

The LIFE Experience of the Unit of Environmental Science & Technology,
National Technical University of Athens

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National Technical University of Athens (NTUA)











NTUA (www.ntua.gr) was founded in 1836 and is the oldest and most prestigious educational institution of Greece in the field of technology.

NTUA in numbers:

- 9 Faculties, 1350 personnel
- 700 academic staff
- 140 scientific assistants
- 260 administrative & technical staff
- 8500 Undergraduate students
- 1500 graduate students



Unit of Environmental Science & Technology (UEST)

Areas of Expertise			Tools	
 Waste management	 Wastewater Treatment	 Eco design	 Life Cycle Analysis	 Environmental Impact Assessment
 Desalination & Brine treatment	 Pollution & Environment Control	 Climate Change	 Integrated Product Policy	 Decision Support Systems


UEST Laboratory – ISO 9001:2000 & 17025:2005 certified

100
industries per year







30 years: we implemented over 150 projects

 **32**
ENV, CLIMA


Industry 82

 **OTHER EU 30**
(H2020, FP7, EUROPEAID, INTERREG, TWINNING)



SOL-BRINE Project

- ❖ **Area of implementation:** Tinos Island, Greece
- ❖ **Project Budget:** 1,209,689.00 €
- ❖ **EC Funding (LIFE+):** 604.844,00 € (50% of Total Budget)
- ❖ **Duration:** 39 months
- ❖ **Start date:** 01/10/2010
- ❖ **End date:** 31/12/2013



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SOL-BRINE: Partners

 **Municipality of Tinos Island (Project Coordinator)**

 **National Technical University of Athens (NTUA)**
School of Chemical Engineering
Unit of Environmental Science and Technology ([UEST](#))

 **Culligan Hellas S.A.**

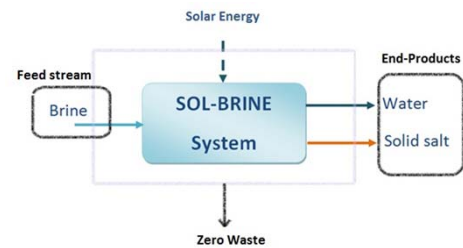
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SOL-BRINE: Main aim

“The main objective of this project was the development of an innovative, energy autonomous system for the treatment of brine from seawater desalination plants ”

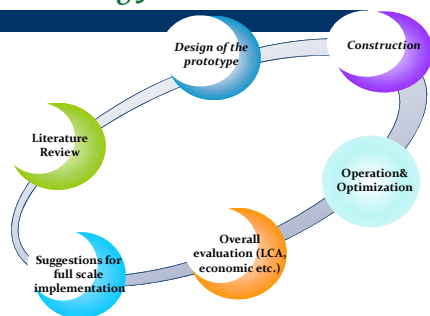
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SOL-BRINE: Concept



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Methodology



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Innovative aspects of the project

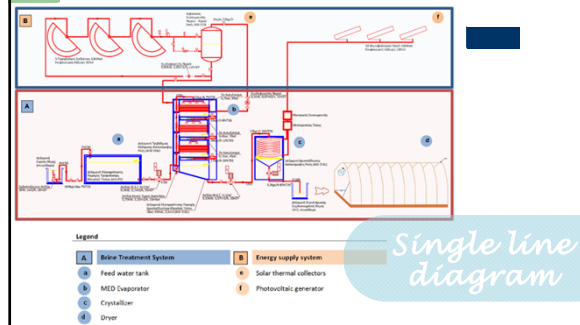
- ❖ **Total brine elimination.** The system has been designed in line with the Zero Liquid Discharge principle
- ❖ **Water Recovery (>90%)**
- ❖ **Production of useful end-products.** Through the operation of the prototype system the following two products are produced: (a) distilled water of high quality and (b) dry salt. These products have potential market opportunities.

