



مبادرة الحل المتكامل  
لمكب طرابلس

بالتعاون  
مع



**UNITED  
FOR THE  
ENVIRONMENT**

# TRIPOLI ENVIRONMENTAL CONFERENCE

**MARCH, 31 2023  
TRIPOLI, LEBANON**

# TABLE OF CONTENTS

---



02

Table of Contents

03

Welcome Message

04

About Us

05

Our Goal

06

Meet the Team

07

Speakers Summaries

08

Let's Work Together

# WELCOME MESSAGE

يتشرف منسق "مبادرة الحل المتكامل لمكب نفايات طرابلس" بالتعاون مع تحالف متحدون بحضوركم "مؤتمر طرابلس البيئي، الحل الجذرية لمكب طرابلس" في معرض رشيد كرامي الدولي، وذلك لاستعراض الحلول البيئية والصحية والاقتصادية والقانونية المتكاملة والقابلة للتطبيق بشكل علمي ومفصل، من قبل مراجع في علم الموارد واختصاصيين بيئيين من جامعات لبنان والعالم وحقوقيين ناشطين في هذا المجال.

**The coordinator of the "Integrated Solution Initiative for the Tripoli Landfill" in cooperation with "United Alliance" (Mouttahidoun) is honored to attend the "Tripoli Environmental Conference, Radical Solutions for the Tripoli Landfill" at the Rashid Karami International Exhibition, in order to review the environmental, health, economic and legal solutions that are integrated and applicable in a scientific and detailed manner, by resource and environmental specialists from the universities of Lebanon and the world and human rights activists in this field.**

**Le coordinateur de "La conférence environnementale de Tripoli, Les solutions radicales à la crise de décharge de Tripoli" en coopération avec "L' Alliance Unis" est honoré d'assister à la "Conférence environnementale de Tripoli, solutions radicales pour la décharge de Tripoli" à l'exposition internationale Rashid Karami, afin d'examiner l'environnement , des solutions sanitaires, économiqueet juridiques intégrées et applicables de manière scientifique et détaillée, par des spécialistes de l'environnement des universités du Liban et du monde et des militants des droits de l'homme dans ce domaine.**

# ABOUT US

مبادرة الحل المتكامل لمكب نفايات طرابلس " وُلدت من رحم أوجاع أبناء مدينة طرابلس الذين دفعوا الثمن وما زالوا يعانون تلوثاً وأمراضاً نتيجة وجود مكب تحوّل إلى قنبلة موقوتة وبؤرة أمراض استُغلت من قبل حفنة من الفاسدين على مدى سنوات دون محاسبة أو مساءلة وفي هذا السياق وإضافةً إلى المتابعة القانونية للملف البيئي في طرابلس والشمال وما تضمنه من دعاوى مرفوعة بوجه المسؤولين عن هذه الأزمة من قبل تحالف متحدون، نَظَم منسق "مبادرة الحل المتكامل لمكب طرابلس" السيد بول الحامض بالتعاون مع تحالف متحدون في ١ شباط ٢٠٢٣ مؤتمراً تحذيرياً تناول فيه تقرير الخبير البيئي ريمون متري المكلف من قاضي التحقيق الأول في الشمال سمراندا نصار والمتضمن تقريراً ملحقاً به أعدّه فوج الهندسة في الجيش اللبناني والذي أكد على وجود كثافة من غاز الميثان الذي تجعله جاهزاً للانفجار بمجرد تعرضه لحرارة مؤاتية أو عبث به، عدا ما يجعله ثروة كبيرة إن وجد الحل المناسب.



The "Integrated Solution Initiative for the Tripoli Landfill" was born out of the womb of the pain of the people of Tripoli, who paid the price and are still suffering from pollution and diseases as a result of the existence of a dump that turned into a time bomb and a hotbed of diseases, exploited by a handful of corrupt individuals over the years without accountability.

In this context comes the legal follow-up of the environmental file in Tripoli and the North, through the lawsuits filed against those responsible, by the United Alliance. Mr. Paul Al-Hamod, the coordinator of "The Integrated Solution Initiative for the Tripoli Landfill", in collaboration with the United Alliance, held a warning press conference on February 1, 2023 which dealt with the report of the environmental expert, Raymond Mitri, assigned by the first investigating judge in the North Samaranda Nassar, which included an attached report prepared by the Engineering Regiment of the Lebanese Army. The report confirms the presence of dense layers of methane gas, which makes it ready to explode as soon as it is exposed to a favorable temperature or is tampered with, except if it finds the proper solutions.



**« L'Initiative de solution intégrée pour la décharge de Tripoli » est née du ventre de la douleur des habitants de la ville de Tripoli qui en ont payé le prix et qui souffrent encore de la pollution et des maladies en raison de l'existence d'une décharge qui transformé en une bombe à retardement et un foyer de maladies exploité par une poignée de personnes corrompues au fil des ans sans rendre de comptes.**

**Dans ce contexte, et outre les suites judiciaires du dossier environnemental à Tripoli et les poursuites intentées contre les responsables de cette crise par l'Alliance unie, M. Paul Al-Hamod, le coordinateur de « The Integrated Solution Initiative for la décharge de Tripoli, a organisé en coopération avec l'Alliance unie, le 1er février 2023, une conférence d'avertissement au cours de laquelle il a traité du rapport de l'expert en environnement, Raymond Mitri, assigné par le premier juge d'instruction du nord de Samaranda Nassar, qui comprenait un rapport ci-joint préparé par le Régiment du Génie de l'Armée Libanaise, qui a confirmé la présence de gaz méthane dense, ce qui le rend prêt à exploser dès qu'il est exposé à une température favorable ou est altéré, sauf s'il trouve les bonnes solutions.**



