi

NOVAMONT

Enabling Internal and External Transformation

Circular Bank

- Adoption of a corporate carpooling service as official **ridesharing** solution of the Bank
- Circular procurement of **refurbished ICT** components and re-sale of used ones
- **Plastic reduction** program, starting from introduction of water dispenser and steel bottles

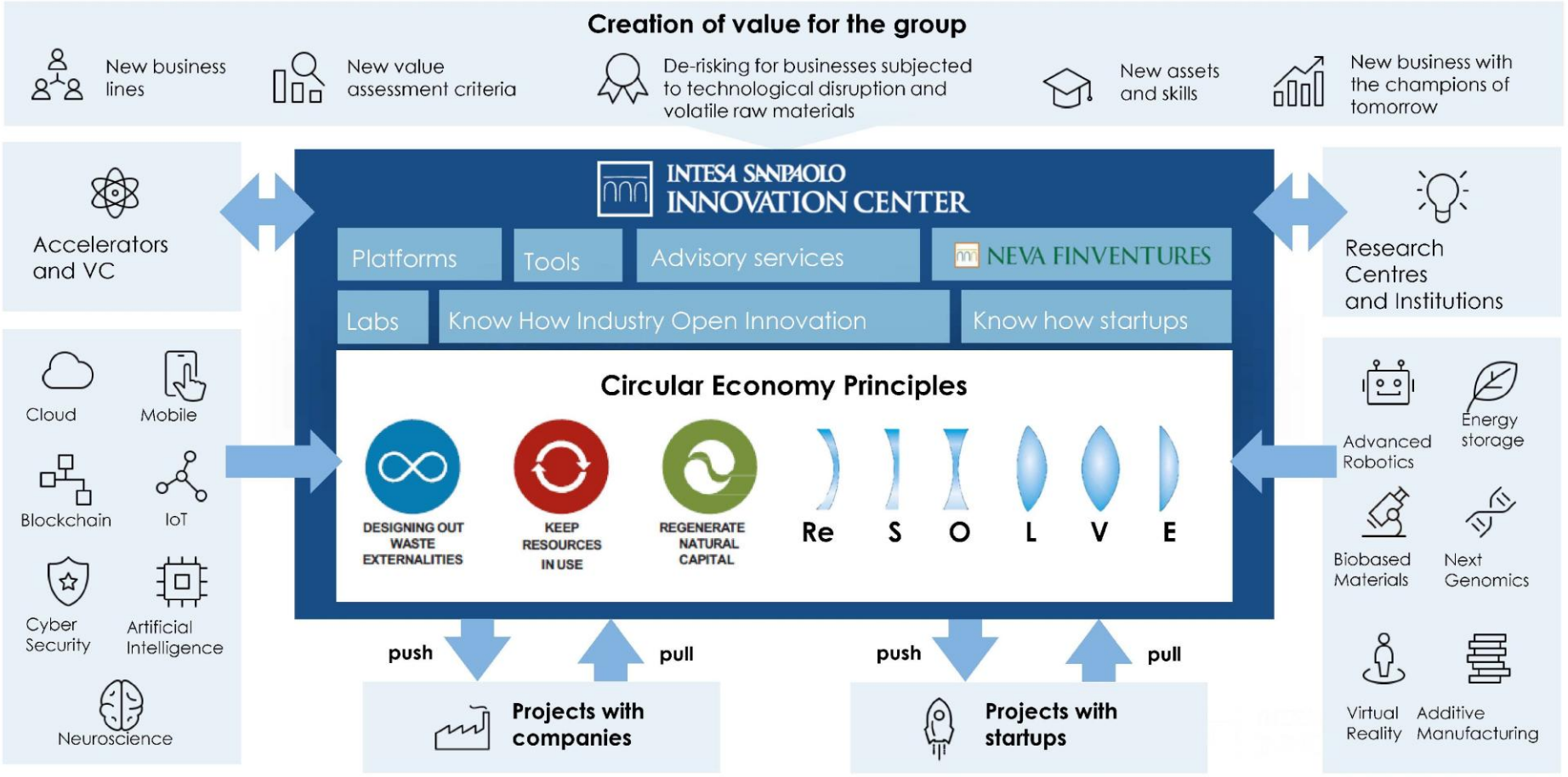
Education

- Training on CE within the internal **Talent Program**, with more than 100 talents involved
- CE course for more than **50,000 employees** coming from multiple Group business units
- Lectures on Circular Economy for **high school**: more than 500 students involved at date
- Several **keynotes to national and international events** organized since 2016