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Innovative aspects of the project

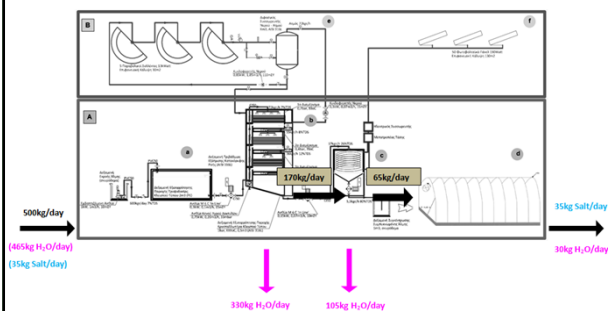
- ❖ **Energy autonomous operation.** Solar thermal collectors are used for delivering hot water ($10 \text{ kW}_{\text{th}}$ at approximately 70°C) and a photovoltaic generator ($10 \text{ kW}_{\text{el}}$) for electricity. All energy requirements are covered exclusively through the use of solar energy
- ❖ **Use of state-of the art technology:** the evaporation of water is realized through custom designed vacuum evaporation technology (evaporator and crystallizer) and solar dryer

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Mass Balance



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Energy supply system



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Brine treatment system

The pilot brine treatment system is consisted of the following units:

- (a) Evaporator
- (b) Crystallizer
- (c) Solar Dryer

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Evaporator unit



Figure: View of the interior (1st Effect)



Figure: Transportation of the evaporator unit from the manufacturer's facilities

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Evaporator unit



Figure: View of the evaporator (installed on site)

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Crystallizer

Its purpose is to crystallize the brine effluent, producing a slurry (magma) with humidity levels of approximately 50%. The whole process is characterized by energy efficiency through the combined use of vacuum technology and heat pump.

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Crystallizer unit



Figure: View of the crystallizer (installed on site)

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Dryer unit



Figure: View of the dryer (installed on site)

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Photo from the constructed prototype brine treatment system!

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SITE VISIT



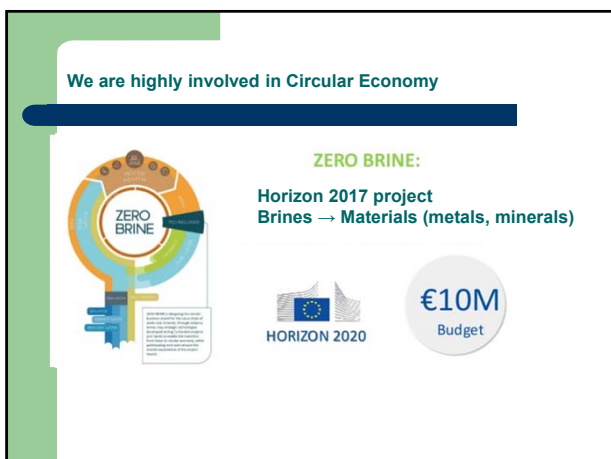
Project awards



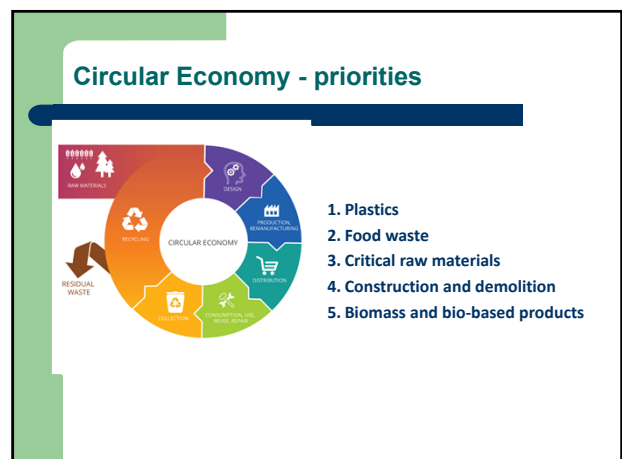
SYNERGIES



We are highly involved in Circular Economy



Circular Economy - priorities



Waste & natural resources

- ❖ Each year in the European Union:
 - 7.3 billion tonnes of resources are consumed
 - 2.7 billion tonnes of waste are generated,
 - 40% is being re-used or recycled, the rest ends up at landfill or is partly incinerated.