The Integrated Solution for Tripoli Landfill Initiative and the United Alliance seek to achieve two main goals:

- Finding scientific and environmental solutions to address the Tripoli landfill crisis and applying them effectively "from source to landfill"
- Holding those responsible for the environmental crimes committed against the people of the city of Tripoli accountable, in accordance with the law and without any interference that would obstruct the course of the judiciary

تسعى مبادرة الحل المتكامل لمكب طرابلس وتحالف متحدون إلى تحقيق هدفين أساسيين:

- إيجاد الحلول العلمية والبيئية لمعالجة أزمة مكب طرابلس وتطبيقها بشكل فعلي "من المصدر إلى المطمر"
- محاسبة المسؤولين عن الجرائم البيئية المرتكبة بحق أهل مدينة طرابلس وفق القانون ودون أي تدخلات من شأنها عرقلة مسار القضاء



**OUR  
GOAL**

L'Initiative de solution intégrée pour la décharge de Tripoli et l'Alliance unie cherchent à atteindre deux objectifs principaux

- Trouver des solutions scientifiques et environnementales pour faire face à la crise de la décharge de Tripoli et les appliquer efficacement "de la source à la décharge"

- Responsabilisation des responsables des crimes environnementaux commis contre les habitants de la ville de Tripoli conformément à la loi et sans aucune ingérence qui entraverait le cours de la justice



# MEET THE TEAM



**Al Hamod, Paul**

**Coordinator of the "Integrated Solution Initiative for the Tripoli Dump"**

**An expert in customs affairs and ports and an anti-corruption activist**

**منسق "مبادرة الحل المتكامل لمكب طرابلس" خبير بالشؤون الجمركية والمرافئ وناشط في مكافحة الفساد**



**Dabbousi, Toufic**

**President, Chamber of Commerce, Industry & Agriculture of Tripoli & North Lebanon**

**Launcher of the initiative "Tripoli, The economic capital of Lebanon"**

**رئيس "غرفة التجارة والصناعة والزراعة في طرابلس ولبنان الشمالي"**

**صاحب مبادرة "طرابلس عاصمة اقتصادية للبنان"**



**Estephan, Tania**

**Journalist, News broadcaster and Presenter in political and social programs**

**صحفية ومذيعة إخبارية ومقدمة برامج سياسية واجتماعية**



**Darwish, M. Ragy**

**Professor of Resource and Environmental Economics and former Chairman of the Agricultural Economics Department at the American University of Beirut**

**Economic Consultant and Certified TOT, Resources and Environmental Economics**

**Cofounder and former president of the Association for Human and Economic Abilities Development (AHEAD)**

**بروفيسور في اقتصاد الموارد والبيئة والمدير الأسبق لقسم الاقتصاد الزراعي في الجامعة الأمريكية في بيروت مستشار اقتصادي ومعتمد في الموارد والاقتصاد البيئي مؤسس مشارك ورئيس أسبق لجمعية التنمية البشرية والاقتصادية**



## Abdulfatah, Laudy

### Lawyer

Attorney at Law at the Tripoli Bar

A lawyer with the United Alliance, entrusted with the environmental file of Tripoli and the North

محامية بالاستئناف في نقابة طرابلس  
محامية في تحالف متحدون موكلة بالملف البيئي في  
طرابلس والشمال



## United Alliance

### Legal Team

United (Mouctahidoun) is an alliance of anti-corruption lawyers and activists.

It aims at holding those responsible for the waste and embezzlement of money accountable and seeks to bring the perpetrators in front of a court of law, regardless of any sectarian or partisan affiliations. It also aims for a fair justice system independent of political interference.

متحدون هو تحالف مؤلف من محامين متخصصين في مكافحة الفساد، يعاونهم ناشطون في المجال. يهدف التحالف الى محاسبة المسؤولين عن هدر واختلاس الأموال وهو يسعى إلى وضع الجناة أمام المحكمة، بغض النظر عن أي انتماءات طائفية أو حزبية. كما يهدف إلى نظام عدالة نزيه ومستقل عن التدخل السياسي.

### Media Team

Law students, anti-corruption activists  
PR and event management specialists, graphic designers, multimedia specialists

حقوقيون، ناشطون في مجال مكافحة الفساد، منسقو أنشطة وعلاقات عامة، فنيون في التصوير والمواد الإعلامية

**UNITED  
FOR THE  
ENVIRONMENT**





# SPEAKERS SUMMARIES

## بول الحامض

Paul Al Hamod

- لمحة شاملة عن المكب
- نقل صورة عن معاناة أبناء طرابلس
- إمكانية ترتيب على لبنان عقوبات مالية للدول المجاورة نتيجة تلوث البحر الأبيض المتوسط الذي قد يحدثه تسرب النفايات إليه
- الفساد والصفقات المشبوهة التي أدت الى حصول الأزمة
- المطالبة بإرجاع ما تم تبديده واختلاسه من أموال لإعادة توظيفها في مشاريع فعالة تعالج الأزمة
- رفض رصد أموال جديدة للقيام في مشاريع جديدة
- المطالبة بتفعيل قانون الحق في الوصول الى المعلومات ٢٨/٢٠١٧ الصادر في ١٠ شباط ٢٠١٧
- ضبط والتأكد من قانونية المناقصات التي يجريها مجلس الإنماء والإعمار من خلال تفعيل قانون الشراء العام ٢٤٤/٢٠٢١ الصادر في ٢٩ تموز ٢٠٢١