Startups

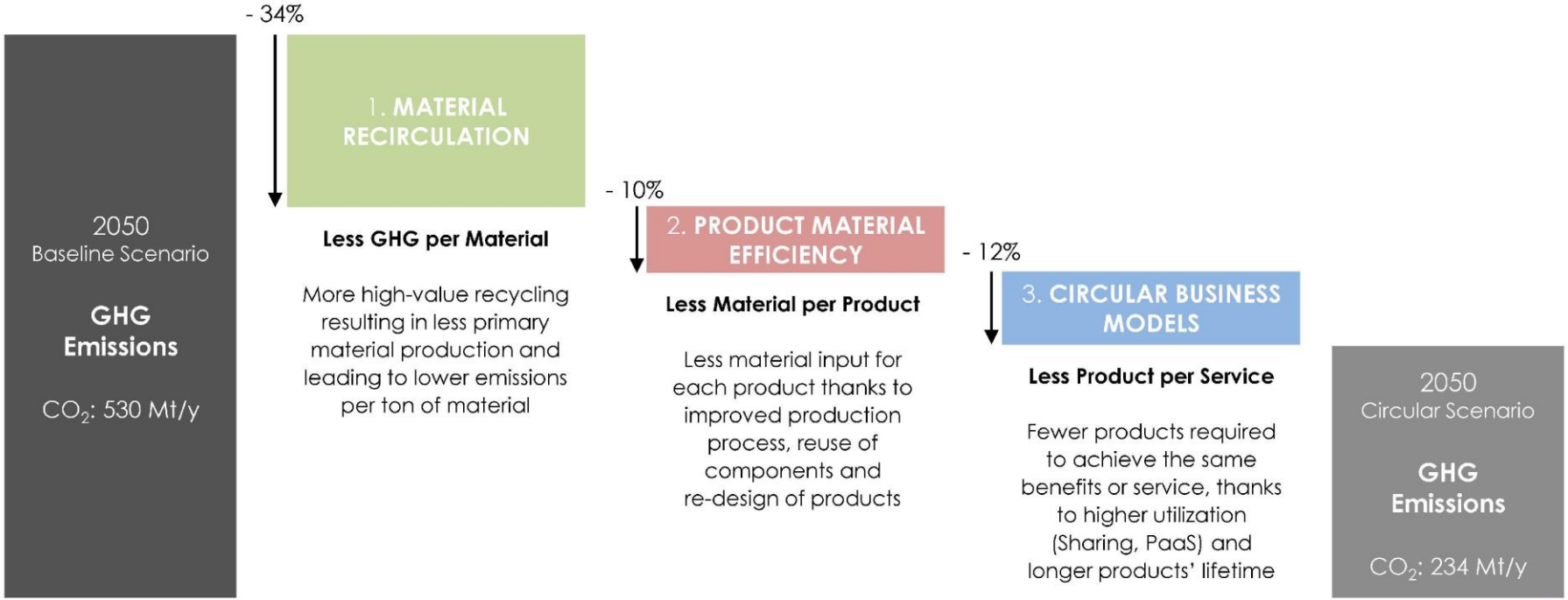
- Circularity as preferred entry criteria for **Startup Initiative**, ISP distinctive acceleration program
- Since 2016, 5 Startup Initiatives **entirely focused** on Circular Economy
- **Mentoring** on Circular Economy has involved more than 50 Startups at date

Long-term innovation: future-proof competitiveness



Circular Economy and GHG Emissions

CE strategies for materials and products could reduce GHG emissions by 56% *



* *Within 30 years, compared to 2050 baseline scenario*

Adapted from: CE - A Powerful Force for Climate Mitigation (Material Economics, 2018)

Business Mission
to the UAE
April 14-16, 2019

Energy, Water & Environment

Opportunities and challenges for strategic partnerships with Italian companies in the evolving UAE energy sector