Waste & natural resources

- ❖ If this quantity of waste was recycled then:
 - the equivalent of 148 million tonnes of CO₂ emissions could be avoided annually;
 - Around 5.25 billion euro would be saved from the recovery of recyclables such as paper, glass, plastics, aluminum and steel per year.
 - 500,000 new jobs at least would be created.

We create value

PLASTICS



FOOD WASTE & BIO-MASS FEEDSTOCKS



ATHENS-BIOWASTE LIFE+ project

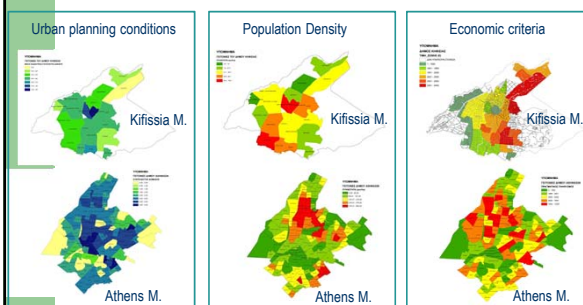
- **Project title and acronym:** «Integrated management of bio-waste in Greece – The case study of Athens, **ATHENS-BIOWASTE**»
- **PROJECT LOCATION:** Athens, Greece
- **BUDGET INFO:** 1,339,930.00 € (50% EC Co-funding)
- **DURATION:** Start: 01/09/11- End: 31/08/2014
- **PROJECT'S IMPLEMENTORS:**
 - **Coordinating Beneficiary:** National Technical University of Athens
 - **Associated Beneficiaries:**
 - Association of Communities and Municipalities in the Attica Region
 - EPTA – Environmental Engineers – Consultants
 - Municipality of Athens
 - Municipality of Kifissia

ATHENS-BIOWASTE BACKGROUND and AIMS

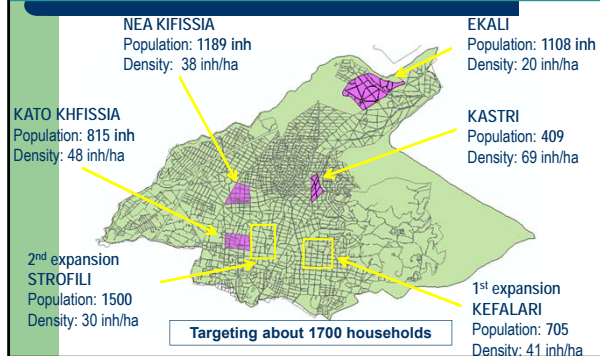
- ATHENS-BIOWASTE aims to establish and promote sustainable biowaste management in Greece using the municipalities of Athens and Kifissia as case study areas.
 - Separate collection systems in the Municipalities of Athens and Kifissia
 - Collection and composting of biowaste at the MBT facility of EDSNA
 - Developing appropriate bio-waste management software tool
 - Drafting recommendations for the amendment of the current technical specifications included in Greek legislation
 - Raising environmental awareness and knowledge in citizens and other stakeholders regarding management of bio-waste

Selection and planning of separate collection methods for the case study areas

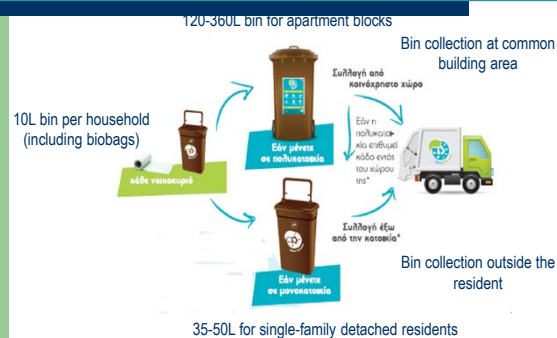
Criteria considered for the selection of the pilot areas in Athens & Kifissia municipalities