### Comprehensive overview of the landfill

- Transferring a picture of the suffering of the people of Tripoli
- The possibility of arranging for Lebanon financial penalties for neighboring countries as a result of the pollution of the Mediterranean Sea that may be caused by waste leakage into it
- Corruption and suspicious deals that led to the crisis
- Demanding the return of the money that was wasted and embezzled in order to re-employ it in effective projects that address the crisis
- Refuse to allocate new funds to undertake in new projects
- Demanding the activation of the Right to Information Law 28/2017 issued on February 10, 2017
- Control and ensure the legality of tenders conducted by the Council for Development and Reconstruction by activating the Public
- Procurement Law 2021/244 issued on July 29, 2021

# SPEAKERS SUMMARIES

## توفيق دبوسي

Toufic Dabboussi

(ONLY IN ARABIC)

النظر إلى مكب طرابلس من الناحية الاقتصادية الاستثمارية (نترك للبروفيسور راجي درويش أمر الغوص في الجدوى الاقتصادية).

كيف يمكن جذب المستثمرين لاسيما من أهل طرابلس مقيمين ومغتربين في استراليا والخليج واميركا وأوروبا وغيرها وجبل النفايات الضخم قابع في مكانه الفزاعة ليس فقط في روائحه وعصائره السامة والكريهة ، بل ايضاً في كونه مشبعاً بالغازات العضوية وأهمها غاز الميثان الشديد الاشتغال وفق تقرير الخبير متري وفوج الهندسة في الجيش اللبناني؟  
كيف سينجح اي استثمار في مرفأ طرابلس ومشاريع تأهيله ومحيطه براً وبحراً في ضوء التلوث الهائل الموجود لا سيما منه ما أدى إلى إبادة البيئة البحرية و الثروة السمكية ، ثروتى مدينة طرابلس؟

الحل؟ ممكن، وخاصةً بجهود خيرة من أهل المدينة والجوار وكفاءات علمية من لبنان والخارج ونوايا صادقة في اصرارها على الخروج من هذه الأزمة المميتة .  
فلنبدا هذا المشوار معاً نحو تعزيز عامل الاستثمار واجتذاب رؤوس الأموال لتحقيق ذلك .

الحل يكمن في أهل المدينة، في كفاءتها العلمية من لبنان والخارج ولكن الأهم هو الإصرار لتذليل العقبات ومحاربة الضغوطات من أجل الخروج من هذه الأزمة المميتة، في الختام دعى الى توحيد الصفوف وتصفية النوايا للبدء مشوار تعزيز عامل الاستثمار واجتذاب رؤوس الأموال لكي تعود عاصمة الشمال العاصمة الاقتصادية للبلاد.

# SPEAKERS SUMMARIES

## تانيا اصطفان

**Tania Estephan**  
(ONLY IN ARABIC)

اجتمعت في هذا النشاط الفريد من نوعه وبهذا الوقت الصعب  
أيادي نظيفة لتحارب الفساد مع أبناء طرابلس ومع كفاءات  
ومراجع علمية مشهود لها.  
وكان اللقاء لنقول أن الخير لازال موجود في لبنان ولازال بين أبناء  
طرابلس.  
نعم سوياً نستطيع حلّ مشاكلنا ونستطيع تنظيف بيوتنا  
ومدينتنا.  
سنستطيع إرجاع طرابلس عاصمة لبنان الثانية، ولما لا؟ أو كما  
أسمها السيد دبوسي عاصمة لبنان الاقتصادية.  
حان الوقت لنعمل متحدون مع "مبادرة الحل المتكامل لمكب  
طرابلس"، معا نستطيع.

# لودي عبدالفتاح

Laudy Abdul-Fattah

نحن في تحالف متحدون طلاب حول قبل أي شيء آخر، لكن لا قيامة لأي بلد بلا محاسبة، والتي تبدأ منا بيد ممدودة للجميع دون استثناء. لا نبغى "قتل الناطور" بقدر ما نريد كلنا "أكل العنب" لكن مع راحة ضمير.

- التّقدم بالدعوى أمام النّائب العام البيئي القاضي غسان باسيل في تموز ٢٠١٩
- إحالة النّائب العام البيئي المدعى عليهم السادة: أحمد قمر الدين بصفتة رئيس اتّحاد بلديات الفيحاء (سابقاً)، الشركة المتعهدة تنفيذ مطمر نفايات طرابلس "باتكو" ويحيى نور الدين الباش المفوض بالتوقيع عنها، الشركة المشغلة لمعمل فرز النفايات في طرابلس "إي إم بي" شادي ورائيا أبو مصلح المفوضين بالتوقيع عنها، شركة دار الهندسة نزبه طالب وشركائه، رانيا سمير أبو مصلح، جميل نزبه طالب، أنطوان بدو أزور، شركة ليبان كونسولت وأنطوان جرجي معوشي، وذلك بجرائم:
- مخالفة قانون حماية البيئة الرقم 2002/444 سيما المواد 58 و 59
- مخالفة قانون الإدارة المتكاملة للنفايات الصلبة رقم 2018/80 سيما المادة 36
- مخالفة قانون المحافظة على البيئة ضد التلوث من النفايات الضارة والمواد الخطرة رقم 64/88 سيما المادة 10 الفقرة الأولى، معطوفة على المادة 61 من قانون 2002/444
- المسؤولية الجزائية للهيئات المعنية سندا للمادة 210 من قانون العقوبات معطوفة عليها جميع المواد المذكورة آنفاً بالنسبة للشركات المدّعى عليها
- اعتياد الإجرام سندا للمادة 263 من قانون العقوبات مضافة بالنسبة للمدعى عليه الأول أحمد قمر الدين
- صدور تقرير الخبير البيئي بتكليف من قاضي التحقيق الأول في ١٩ كانون الثاني ٢٠٢٣ المؤكد على وجود كثافة في غاز الميثان القابل للانفجار التأخر في تعيين موعد جلسة بعد صدور التقرير



We in United Alliance seek solutions before anything else, but there is no resurrection for any country without accountability, which we reach out for with an outstretched hand to everyone without exception. We are not after "killing the guard" as much as we're after all of us "eating the grapes", but with a clear conscience.