Business Mission
to the UAE
April 14-16, 2019

Roberto Zanino

Dep. Energy Politecnico Torino

Energy-Water-Environment

Key R&D efforts @ Politecnico di Torino to strengthen cooperation with MENA Countries

Roberto Zanino roberto.zanino@polito.it

Rector's Delegate for European Relations

Acknowledgments: P. Asinari, E. Bompard, S. Corgnati, F. Laio, P. Lombardi, G. Mattiazzo, R. Sethi

Politecnico di Torino (PoliTo)

- ~35000 BSc+MSc students (15% international)
- ~1000 PhD students
- ~1000 professors
- ~300 MEur annual budget



- Education: BSc degrees include Energy engineering, Environmental engineering, … // MSc degrees include Energy and nuclear engineering, Engineering for climate change, …
- Research: Six top 50 in 2019 QS world ranking by subjects

PoliTo Platforms

PLATFORMS

Tools to communicate, promote and value

all PoliTo research activities in strategic areas of interest for companies & businesses → IMPACT!

PoliTo Platforms to be boosted:

- **Energy and Water**
- **Circular economy and Clean Tech**
- **Digitalization/AI**
- **Manufacturing 4.0**
- **Mobility**
- **Urban and regional**

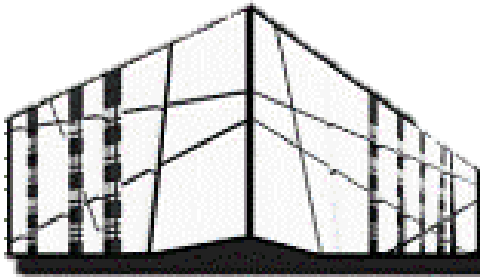




Energy@PoliTO. The Energy Center Initiative

Energy Center House (**EC-H**)

New building within the campus of POLITO that hosts companies, start-ups and public administrations active in the field of energy technology, management and policy



Energy Center Lab (**EC-L**)

It gathers a multi-disciplinary group of PoliTo faculty devoted to discovering the best techno-economic, social and environmental solutions for a transition toward a more sustainable society