Pilot areas selected in Kifissia Municipality



Kifissia Municipality Biowaste



Pilot areas selected in Athens Municipality

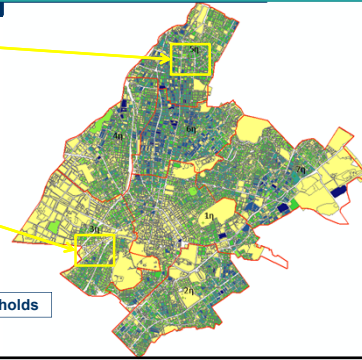
1st area KYPRIADOU

Population: 2.707
Density: 208 inh/ha

2nd area GAZI

Population: 1.447
Density : 54 inh/ha
≈ 80 restaurant, bars etc

Targeting about 2000 households



Further biowaste collection points in Athens Municipality



Armed Forces Officers Club
(Restaurant - Food waste)



Agricultural University of Athens
(Restaurant – Food waste)



Agricultural Floricultural Nurseries Cooperative of Attica
(Green waste)

Athens Municipality Biowaste kerbside collection system

10L bin per household
(including biobags)

30-50L bin per bar
restaurant etc.
(including biobags)



Planning of the awareness campaign

Horizontal Actions

- Website
- Facebook profile
- Project Logo & banner
- Hotline

1st Phase
Awareness
Briefing

Prior to the
initiation of
the scheme

2nd Phase
Active
involvement
Guidance

During the
initiation of
the scheme

3rd Phase
Reminding
Sensitization

After the
initiation of
the scheme

Implementation of the separate collection program in the selected areas

Distribution of bins and biodegradable bags to households



Implementation of the separate collection program in the selected areas

Collection and Transportation of source separated biowaste



Composting of the collected material and analysis of the final product

Mechanical and Biological (Composting) Treatment plant in Attica Region



Composting process at the MBT



**‘Good practice’ examples of
implementing
CIRCULAR ECONOMY
on waste management in
islands**

The ‘ISWM TINOS’ LIFE+ project

LIFE 10 ENV/GR/000610

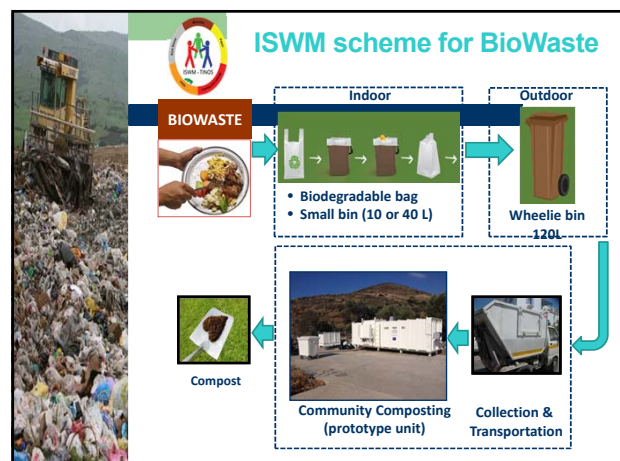
SCOPE: ‘ISWM-TINOS’ project aimed to promote and demonstrate an Integrated Solid Waste Management (ISWM) system to a selected remote area of the Municipality of Tinos for the sustainable management of MSW in line with the Waste Framework Directive 2008/98/EC

Tinos Island
Target population: 400 inhabitants

LIFE+ ‘ISWM TINOS’ pilot project in remote communities of Tinos Municipality:

- Separate collection of dry recyclables & biowaste in **5 different streams** and composting at **community level**

Website: www.iswm-tinos.uest.gr








Decentralised composting of BioWaste


Compact prototype biowaste composting unit



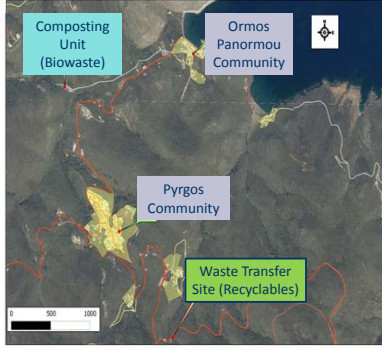


- ✓ The capacity ranges between 70 to 200 tn yr⁻¹ (residence time 15 to 60d)
- ✓ Automated hydration, aeration and deodorization systems
- ✓ Biofilter for the treatment of emitted gases
- ✓ Collection and recirculation of leachates
- ✓ No mechanical agitation is needed