- The case was filed before the Environmental Attorney General, Judge Ghassan Bassil, in July 2019
- Referral of the Environmental Public Prosecutor to the Defendants: Ahmed Qamar Al-Din in his capacity as President of the Federation of Al-Fayhaa Municipalities (formerly), the company that undertakes the implementation of the Tripoli waste landfill "BATCO" / Yahya Nour Al-Din Al-Bash, the authorized signatory on its behalf, the company that operates the waste sorting plant in Tripoli, "i.e. "AMB" Shadi and Rania Abou Mousleh, the authorized signatories, Dar Al-Handasah Company, Nazih Talib and Partners, Rania Samir Abou Mousleh, Jamil Nazih Talib, Antoine Bedouin Azour, Liban Consult and Antoine Gerji Maouchi, for crimes:
- Violating the Environment Protection Law No. 444/2002, especially Articles 58 and 59
- Violating Integrated Solid Waste Management Law No. 80/2018, especially Article 36
- Violation of the Environment Preservation Law against Pollution from Harmful Waste and Hazardous Materials No. 64/88, especially Article 10, the first paragraph, attached to Article 61 of Law 444/2002
- The criminal liability of legal entities, according to Article 210 of the Penal Code, with all the aforementioned articles attached to it in relation to the defendant companies
- The habit of criminality, according to Article 263 of the Penal Code, added to the first defendant, Ahmed Qamar Al-Din.
- The issuance of the environmental expert's report, commissioned by the first investigating judge, on January 19, 2023, confirming the presence of explosive methane gas density
- Delay in setting a date for a session after the report is issued

# **M. RAGY DARWISH, PH.D.**

**ECONOMIC CONSULTANT AND  
CERTIFIED TOT  
RESOURCES AND  
ENVIRONMENTAL ECONOMICS**

## **A Conceptual Economic Approach for Integrated Waste and Re-Water Management and “Safe Use” in Tripoli and North Lebanon**

**(باللغة الإنجليزية فقط)**

### **1. Types of wastes and their relative “products”**

**Wastes are consisting of solid wastes (SW) and wastewater (WW). Solid wastes can be classified into three main categories, namely: biowaste, recyclable waste, hazardous material, and some gasses: Methane and carbon dioxide make up 90 to 98% of landfill gas. The remaining 2 to 10% includes nitrogen, oxygen, ammonia, sulfides, hydrogen and various other gases. Landfill gases are produced when bacteria break down organic waste. The methane content of raw (untreated) biogas may vary from 40%–60%, with CO<sub>2</sub> making up most of the remainder along with small amounts of water vapor and other gases, as mentioned earlier.**

**Wastewater is a water that has been used in the home, in a business, or as part of an industrial process. Treated wastewater will have three products; Water: ready for reuse according to the treatment level; Sludge; and Biogas. For example, secondary treated wastewater can be used in “Land Application” for producing agricultural crops. These crops cannot be used in direct human consumption, they have to be processed first. While tertiary and advanced treatment levels can be used in recreation and fish farms up to the production of potable tap water. Biogas and sludge are the products of wastewater treatment. The biogas forms due to the microbial degradation of the waste and sludge are the end by-product of the wastewater treatment.**

## **1.1 The Big Question**

**Before proceeding any further let's raise an important question, which "Is Waste a liability or an Asset"? The answer will be: it depends on how we treat the waste and whether we can Recycle and/or Use part of it or even all of it (i.e., in case of Reuse of Treated Wastewater, Henceforth Re-Water). In the rest of the presentation we will try to shed the light on the ample Economic and financial opportunities that exist in waste reuse, both SW and WW, so as to be able to firmly answer the question.**

## **2. The Problem of waste in Brief (Economic Perspective)**

### **2.1 Conventional Waste Treatments**

**Conventional or Traditional solid waste management techniques, such as: landfills and incineration usually increase the pressure on natural resources and raise concerns over human health, as well as increasing the financial burdens on local, regional and central governments.**

**Landfill which is the least costly approach of disposal, but only if suitable land type and size are available, suffers from several drawbacks. These drawbacks include: a continuous expansion of the required landfill areas that usually comes on the account of agricultural land base; provide potential pollution sources of surface water as well as groundwater aquifers; and reduce the property values of surrounding areas. All of which are forming a kind of negative externality due to the presence of the landfill. These disadvantages have led to the growing public concern over the potential hazards of land disposal and consequently the imposition of strict federal regulations governing the design and operation of landfills. These regulations have led to a continuous increase in the management costs of such disposal techniques and thus increasing the financial burdens on local and central governments.**

**Incineration of solid wastes on the other hand will reduce the volume of pollutants but does not solve the pollution problems. In addition to heat, incineration of Municipal Solid Wastes (MSW) releases several pollutants into the atmosphere, including particulate matter and incomplete combustion products. The emitted toxic gases usually cause pollution problems to air and soil and have hazardous effects on human health. Further increase the health costs due to the increase in the numbers of sick citizens.**

To sum it up, the above stated conventional MSW management techniques may exhibit one or more of the following characteristics; require financial costs with no direct monetary return, reduce agricultural land base (usually the least costly as compared to urban land), pollute the environment, and raise potential health hazard.

