





# به نام خدا I.R. of Iran Golestan Province Waste Management Organization

AN INNOVATIVE PROJECT FOR THE SUSTAINABLE MANAGEMENT OF MUNICIPAL SOLID WASTE



# **DBOT CONCESSION PROPOSAL**

# **Technical and Financial Feasibility Study**

Follow up from Official Meetings on 24/09/2017

مهر October 2017 – ۱۳۹۶

Montana S.p.A. Via Angelo Fumagalli, 6 – 20143 Milano ITALY



# Agenda

- 1. Scope of the Feasibility Study
- 2. Team Introduction (details in Company Profile)
- 3. MSW in the Golestan Province and Assumptions
- 4. Strategic Proposal and Implementation Master Plan
- 5. The Technical Solution: BEST®
- 6. Cooperation Model and Structure of the Proposal
- 7. Next steps and timeline for operation





## SCOPE OF THE DOCUMENT

- Scope of this Fesibility Study (FS) document is to supply to Golestan WMO the tools to evaluate our DBOT investment proposal regarding the long term mangament of MSW of all the Province;
- The FS and in particular the related Economic and Financial Model is to be considered as an open tool for negotiation among the Parties
- It has to be considered that a further review of this Feasibility Study will be necessary along the negotiation, after signing a proper engaging Term Sheet, due to the lack of some major data/information (site surveys; waste quality; public funding availability and FiT values)
- > This document represents an update of the previous FS version presented to the authorities in relation to the modelling of new economic scenario



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## WHO IS MONTANA

- An ethically sound Business Development/Consulting/Engineering Firm
- Owned by its management, headquarters in Italy and activities in several countries
- A long story of success and reliability on the European market since 25 years
- A Team of 45 Technicians with multidisciplinary competence in all environmental sectors (Waste Management, Remediation, Renewable Energy; Natural Hazards)
- A portfolio of over 1800 Projects developed for all kind of Clients and investors (from large Multinational Companies to Public Authorities)
- Operative presence in the I.R. of Iran since mid 2014 with a team of 5 staff
- Consistent set of over 10 ongoing Projects in Iran on MSW, Industrial Waste, Renewable Energy;





## MONTANA IN THE I.R. OF IRAN

## Why

- To promote etically sound cooperation between Italy and Iran in the environmental sector for the benefit of our common and only Planet Earth;
- Long term friendship and trust with very competent and reliable Iranian Team technicians;
- Good knowledge of the Iranian context (habits, regulation, market, environmental problems) through several projects since 2014;

### Targets

- Contribute to solve the important Waste Management challenges that the Country is facing avoiding the repetition of the past errors through appropriate technology transfer;
- Create opportunities through modern business models and to bring investments in the Country.



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### STRUCTURE OF THE SERVICES IN THE GOLESTAN PROVINCE

Respect to many other Provinces of Iran the Golestan Province has already reached important results in the MSW management by applying a specific Waste Management Master Plan and:

- Organization of MSW collection services by 3 sub areas (West –Center – East) with 12 Transfer Stations (TS)
- Definition of 3 specific centralized treatment and disposal centers (AGH GHALA – West; AZAD SHAHR – Center; Minor sites-East )
- Setting up of communication social projects to start source segregation projects



The assumption in the FS is that the structure in 3 sub-provinces will evolve in 1 single organization before the implementation of the proposed BEST<sup>®</sup> Project: in any case the project has a significant degree of flexibility.





### **MSW QUANTITY**

The MSW produced in the Province of Golestan is quite well characterised in terms of quantity based on the population data and on measured collected waste (weighbridge):

1	Province area: amount to 20.437,7 km <sup>2</sup> (density of 87 persons/km <sup>2</sup> )
2	Total Province population: 1.777.014 persons ( 882.475 in the 29 Cities and 894.539 in the 1066 Villages)
3	<ul> <li>The total average amount of waste collected in the 3 different sub-provinces is around 900 t/day</li> <li>(about 0,56 kg/day/person) divided as:</li> <li>West: 400 t/day</li> <li>Center: 400 t/day</li> <li>East/other: 100 t/day</li> </ul>

Forecast of production in the long term is not available but an estimation can be provided at FS level in the order of 1-1,5 %/year for the next 15 to 20 years considering the combination of: population increase; consumption habits evolution; completion of serviced areas.

The consequent Scenario for the FS @2037 is of around 1.150 t/day of collected MSW in the 3 zones: West: 500 t/day Center: 500 t/day; East: 130 t/day.

For the FS purposes the fluxes from the East region are not considered at the moment but can be easily added to the negotiation considering the flexibility of the technology.



