CONVECO
SPECIALIST IN BIOGAS TECHNOLOGY

Confederation of Indian Industry

STAKEHOLDER WORKSHOP ON

WASTE MANAGEMENT FOR SUSTAINABLE GROWTH & INVESTMENT OPPORTUNITIES IN MADHYA PRADESH

BIOGAS MANAGEMENT

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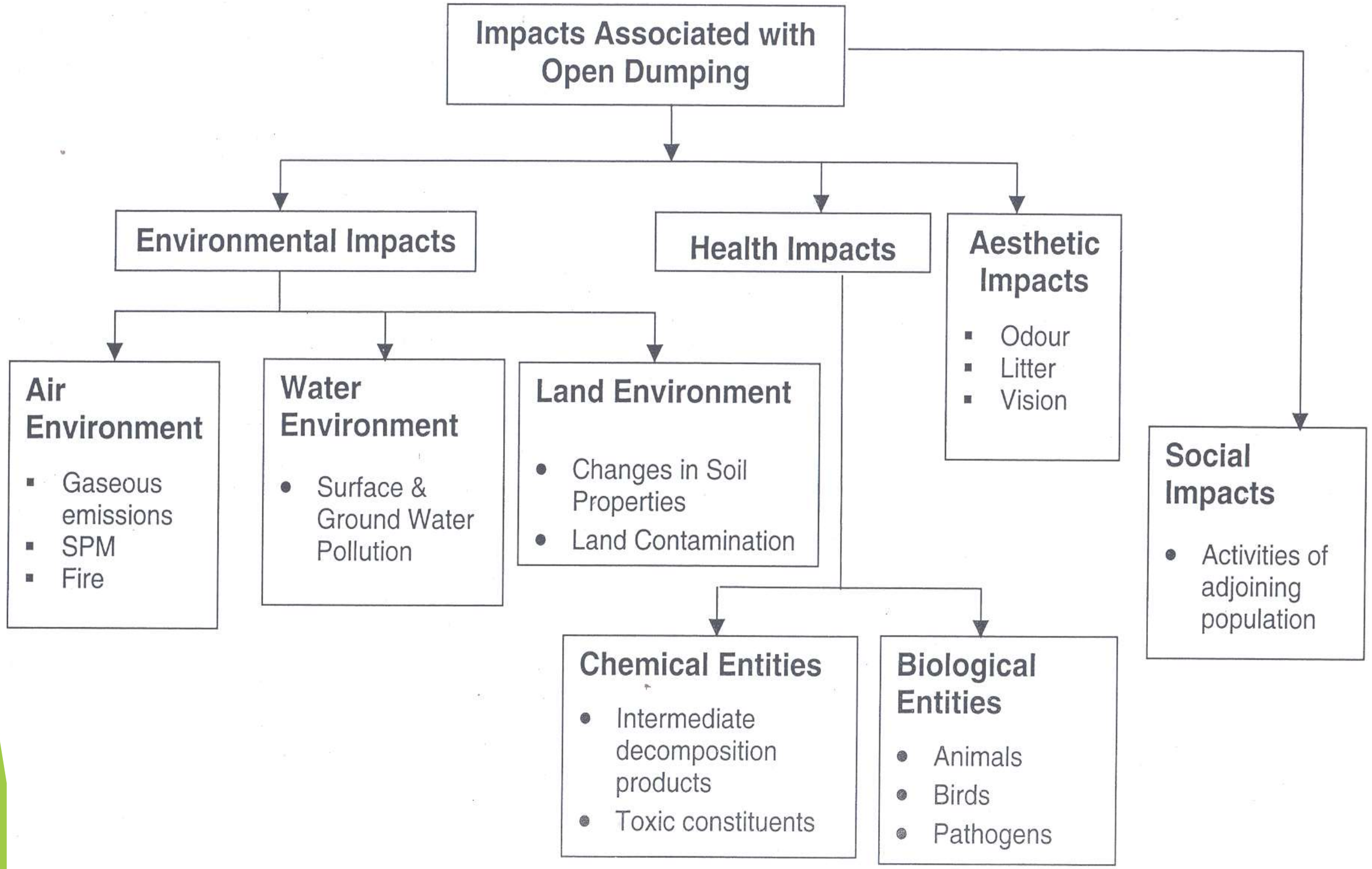
Landfill Challenges/Management

- The most prevalent way of disposing MSW in Indian cities is open dumping
  - Easiest and considered to be the cheapest method of removing waste from the immediate environment.
- Many old landfills and dumpsites existing throughout India pose a threat for public health and environmental quality around the dumpsites.
- Most solid waste is dumped in landfills without sorting or treatment leading to air, land and water pollution/foul odour/unsightliness

- **Carbon-di-oxide, Methane and other harmful gases generated by decaying organic wastes are released into the atmosphere.**
- **Methane is a green house gas and can itself be a danger to inhabitants of an area because it is flammable and potentially explosive.**
- **Improper management of leachate is contaminating the ground water and causing underground water/ river pollution in nearby areas**

Landfills are the world's third largest anthropogenic emission source, accounting for about 12% of global methane emissions (USEPA).