As for wastewater, the second component of waste, conventional management techniques are used. Up until now construction of wastewater treatment facilities for municipal or industrial areas has been planned with "concrete and steel" in some countries. The disadvantages with these systems are higher energy requirements and large labor involvement. The recent increase in energy prices and labor costs have produced economic pressures which demanded revolutionary changes for these methods with the aim of developing more cost effective or cheaper methods.

## **2.2 Non-conventional Waste treatments**

Rossiter stated that "sink it", "burn it" or "bury it", were formal solutions for MSW management that are currently being replaced with new approaches of pollution prevention. Newly developed non-conventional MSW management techniques have introduced new dimensions to overcome some of the above-mentioned problems. Recent innovation technologies of treating biowaste allow for a transformation of such wastes into an appropriate usable material i.e. composting to be used as a soil conditioner, compacting to be used for feed rations, fuel and energy production, etc.

### **2.2.1 Solid Wastes**

Recycling and or reuse of municipal and agricultural bio-waste have been investigated by several researchers and currently practiced in different ways in some countries. Two of the most rapidly growing non-conventional MSW management techniques are composting for soil enrichment and compacting for feeding livestock. Both techniques are becoming popular, known, and accepted as compared to other non-conventional techniques i.e. power and gas generation, etc.



**When transferred into compost, urban bio-waste could be used with fertilizers in agriculture, to enrich soil properties, thus reduce the country's imports of fertilizers and at the same time increase urban organic waste reuse while lowering its disposition costs and freeing additional land resources for more valuable use.**

**The organic component of urban and agriculture wastes, henceforth bio-waste, may constitute sound nutritional alternative sources of feed, as argued by several scientists. Some of such bio-wastes proven to have high nutritional values at lower purchasing costs when compared to traditional feed sources. Thus, bio-waste may provide an opportunity to be used as a partial replacement for traditional feed components.**

### **2.2.2. Re-Water**

**One of the most popular method in waste water treatments is land application systems which consumes relatively lower energy and labor levels and therefore have lower costs, but requires more land area. Currently, in many states in the U.S., the land treatment systems are commonly used allowing the treated waste water to be successfully reused as a water resource.**

**Although irrigation with wastewater is in itself an effective form of wastewater treatment, a pretreatment for wastewater should be provided before it can be used for agricultural or land scape irrigation. The level of the first treatment required for the agriculture and land scape irrigation usually depends on the soil characteristics, the type of crops irrigated, the types of the distribution and application systems, and the degree of public exposure.**

**To conclude the above argument of waste (SW and WW) problems, the following brief summary for the possible treatment actions and the expected outcomes of each possibility are summarized and listed below**

## **2.3. Re-Water Management (Action Vs. No Action)**

### **A. No Action**

**Open dumping of WW, if not properly treated (No Action), into oceans and fresh water streams poses risk to the human health, the environment and the world various ecosystems:**

**Resulting into two main economic costs:**

**Environmental Degradation Costs                      (Direct and Indirect)**  
**Health Problems Costs                                      (Direct and Indirect)**

#### **Example: (Environment Degradation)**

**The total costs borne by the Saudi economy for treating wastewater were about 659 million dollars in 2019. Direct costs of environmental degradation account for 75.5% of that total, to reduce such costs, the study suggest the need to continue to make full use of it for agricultural and industrial purposes.**

**(Source: Ghanem A., et al., January 2022: Estimating costs of environmental degradation resulting from not fully reusing treated wastewater)**

#### **Example: (Health Hazard Impacts)**

**VSL (Value of Statistical Life) for Egypt in the amount of LE 3.0 million in 2016/17, based on a GDP per capita of LE 37,192 in 2016/17 according to MOF (2018). The VSL is 82 times GDP per capita, i.e., individuals and families may be willing to pay a premium or higher rent for properties (land and buildings) in a cleaner and less polluted neighborhood or city.**

**(Source: Larsen, Bjorn. 2019. Egypt: Cost of Environmental Degradation: Air and Water Pollution. The World Bank.)**

### **B. Action but No Use**

**If WW is adequately treated but with No Use, i.e., Protection and Prevention Policies, higher cost will be imposed wastewater Management, without a monetary Return that can offset such costs.**

### **C. Action and Use**

**WW is treated and then used in different suitable economic activities, henceforth "Re-Water". Re-Water ensures financial/monetary returns that may partly or totally recover the investment and operating costs of the treatment. In addition, it reduces the demand on fresh water for more pressing needs.**

## 2.4. Solid Waste Management

The same argument can be developed with the Three Action Scenarios, for Solid Waste, replacing only water treatment with Recycling and Reuse components in the SW. For instance, the recyclable items include: 1. Food & Beverage Cans; 2. Paper; 3. Flattened Cardboard & Paperboard, etc.; 4. Food & Beverage Containers; 5. Glass Bottles & Containers. Whereas, Biowaste can be use in composting and/or compacting for feed rations. In addition, to biogas (methane) recovery and use. All of the previously mentioned items have monetary values and willingness to trade amongst waste producers and potential recyclable entities, i.e., farmers for fertilizer and feed rations; plastics producers, etc. Just to stress on the importance of recycling, the waste management facilities should seek to achieve maximum volume of recycling and reuse out of their waste bulk, since the more the recycling and reuse the less land is needed for landfill. Maximizing the recycling and use volumes will result in larger revenues to the waste facilities, and reduce the financial burden on municipalities and local governments through these processes of cost recovery. The non-conventional can be then contrasted with conventional methods of Landfill and Incineration, with no monetary returns from recyclable items. Or even uncontrolled and open dumping of SW that lead to environmental degradation and health problems imposing direct and indirect costs as mentioned earlier.