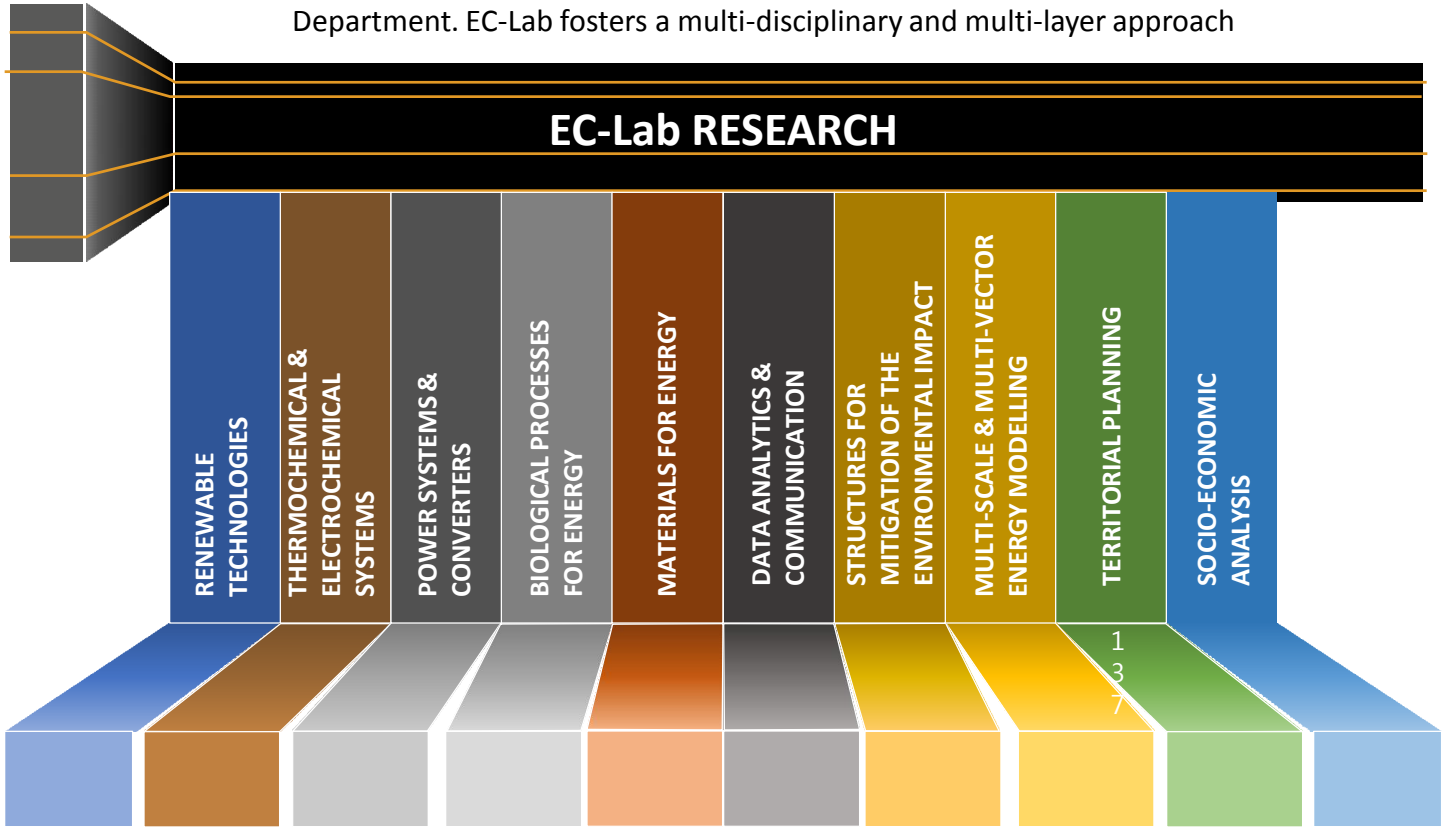


Energy Center Initiative. Companies and institutions involved

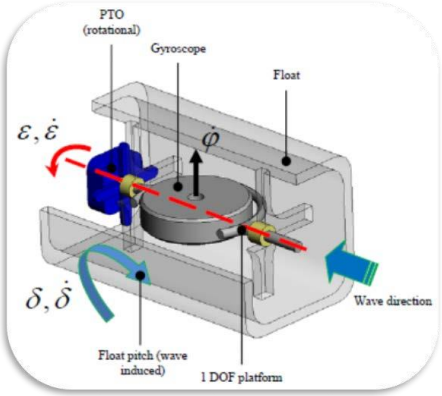


EC-Lab. Research

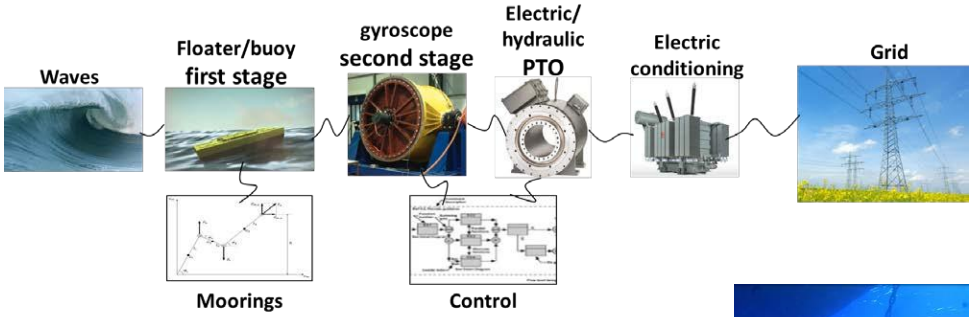
Competences and knowledge booster | Vertical research is developed within each Department. EC-Lab fosters a multi-disciplinary and multi-layer approach



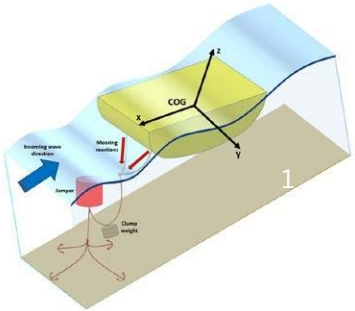
PoliTo marine energy technology

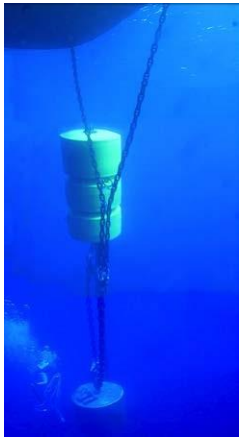


ISWEC (Inertial Sea Wave Energy Converter) is composed of a sealed hull carrying inside a gyroscopic platform. The mechanical energy harvested from the waves through the gyro is converted in electricity from a generator