#### **MSW QUALITY DATA AND ASSUMPTIONS**

The MSW produced in the Province of Golestan has been characterised in the past but with some relevant discontinuity in time and incoherence among the data actually available for the FS. For the assessment of the initial MSW composition to be used in the FS we have based our analysis on the 1993-1994 and 2001 (International Journal of Academic Research) and more recent analysis made on the AGH GHALA and AZAD SHAHR MSW Processing Centers suplied by the **Golestan WMO** 

The following table represents the FS MSW composition evaluation at Province level based on conservative assumptions.

MSW Fractions	% in weight
Organic/Green Waste	70,0%
Inert Waste	7,0%
Paper and Cardboard including coupled materials (Tetrapak)	10,0%
Leather Wood Textiles	5,0%
Plastics (film, PVC, PP, PS-PET/HDPE)	5,0%
Glass	2,0%
Metals (Ferrous and non ferrous)	1,0%
TOTAL	100,00%

NOTE: the actual available data supplied by WMO on the quality of the MSW is not sufficient for entering into the contractual phase. While we wait for the requested detailed data from WMO, we consider that an extensive campaign of MSW analysis could be necessary in cooperation with the authorities.



### SITES AND INFRASTRUCTURE: AGH GHALA Processing Center

For the FS study purpose we had a preliminary survey on the AGH GHALA MSW Processing Center and we where delivered some general maps on the site and some basic info on machineries and facilities.

Major assumptions of the FS respect to the existing infrastructure are:

- 1. Possibility to use of all the available site without costs (85 ha total of which over 25 actually greenfield)
- 2. Possibility to use free of charge all existing technological facilities including buildings and sorting plants.
- 3. Consider water and energy supply (20kV at least for 3 MW injection) available on site
- 4. Include the remediation of the actual landfills of approximately 35 (and 30 ha Azad Shahr) as an option in the proposal







NOTE: further updated site data (topographic surveys, geotechnical and well data) shall be supplied by WMO on both sites, including availability of further 20-30 ha on Agh Ghala, before entering into the contractual phase



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### **MSW** MANAGEMENT OPTIONS: WHAT DO DO? **MATURITY STAGE**

Lower		<ul> <li>Immature (OLD)</li> </ul>	<ul> <li>No waste sorting</li> <li>Dumping in informal landfills</li> </ul>
	nology – Cost	Early maturity	<ul> <li>No / limited waste sorting</li> <li>Proper disposal in sanitary landfill         <ul> <li>Leachate management</li> <li>Landfill gas + energy recovery</li> </ul> </li> </ul>
	Techi	Fully mature (CURRENT)	<ul> <li>Option 1:</li> <li><u>Full separate collection</u> with material recovery</li> <li>Mechanical-biological treatment</li> <li>RDF production + final landfill</li> </ul>
Higher			<ul> <li>Option 2:</li> <li>Incineration with energy recovery</li> <li>Limited waste sorting</li> </ul>

**TYPICAL TECHNOLOGY** 





#### **BEST®** : SIGNIFICANTLY BETTER ENVIRONMENTAL PERFORMANCES







### **BEST**® : EFFECTIVE SOLUTION TO BRIDGE THE TECHNOLOGY AND COST GAP



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### **Optimal MSW Strategy applied to Golestan Province**

We based our FS Strategy on the analysis and optimization of:

- 1. ideal technological solution BEST<sup>®</sup> balancing, efficiency (energy and environment), costs, and time for realization
- 2. optimal logistic context of the whole province
- 3. Reduction of environmental criticalities, in particular regarding:
  - A the impacts of MSW for the Azad Shahr City
  - B the presence of few areas/villages still isolated respect to the MSW Processing Centers

The result of the FS leads to the optimal solution is represented in the following scheme with related fluxes (t/day) @Year 1 – Year 20:







### **BEST®** Solution applied to the Golestan Province: Master Plan

The following Master plan is resulting from the FS as the ideal solution for the Implementation of the Golestan Province MSW Management Strategy





### **BEST® Solution applied to the Golestan Province: INVESTMENT PLAN**

Due to the high level of customization of the BEST<sup>®</sup> Solution the exact economics of the Project can be defined only in the negotiation phase under a detailed set of information that are currently not available. According to the FS results as a parametric indications the following main figures can be considered to evaluate the in principle feasibility for the Municipality for the 2 main Processing Centers of the Province:

Item	Agh Ghala	Azad Shahr
Investments in new facility in 20 Years (CAPEX)	65 - 70 M€	0,3-0,5 M€
Old Landfill Remediation Investment (CAPEX)	4 - 6 M€	4,5-7, M€
Operational costs (OPEX):	~ 3- 6 M€/y	~ to be assessed
Employed <b>Personnel</b> :	~ 65-70 Units	~ 2-3 Units

CAPEX Item	AVERAGE VALUES %
Earth works and linings	25%
Building and infrastructure	15%
Technological Treatment Equipment	50%
Engineering and testing	10%
Total	100%

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### **TECHNOLOGY BEST® ARTIFICIAL MINES**

**BEST ARTIFICIAL MINES (B):** innovative combination of two well established scientific and technical concepts:

- **1. Activated Bioreactor**
- 2. Landfill Mining

#### A cyclical process with these advantages:

- A. Full control of all incoming waste
- B. Maximisation of recovery of energy and materials
- C. Containment of land use
- D. Minimization of environmental impacts
- E. Containment of treatment costs respect to EU standard
- F. Improved labour conditions
- G. Full compatibility with future increase of source segregation
- H. Integration of European technologies with national industrial competences









### **BEST** <sup>®</sup> **PROCESS: RESULT OF 5 YEARS OF R&D DEVELOPMENT**







### **BEST** <sup>®</sup> **PROCESS: APPROPRIATE INTEGRATION OF SOLID EXISTING TECHNOLOGIES**







Waste pre-treatment



Cell sealing (anaerobic phase)



Bioreactor cell preparation

Leachate recirculation

Waste disposal, Bioreactors's facilities (leachate-biogas)



Massive production of biogas with large volume and weigh reduction



Production of green energy, with reduced environmental impact



Mining of stabilized matter (LFM) and delivery to the selection plant





Separation of recyclable & energy valuable fractions (SSF).



Bioreactors's cells final stabilization and re-opening



Final confinement of residual non recoverable stabilized materials

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## SKETCH TYPICAL PROJECT LAYOUT







## **MECHANICAL PRETREATMENT UNIT**

#### PRETREATMENT Unit Layout 1/2 parallel lines





#### PRETREATMENT Unit (1 or more lines)







## **BIOREACTORS CELLS**

Bioreactor Cell (4 to 6 cells tipically)



HDPE Lining





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## **BIOGAS TO ENERGY UNIT**



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Biogas to Energy Units (2/8 Mw depending

on project size)



Biogas extraction/ control unit







### LEACHATE TREATMENT UNIT

Leachate Treatment Typical Layout





#### Leachate Treatment Unit

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## **MECHANICAL TREATMENT UNIT - MINING**



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### **TECHNICAL STANDARDS**

**Directives/Laws** (www.ec.europa.eu/environment/waste) 1999/31/CE EU Directive on Landfills and Bioreactors Italian National Law Decree 26/2003 on Landfills UE Technical scientific documents on Landfill Mining (<u>www.eurelco.org</u>)

Technical Standards (www.uni.com, www.cen.eu, www.astm.org)

Artificial Lining (Bioreactors): UNI-EN/ISO, ASTM, CEN-TS

**Elettromechanical equipments (Mechanical, Biogas, Leachate):** UNI-EN, DIN-ISO

**Civil and Concrete construction (Buildings)**: Aeen-name 2800 III edition, 1384.

Management Standards: ISO 9001 (Quality); 14001 (Environment)















### **BUILDINGS AND INFRASTRUCTURE (EXAMPLES)**

Specific attention will be dedicated to architectural/landscaping aspects of the new project in order to increase its social sustainability.





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### MILESTONES OF THE COOPERATION IN BRIEF

The principles of the cooperation between our investment team and the WMO is to arrange a modern contractual agreement applied worldwide in the form of a DBOT that will :

- A. Ensure Uninterrupted waste management service for the Municipality
- B. Guaranteed and controlled quality of the service on the long period
- C. Avoid direct investments for the Municipality and full control of costs in time (through Gate Fee)
- D. Allow proper transfer of know how, training and possibility to extend the operation to other types of waste (in particular Sanitary Waste)

The perimeter of the agreement will be the full investment and management of the NEW BEST <sup>®</sup> Agh Ghala Provincial MSWM Center but can be extended, also with a PPP approach with WMO to:

- a) Remediation and management of the old landfills
- b) Management of Transfer Stations
- c) Management of MSW collection services



### **STRUCTURE OF THE AGREEMENT: Main Commercial Terms**

#### The following main items can be considered as a preliminary proposal for entering into a next stage of the discussion:

- 1. Form of the contract: international standard DBOT Concession contract for 20 Years + 10 Years among the Province/MWO and a Special Project Company (SPC) established for the project.
- 2. Waste quantity: minimum contract waste amount ensured with a "take or pay" clause @ >= 800 t/day with an option for extension to the East Sector to be discussed (+ 100 t/day)
- **3.** Waste quality/logistics: assumed as per available data with no significant changes in collection service structure is made along the agreement duration: MSW composition shall not change in time due to introduction of source segregation
- **4.** Land and infrastructure availability: site for > 40ha free of charge and free from previous liability for the duration of the Concession; site extension respect to actual boundary to be agreed in the negotiation phase.
- 5. Employment of existing personnel: engagement to hire already existing operator in case they have proper qualification and by law requirements up to the design number of the project
- 6. Gate Fee scheme: payments in € or in Rials + Inflation protection formula. Central Bank or other central authority grants/guarantees for risk and payment protection;
- 7. Guarantees: Full liabilities guarantees supplied by the SPC on technical, commercial and environmental performances;
- 8. Profit Sharing: open to a minority participation of the Municipality/MSW Organization to the shares of the project (eg. 5-10%) eventually considering the land/assets values. Revenue-Profit Share with Municipality (eg. Share, Royalties on recovered Materials) to be negotiated. Actually not considered in the BP.



### **REVENUE COMMERCIAL STRUCTURE:**

One of the strengths of the BEST<sup>®</sup> Solution applied to the specific MSW conditions of the Golestan Province is to rely on 3 different sources of revenue:

	Reven	ue Mix	Courco
Revenue Type	Min	Max	Source
Gate Fee	50%	60%	Administration/State
Recyclabes	5%	15%	Market Commodities
<b>Green Energy</b>	25%	35%	PPA Satba

Green Energy contribution depends on the FiT (actually at @2700 IRR/Kwh) which shall be negotiated based on the Decree 153440 of the Ministry of Power in order to reduce impact of Gate Fee.

The advantages od such mix are very important for WMO:

- Containment of Gate Fee costs for the local community
- More resilient structure of the Business Plan (less financial costs)
- Improvement of the Recycling targets along time





## GATE FEE (€/T) VERSUS SIZE (T/DAY) AND FIT (€/KWH): BEST®

Gate Fees ranges have been simulated in the FS with different scenario to give full picture of the project commercial terms:

LEFT: Variation of Waste Fluxes (T/day) at fixed Fit (@2700 IRR/Kwh): Gate Fee in Design Range 35-37€/t Avg is an optimal situation but much higher than actual budget expenditures.

RIGHT : Variation of SATBA FiT at fixed Waste Fluxes (@800 T/day): Actual FiT is not contributing much in the reduction of the Gate Fee and it should be 20 times actual values to have Gate Fee =0





## GATE FEE (€/T) VERSUS NON REPAYABLES (€) AND DURATION (Y): BEST<sup>®</sup>

Gate Fees ranges have been simulated with different scenario also with the related results:

LEFT: Variation of Non Repaiables Funds (€) at fixed Waste Fluxes (@800 t/day), FiT (@2700 IRR/Kwh): effect of the availability of Public Non Repayable Funds to start the project is very important in the reduction on the Gate Fee.

RIGHT: Variation of the Concession Duration (Y) at fixed Waste Fluxes (@800 T/day) and FiT (@2700 IRR/Kwh): impact on Gate Fee of the Concession duration is not relevant over the 20 Years which is the minimum expected duration for the optimization of the BEST<sup>®</sup> process.





#### **GATE FEE SCENARIO: BEST®** VERSUS OTHER TECHNOLOGIES

Gate Fees scenario have been evaluated comparing 4 major available solutions with UE technological standard, considering similar project parameters: Waste Fluxes @800 T/day, FiT @2700 IRR/Kwh.

The clear results of this comparison are shown in the following graph: BEST<sup>®</sup> is an effective solution with costs that are< 50% lower than other advanced technologies and higher only respect to Landfill but of course with large environmental and social advantages, including employment rate which is almost 10 times larger.







### **SUSTAINABILITY: BEST** <sup>®</sup> VERSUS OTHER TECHNOLOGIES:

Comparison of 3 Scenario of different modern technological options has been performed in the FS to evaluate the overall performances and confirm the optimal solution also from the sustainability point of view in terms of equivalent of Greenhouse gases (CO2 in kg/Ton of MSW.