Overview of the ISWM scheme






The 'PAVEtheWAYSTE' LIFE project

Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas

LIFE 14 ENV/GR/000722



Small Cyclades Islands
Target population: 875 inhabitants in islands

- LIFE 'PAVEtheWAYSTE' project in Small Cyclades Islands of Naxos Municipality (& Ancient Olympia):
 - Donoussa
 - Schinoussa
 - Iraklia
 - Koufonissi
 - (& Ancient Olympia)
- Fine source separation in **15 different streams** and pre-treatment (compression, crushing etc.) of recyclables at **neighbourhood level**

Website: www.pavethewayste.eu



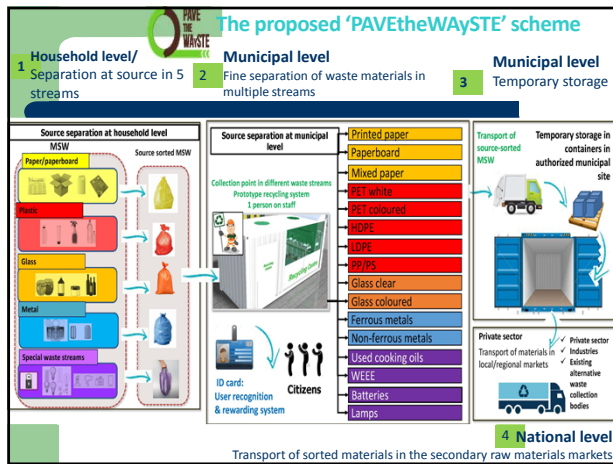


The 'PAVEtheWAYSTE' LIFE project

OVERALL SCOPE:

This project aims to facilitate the implementation of the Waste Framework Directive in remote areas, by enabling local and regional authorities to improve their municipal waste recycling performance and thus pave the way to high resource efficiency.





National Technical University of Athens

Unit of Environmental Science and Technology
School of Chemical Engineering

Production of ethanol from household biowaste

"Waste2bio"

WASTE2Bio

200L Bioconversion facility

The innovative Waste2bio bioconversion facility is comprised of:

- 100L pre-treatment unit (for the sterilisation and enzymatic pre-treatment of the lignocellulosic material/dehydrated household bio-waste);
- 200L bioreactor (for the fermentation process);
- Boiler (for the production of steam which is necessary for the reactors temperature control and the material's sterilization before the initiation of the bioconversion process);
- Control panel (providing fully automated control of the whole process).

It should be stressed that both the reactors may operate as pre-treatment or fermentation reactors. The necessary sensors have been placed inside the reactors and their conditions are controlled automatically.