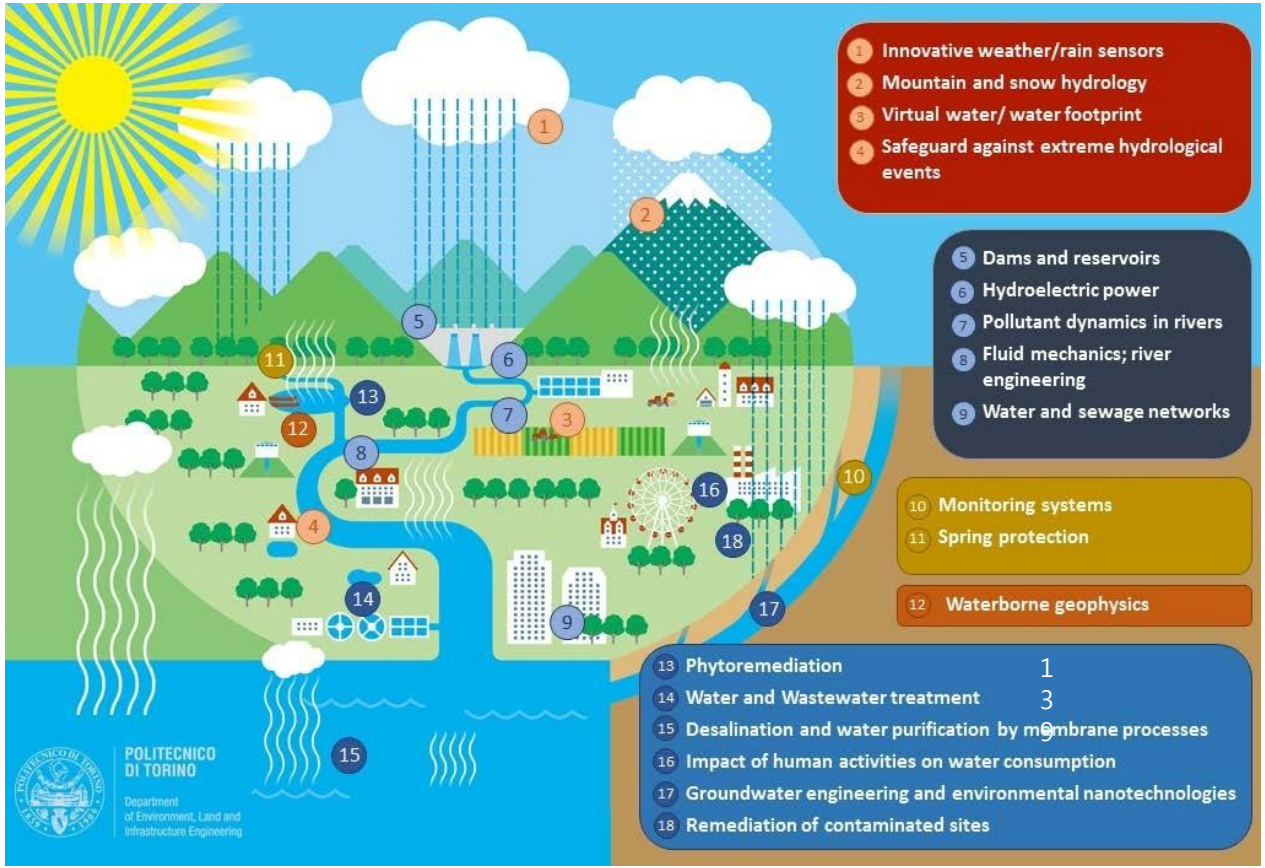








Water studies @ DIATI



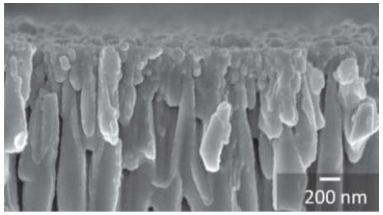
Desalination & wastewater treatment

– **Desalination**, freshwater production, and wastewater reuse by polymeric membranes driven by hydraulic pressure or osmosis.