#### **4.. Solid Waste between Minimizing landfills areas and Maximizing Recycle and Reuse Products**

**As Mentioned above and was kept repeated, that the whole concept of Non-Conventional Management, is to search for means and technologies that will enable the MSW management team to maximize the recyclable and reusable items out of the bulk of Waste production and thus required less landfill areas, smaller management team and generates monetary revenues to help off set the cost of establishing the landfill facility and the operating costs. And thus, departure away from incinerations and conventional landfill, thus reducing, controlling, or even preventing the pollutions and health hazard.**

**The following paragraphs are listing the MSW components, once more, and indicate potential recycling and reuse activities. However, it is worth mentioning that Medical waste (disposal from hospitals and clinics) should be treated separately and differently. The more secured method now is Autoclaving of these types of wastes. Autoclaves operate at high temperature and pressure in order to kill microorganisms and spores. They are used to decontaminate certain biological waste and sterilize media, instruments and lab ware.**

**As for the other solid waste the following is a brief list for each type its percentage in Tripoli MSW with its potential as recyclable or reused item:**

**Biowaste: high content of organic (52%), Composting for Agriculture soil enrichment; compacting for Livestock feed.**

**Biogas (raw form of Bio-Methane: Can be used to produce heat and electricity for use in. Biogas can also be upgraded into biomethane, also called renewable natural gas or RNG, and injected into natural gas pipelines or used as a vehicle fuel.**

**Recyclables: (37 %), compact and sell**

**Exhaust and Other Materials: (11%) Even in this category some can be also recyclables, i.e., Batteries; obsolete computers, etc.**

**From the above figures for the 4 categories, it can be asserted that almost 89% of the MSW is usable and even a percentage of the exhausts can also be reused (no figures were available). Increasing the total 89% further up. Needless to state that at least the 89% will decrease the landfill areas with the same magnitude. Furthermore, brings in monetary revenues to the facilities and or Municipalities.**



**Next, an example of the marketing potentials of ONLY ONE ingredient of biowaste components is introduced, to illustrate the vast potential varieties of production activities for this component:**

### **Renewed Purpose for Your Used Cooking Oil**

**Recycling is the best way to repurpose used cooking oil, what exactly can they be used for?**

**DAR PRO Solutions is the nation's preferred collector and recycler of used cooking oil and inedible meat by-products, helping customers across the country streamline operations and support their sustainability goals. DAR PRO serves a broad range of independent, regional and national chain industries in the U.S. Among our customers are restaurant and supermarket chains, casinos, hotels, major airports, theme parks, virtual kitchens and local eateries.**

**They introduce ten ways used cooking oil can create, such as: fuel alternatives, animal feed and a number of different household products and cleaning materials. Below is a brief list of these products:**

- 1. Biofuel**
- 2. Animal feed**
- 3. Composting**
- 4. Soaps**
- 5. Lamp oil**
- 6. Paint remover**
- 7. Lubricants**
- 8. Shampoo and moisturizer**
- 9. Car cleaning material**
- 10. Furniture and appliance protection**

**Source: <https://www.darpro-solutions.com/media/blog/repurpose-used-cooking-oil>**

**This is only one component of municipal solid Waste (MSW) with being the main ingredient in the ten above marketable product. That in turn underscore the ample market opportunities of recycling and reuse of MSW.**

**To illustrate how thorough economic can work in assessing one of the potential activities in biowaste production. A brief summary for a study that was done in Lebanon for using biowaste ingredients as a feed ration for lactating cows is introduced, next.**

#### **4.1. A Lebanese Case Study:**

##### **A Cost Minimization Model for Feed Formulation Using Bio-Wastes as Alternative Sources: Recycling Bad into Good**

Lebanese dairy livestock growers are faced with major constraints that hinder the sector's development, namely; crucial shortage of local feed availability in the adequate quantity, quality and prices resulting in high production costs. The growers are thus eager to find new innovative alternatives that lower their production costs and consequently increase their businesses profits. Literatures indicate that municipal and agricultural bio-wastes may constitute a potential alternative source of feed. Some of these wastes are proven to have high nutritional values at lower purchasing costs when compared with traditional feed sources. The main objective of this study is to assess the technical feasibility and economic viability of using municipal and agricultural bio-wastes as alternative feed sources. A linear programming model was developed to determine the optimal least cost feed ration that satisfies all the daily nutritional requirements and feed availability constraints for a mid-lactating 600kg Holstein dairy cow, being the prevailing type in the country. Two main scenarios were considered; in the first, conventional feed ingredients were used reflecting the current feeding patterns (status quo) of dairy farms, while in the second nonconventional (bio-wastes) feed sources were introduced. For the bio-wastes scenario, four sub-scenarios with different set of feed ingredients based on seasonal availability; summer, winter, and perennial bio-wastes were formulated. The results indicate that all the bio-waste scenarios considered in this study were feasible and generated daily feed rations that are lower in costs when compared to the status quo, while still satisfying the daily feed and nutritional requirements per cow. The most feasible scenario was the one incorporating summer and perennial bio-wastes along with conventional feed ingredients. This scenario reduces the daily feed cost by almost 55% and replaces about 90% of the conventional daily feed ingredients with bio-waste components compared to the conventional ration. Finally, the use of bio-wastes as alternative feed sources tends to reduce; the feed ration costs, the dumped volume of bio-wastes, the required landfills, and as a consequent the cost of cleaning up the environment; in addition to freeing more agricultural land for production endeavors other than forage crops. In conclusion, the study reveals that agricultural and municipal bio-wastes may provide a potential alternative for the current dairy feed practices that is technically sound, economically feasible, and environmentally desirable.