WASTE2Bio

Pilot plant facility



Demonstration of waste to ethanol pilot plant



Waste Drying as Implemented in our Labs

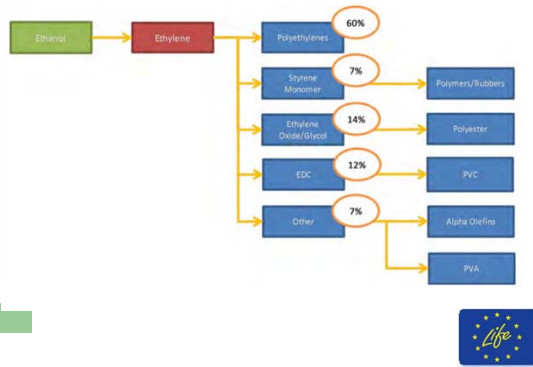


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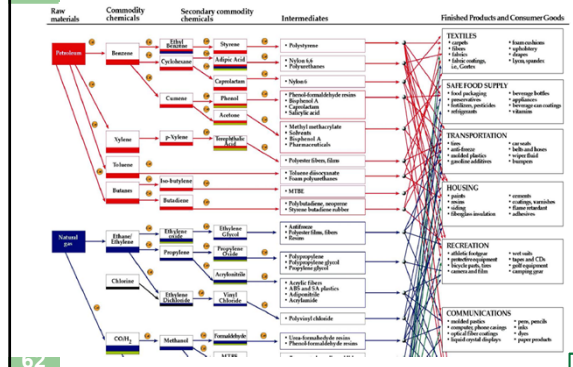
Bio-waste to ethanol perspective



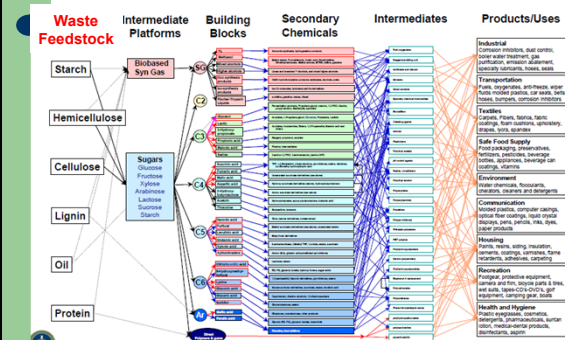
Ethanol Value Chain



An Example of a Flow-Chart for Products from Petroleum-based Feedstocks



Analogous Model of a Bio-based Product Flow-chart for Biomass Feedstocks



LIFE10 ENV/CY/000723

Project website:
<http://uest.ntua.gr/cypadapt/>

Development of a national strategy for adaptation to climate change adverse impacts in Cyprus

Start date: 01-09-2011
End date: 31-3-2014
Duration: 31 months
Project budget: 1.358.847 € (50% EC funding)

The main aim of the CYPADAPT project was to strengthen and increase Cyprus adaptive capacity to climate change impacts through the development of a National Adaptation Strategy.

Project partners



Coordinating beneficiary:

Department of Environment, Ministry of Agriculture, Natural Resources and Environment of Cyprus



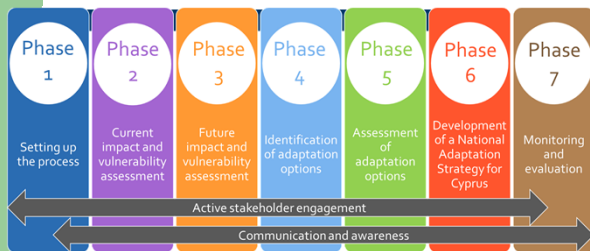
Associated beneficiaries:

National Technical University of Athens



National Observatory of Athens

Project methodology



National Adaptation Strategy of Cyprus

Over 200 measures for enabling adaptation to climate change impacts on the eleven policy areas of Cyprus are included in the NAS.



Indicative Tips & Suggestions

- Brainstorming for many months – deal with actual problems (emphasis on the priority topics of calls) – think of effective & feasible solutions
- Innovation
- Close to market
- Work on the comments of the reviewers
- Strong (not big) Partnership – one beneficiary from other MS
- Financial Part: Be as specific as possible, use actual rates, time
- Collaboration with a large number of reliable beneficiaries – the role of conferences –networking – info days
- The role of local authorities
- The role of mass media
- Keep your projects alive – next steps – emphasis on after-life, feasibility study



Let's join forces and
create synergies!

NAXOS2018

6th International Conference on
Sustainable Solid Waste Management
13-16 June 2018

Naxos Island, Greece
www.naxos2018.uest.gr



... Thank you for your attention

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The block contains three small images arranged horizontally. The first image on the left shows a classical building with columns and a pediment, partially obscured by green foliage. The middle image is a portrait of a woman with dark, curly hair, wearing a patterned top and a necklace. The third image on the right is a portrait of a man with dark hair, wearing a dark suit, white shirt, and a red tie.