CLEAN WATER CENTER

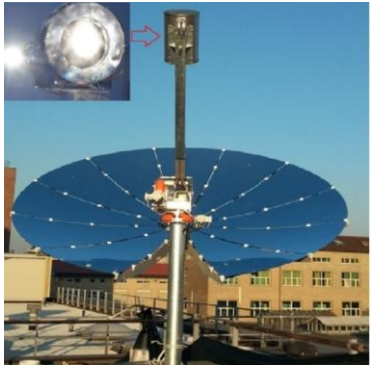
Reverse osmosis Forward osmosis Membrane distillation Membrane crystallization

Nano/ultra/microfiltration

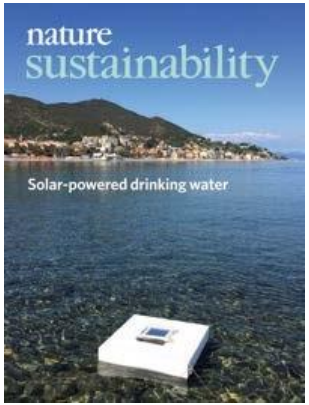


Development of **high-performance membranes**





PoliTo desalination technology



nature sustainability

ARTICLES

https://doi.org/10.1038/s41893-018-0186-x

Passive solar high-yield seawater desalination by modular and low-cost distillation

Eliodoro Chiavazzo*, Matteo Morciano, Francesca Viglino, Matteo Fasano and Pietro Asinari*

Although seawater is abundant, desalination is energy intensive and expensive. Using the Sun as an energy source is attractive for desalinating seawater. Although interesting, current passive devices with no moving parts have unsatisfactory performance when operated with an energy flux lower than 1 kW m^{-2} (one sun). We present a passive multi-stage and low-cost solar distiller, where efficient energy management leads to significant enhancement in freshwater yield. Each unit stage for complete distillation is made of two hydrophilic layers separated by a hydrophobic microporous membrane, with no other mechanical ancillaries. Under realistic conditions, we demonstrate a distillate flow rate of almost 3 l m^{-2} h^{-1} from seawater at less than one sun—twice the yield of recent passive complete distillation systems. Theoretical models also suggest that the concept has the potential to further double the observed distillate rate. In perspective, this system may help satisfy the freshwater needs in isolated and impoverished communities in a sustainable way.

NATURE SUSTAINABILITY | VOL 1 | DECEMBER 2018 | 763–772 | www.nature.com/natsustain



Concentrated Solar Power modeling

Open Volumetric Air Receiver



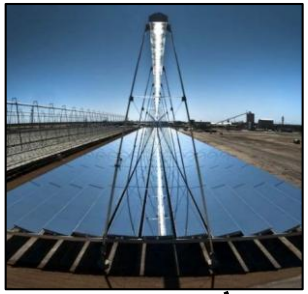
CENER



Tubular Receiver Absorber Tubes



Sodium Billboard Receiver



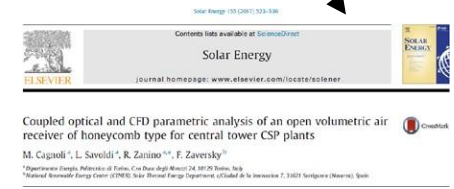
Linear Fresnel Absorber Tube

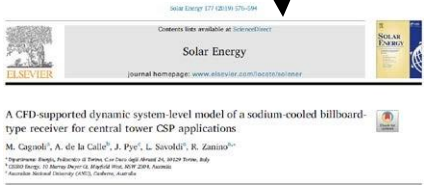


Solar Bowl MOSAIC H2020

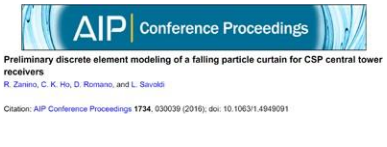


Particle curtain receiver










Thank you for your attention!
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