## **5. Re-Water: The Use of Land application Technique to Maximize Revenues and Decrease Crop Production Cost**

### **Water Scarcity vs. Water Reuse:**

**MENA is the most water scarce region in the world. Worldwide, the average water availability per person is close to 7,000 m<sup>3</sup> /person/year, whereas in the MENA region, only around 1,200 m<sup>3</sup>/person/year is available. One half of MENA's population lives under conditions of water stress. Per capita availability is expected to halve by 2050 (<600 approx.) (Source: Water Sector Brief, World Bank Group). I.e., Egypt, per capita availability was 570 m<sup>3</sup> in 2018, (Source: CAPMAS, 2020) And the declining is still going on.**

**Conventional mechanical and chemical wastewater treatment techniques are expensive and have no direct monetary return to even partially offset the investment and the operational costs. What We can Call: Protect and Prevent Type of Policies. That in turn, induces increasing financial burdens on the municipalities and central governments, especially in the heavily populated communities, i.e., in the case of Domestic Water.**

**Given the current and continuous escalating increase in the scarcity of fresh water resources, the use of "adequately" treated wastewater effluent provides potential giant alternatives for enhancing water resources availability and thus mitigating, if not eradicating, the scarcity of this vital resource.**

**The following is a case study for land application technique in the presence of reservoir facility to see the impact of the reservoir on the optimality conditions, in term of revenues and resource consumption, i.e., Water Fertilizer, Land, etc.**

## **5.1. A Lebanese Case Study:**

### **The Impacts of Storage Facilities on Maximizing Monetary Returns to Communities: An Alternative Approach for Wastewater Reuse Management**

Up until the present, wastewater treatment facilities for municipal areas have been planned with "concrete and steel". The disadvantages with these systems are; high energy requirements and large labor involvement. The continuous increase in energy prices and labor costs have produced economic pressures which demanded revolutionary changes aiming at developing more cost effective or cheaper methods. One of the most popular method in wastewater treatments is land application (or reuse of wastewater in crop production) which consumes relatively lower energy and labor levels and therefore have lower costs, but requires more land area. The relationship between the presence of a reservoir and land requirements for a sound land application system is examined in this paper. The focus of the study is to investigate the economic feasibility of land application in the presence of a storage reservoir and compare the outcome to the application without a reservoir. A five-year linear dynamic programming model was developed to determine the optimal cropping pattern that will consume all or most of the secondary treated effluent, utilize all the effluent's constituents and bring in the highest revenues throughout the optimization horizon. A case study in Tyre Region, South Lebanon, was used for model application. Three scenarios were developed and then compared to no-storage scenarios. In the first scenario, the current existing cropping patterns were considered (status quo), while in the second and the third new crops were introduced in addition to the current ones. Supplementary irrigation was allowed in the first and third scenarios to determine the profitability levels under such conditions. The three scenarios were tested under different reservoir capacities. The results indicate that higher profits are achieved in the presence of a reservoir when compared with no reservoir. Also, the presence of storage facilities enhances the efficiency of wastewater usage and the flexibility of the associated cropping patterns. A trade-off between the storage capacity and land and fresh water requirements (supplementary irrigation) is noticed. As the storage capacity increases, less land and fresh water are needed, more effluent volume is consumed and higher net returns are achieved as compared to no reservoir situation.