#### > The results show that BEST<sup>®</sup> option is the best option overall with C02 Emissions of 1/2 and 1/3 of the other Scenario





### GATE FEE SCENARIO: RESULT DISCUSSION

The FS study has lead to the following conclusions as a base for the completion of the negotiation:

- 1. Gate Fee is reducing with the size of the Project hence confirming that centralization on Agh Ghala site is a good solution;
- 2. Gate Fee can be reduced with the negotiation of a higher FiT with SATBA respect to the actual values but the impact is not so relevant;
- 3. Gate Fee is not very much effected by the recovery of materials since amounts in % is not significant in the balance and SSF (Solid Secondary Fuel) prices are not expected to be high in the mid term;
- 4. Cost of the Remediation of both Agh Ghala and Azad Shahr Old Landfills is uncertain since much data are missing from MWO but estimated prudentially in the order of 8-10 M€. This would have an effect on the Gate Fee in additional + 8-9 €/Ton if to be charged on the future waste.
- 5. Reduction of Gate Fee through recovery of Landfill Biogas of the Old landfill/s is possible but needs specific data set on historical waste quality, and the old landfills which are still missing from WMO.

> Gate Fee Ranges in the order of 30-40 €/T (without Non Repayable Funds) are very far from the actual budget of WMO but are unavoidable if the Province wishes to move to modern environmental standards and to reduce heavy impacts of long term pollution and related sanitary problems on the food chain.



### **CONCLUSIONS BENEFIT/COST EVALUATION**

- **BEST • ARTIFICIAL MINES** technology under **DBOT/PPP cooperation model** can be considered an optimal sustainable solution for MSW management in the Golestan Province considering:
- ☑ The prosecution of current MSW management practices is not an option for the heavy pollution impact;
- ☑ The BEST<sup>®</sup> option is 50 to 70% cheaper respect to other modern options (WTE+LF or MT+AD+LF) with higher overall efficiency;
- ☑ The option of Standard Landfill is significantly cheaper but will lead to large future costs and burden for the future generations and use of land;
- ☑ The timing for implementation of the BEST<sup>®</sup> option is significantly lower than WTE and can respond better even to emergency and peak situations (eg. Summer tourism increase) due to its high flexibility;
- ✓ The level of innovation of the Project will represent a leading example for the rest of I.R. of Iran and the Middle East area;
- ☑ The implementation of BEST<sup>®</sup> will cost to each citizen less than of one soft drink a week!



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#### **GATE FEE SCENARIO: STRATEGIC SUGGESTIONS**

The proposal deriving from the implementation of the FS is structured in the following steps which the WMO should take in order to move Forward can be shared with an open book approach:

- 1. Sign an engaging Term Sheet on the DBOT with general commercial terms(Gate Fee ranges, duration, ecc), subject to the obtainment of the following additional results;
- 2. Negotiate the dedicated FiT with SATBA possibly > 6-7000 IRR/Kwh , according to new regulations in order to reduce the Gate Fee at the lowest reasonable levels;
- 3. Establish a specific financing request to Central Government of a dedicated Non Repayable (or special low interest) Fund in the order of > 5.000.000 € for the new BEST<sup>®</sup> Investment in order to reduce the Gate Fee and in the order of 10.000.000 € for the remediation of the 2 Old Landfills;
- 4. Agree on a final Gate Fee structure consequently by eventually setting increasing values in time (eg a step every 3 to 5 years) to contain the impact on social costs;





### **ROADMAP TO START OF OPERATIONS**

Starting from the current date we propose the following detailed work program and Key Milestones (X). Note: final COD date is strictly related to the support of competent authorities within Permitting Procedures.

	Months	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Marc	Apr	May	June	July	Aug	Sept	Oct	Nov	Dic
Activity/Milestones	Responsability	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17
Negotiation Process																		
Presentation Meetings and Site Visits	WMO-Montana	Х																800000000000000000000000000000000000000
Data Collection (including site informations)	WMO																	
Feasibility Study and Business Plan	Montana																	
First Discussion Meetings	WMO-Montana		Х															
Update of the Feasibility Study with Multiple Scenario	Montana																	
Negotiation ad Signing of Engaging Term Sheet	WMO-Montana				X													
PPA Renewable Energy Flt Negotiation	WMO-Montana						X											
Non Repayable Fund Negotiation	WMO						Х											
Completion of Data Collection (Surveys-Waste Quality)	WMO		~~~~~~															
Feasibility Design	Montana																	
Negotiation and Signing of DBOT Concession Contract	WMO-Montana							Х										
Permitting procedures																		
Site investigation detailed survey	Montana																	
Basic (Permitting) Design	Montana																	
EIA Study	Montana - DOE																	
Permitting process	Montana																	
Financing process	Montana																	
Realization and Operation																		
Detail design and procurement	Montana																	
Construction and supervision	Montana																	
Commissioning-Testing Operation start-up (CoD)	Montana																	X





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