## **Bibliography**

- Ostler, N.K., Nielsen J.T. "Waste Management Concept". Vol. 5. Prentice Hall's Environmental Technology Series. Columbus, Ohio: Upper Saddle River, New Jersey, 1998.
- U.S. Environmental Protection Agency. "Municipal Solid Waste in the United States". Available from <http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm>
- United States Environmental Protection Agency, 1981. Process Design Manual - Land Treatment of municipal Wastewater. USEPA, Center for Environmental Research Information, Cincinnati, OH.
- U.S. Congress, Office of Technology assessment. 1989. Facing America's Trash: what Next for Municipal Solid waste? OTA-O-424. Washington, DC: U.S. Government Printing Office.
- Rossiter, A.P. Waste Minimization Through Process Design. McGraw-Hill, Inc. 1995.
- Aston University 2003. "Bright spark to create new energy source - prof to turn gardening waste into fuel for electricity production". United Kingdom: Aston University; Available from <http://www.aston.ac.uk/marketing/releases/18jun.htm>;
- Brook, Robert and Julio Davila. (Eds). "The Peri-Urban Interface: A Tale of Two Cities". Bethesda (Wales): University of Wales and University College - London, 2000.
- University of Birmingham, School of Public Policy, Univ. of Wales-Bagnor, Centre for Arid Zone Studies, Univ. of Agricultural Sciences and SDM College of Engineering and Technology, Dharwad. "Urban waste and soil management: improving access and opportunities in Hubli-Dharwad, India". UK Department for International Development, 2000.
- Kubik, D. and Stock R. "Byproduct feedstuffs for Beef and Dairy Cattle". Available from <http://www.ias.unu.edu/proceedings/ismy/wet/loinaqu/paper.html>;
- Lalman, D.L. "Alternative Feeds for beef Cows and Stockers". Colombia: Department of Animal Sciences, University of Missouri; Available from <http://muextension.missouri.edu/xplor/agguides/ansci/g0276.htm>;
- Hadjipanayiotou, M. "The role of crop residues and agro-industrial byproducts in filling the deficit of animal feedstuffs in the Middle East". Aleppo, Syria: Improvement of Crop-Livestock Integration Systems in West Asia and North Africa, ICARDA, (1997): 372-385.
- Onwuka, C. F. I., P. O. Adetiloye and C. A. Afolami. "Use of household wastes and crop residues in small ruminant feeding in Nigeria". Small Ruminant Research, 24 (1997): 233-237.
- Yunker, R.S., Winland S.D., Firkins J.L., Hull B.L. "Effect of Replacing Forage Fiber of Non-fiber carbohydrates with dried Brewers grains". Journal of Dairy Science. 81(10) (1998): 2645-2656.
- Bistanji G., Hanmadeh S., S. Hajj Hassan, F. Tami, and R. Tannous. "The potential of agro-industrial byproducts as feeds for livestock in Lebanon". Livestock Research for Rural Development, 12 (2000): 3.
- Bampidis, V.A. and P.H. Robinson, 2006. Citrus by-product as ruminant feed. A review. Animal Feed Science Technology, 128:175-217.
- Denek. N. and A. Can, 2006. Feeding value of wet tomato pomace ensiled with wheat straw and wheat grain for Awwasi sheep. Small Rumin. Res., 65: 206-265
- Valizadeh, R. and S. Sobhanirad, 2009. The potential of Agro-industrial by-products as feed sources for livestock in Khorasan Razavi Province of Iran. Journal of Animal and Veterinary Advances 8 (11): 2375-2379.
- Sauvant, D., J. Perez, G. Tran. 2005. Tables of Composition and Nutritional Value of Feed Materials Pigs Poultry Cattle Sheep Goats Rabbits Horses Fish.
- Nuraini, S. and S. A. Latif. 2009. Improving the quality of Tapioca by product through fermentation by *Neurospora crassa* to produce  $\beta$  carotene rich feed. Pakistan Journal of Nutrition 8:487-490.
- Council for Development and Reconstruction. "The Lebanese Council for Development and Reconstruction Progress Report", 2003.
- Darwish, M. R. and Carla Moukarzel, "Towards A sustainable Agricultural Policy in the Yamouneh Region", Final Report, USAID, Faculty of Agricultural and Food Sciences, American University of Beirut, Beirut, Lebanon, December 2001.
- Agriculture in Lebanon. "Agriculture Census Project- FAO", 1999.
- Agriculture in Lebanon., "Agriculture Census Project- FAO", 2003.
- Bath, D., J. Dunbar, J. King, S. Berry, and S. Olbrich. "Byproducts and Unusual Feedstuffs". Feedstuffs. 1995. 67 (July 1995):30.
- National Research Council. "Nutrient Requirements of Dairy Cattle". Sixth Revised Edition. Washington, D.C.: National Academy Press, 1989.
- Harris, L.E., L.C. Kearl, and P.V. Fannesbeck. "Use of regression equations in predicting availability of energy and protein". J. Anim. Sci., 35 (1972): 658.
- Pond, W.G., D.C. Church, K.R. Pond. "Basic Animal Nutrition and Feeding". Fourth Edition. John Wiley and Sons, 1995.
- Schrage, L. "LINDO An optimization modeling System". Chicago, Ill: Graduate School of Business, University of Chicago, The Scientific Press, 1991.
- Darwish M. R., M. Sharara, M. Sidahmed, M. Haidar, 2007, "The Impact of a Storage Facility on Optimality Conditions of Wastewater Reuse in Land Application: A Case Study in Lebanon". Journal of Resources, Conservation and Recycling



## **Brief Introduction for**

**M. Ragy Darwish, Ph.D., Resources and Environmental Economics**

**Dr. Darwish is currently independent Economic Consultant and a certified Trainer of trainers by IFAD and ZIG Germany,**

**He earned his Master Degree in Agricultural Economics from Colorado State University USA, and his Ph.D. is in Agricultural Economics focusing on Environmental Economics with minor in Ag. Engineering from Texas Tech University USA.**

**After earning his PH.D. he worked as A Visiting Assistant Professor at the department of Agricultural Economics, at Texas Tech University, for a couple of years,**

**Dr. Darwish then joined the American University of Beirut (AUB) as an assistant Professor, then Associate professor.**

**He joined Rafik Hariri University as a chairman of the Financial Studies Department (FSD), then he became the Acting Dean of the College of Business Administration, (CBA), and also remain the Chair of FSD.**

**Dr. Darwish taught classes at both undergraduate and graduate levels.**

**He engaged in many research projects related to economics assessment of biodiversity; solid waste and wastewater management**

**He managed to publish more than 25 articles in peer reviewed journals. He also was the author of several training manual and technical reports related to Water and wastewater policies and solid waste management**

**He involved in many training workshops for top, intermediate and grassroots level trainees**

**Dr. Darwish was a consultant for several local, regional and international agencies, USAID; UNDP; Mercy core, Right to Play**



**UNITED  
FOR THE  
ENVIRONMENT**

# LET'S WORK TOGETHER

**E mail: [Management@unitedforlebanon.com](mailto:Management@unitedforlebanon.com)**

---

**Phone: +961-1-427 027 +961-71-976060**

---

**Address: Beirut, Adlieh**

---