Challenges……Cont.



Environmental Challenges

Landfill Biogas: production mode

Landfill gas is produced by wet organic waste decomposing under anaerobic conditions in a landfill.

The waste is covered and mechanically compressed by the weight of the material that is deposited above and this prevents oxygen exposure thus allowing anaerobic microbes to grow up.

LANDFILL BIOGAS: the main problem for uncontrolled site

The gas builds up and is slowly released into the atmosphere if the site has not been engineered to capture the gas.

- RISK OF EXPLOSION: Landfill gas released in an uncontrolled way can be hazardous since it can becomes explosive when it escapes from the landfill and mixes with oxygen.
- GLOBAL WARMING CONTRIBUTE: The methane in biogas is twenty times more potent a greenhouse gas than carbon dioxide.
- PHOTOCHEMICAL SMOG: The VOCs (volatile Organic Compounds) that escapes from landfill could contribute to the formation of photochemical smog.

- *Biogas is produced by anaerobic digestion with anaerobic bacteria. It is primarily composed by:*
- *methane (CH_4) and carbon dioxide (CO_2);*
- *and may have small amounts of: oxigen (O_2), nitrogen (N_2), water (H_2O), sulphide dioxide (H_2S).*

Challenges...Cont.

The chemical reactions that occurs in a waste dump are

- Dissolution
- Suspension of waste materials
- Biological conversion products in the liquid percolating through the waste
- Evaporation and vaporization of chemical compounds
- Sorption of volatile and semi volatile organic compounds into the waste material
- Decomposition of organic compounds
- Oxidation-reduction reactions affecting metals and the solubility of metal salts.

The dissolution of biological conversion into the leachate is of special importance because these materials can be transported out of the waste dump with the leachate.

The important physical changes in waste dumps are

- Lateral movement of gases in the waste
- Emission of gases to the surrounding environment
- Movement of leachate within the waste and into underlying soils
- Settlement caused by consolidation and decomposition of the waste.

The uncontrolled release of landfill gas, methane contributes to the green house effect. Landfill gas can migrate laterally and potentially cause explosions.

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Existing Dumpsites at Delhi

S. No.	Name of SLF Site and Compost Plant	Area (in Acres)	D.O.S	D.O.C	Height in Meter	MSW being dumped per day in MT
1.	SLF Ghazipur	70.00	1984	Almost saturated	Average. 30.00 from general ground level	2500.00
2.	SLF Bhalswa	40.00	1994	Almost saturated	Average. 25.00 from general ground level	2900.00
3.	SLF Okhla Ph-I	32.00	1996	Almost saturated	Average. 50.00 from general ground level	400.00
4.	Waste to energy plant at Okhla					1200.00
4.	Compost Plant, Bhalswa	12.00	1999	2029	-	500.00
5.	Compost Plant, Okhla	08.00	2008	2038	-	300.00
6.	Integrated landfill facility at Narela-Bawana		2011	-	-	1500

Source: South Delhi Municipal Corporation 2015

Ghazipur Landfill site, Delhi

Fire in the month of October 2017

- This landfill has been over-saturated since 2002.
- Despite the recent alarming incidents, garbage continues to be dumped there due to lack of alternatives.

As of now almost height is 63 m

Landfill Explosion – Global References

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BIOGAS AS A PROBLEM

1992 – Mariano Comense (Italy)
A biogas explosion located in the top waste layers caused a deep landslide and resulting detachment of a portion of the landfill.

1996 – Masserano (Italy)

Explosion in a house located at a distance of about 350 m from the landfill site: 1 person killed and 2 injuries

Landfill ……Cont.

BIOGAS AS A PROBLEM

1996 – Istanbul - Turkey

A landslide caused by biogas explosion caused fall of waste down to a illegal "waste pickers" camp

25 people killed, many people injured (unofficial)

1996 – Hiriya (Israel)

A biogas explosion located in the landfill body caused a deep failure crack and resulting slide and detachment of a wide volume of waste.

Major Concern

- **Institutional/Administrative**
- Finding new landfills in and around cities is nearly impossible because of the poor track record of dumpsite operations and its maintenance in India and the Not in My Backyard (NIMBY) phenomenon.
- Reclamation of landfill site
- Management of Existing huge heap of Waste
- Time requirement for segregation and reuse of Existing waste
- **Environmental Challenge**
- Emission of green house and other gases
- Water and Soil Pollution because of Leachate generation
- Aesthetic environment - Odor,
- Animal/ Birds

Typical Composition of Landfill Gases in Municipal Solid Waste Landfill Sites.

Component	In Percent
Methane	45–60
carbon dioxide	40–60
Nitrogen	2–5
Oxygen	0.1–1
Ammonia	0.1–1
NMOCs (non-methane organic compounds) NMOCs commonly found in landfills include acrylonitrile, benzene, 1,1-dichloroethane, 1,2-cis dichloroethylene, dichloromethane, carbonyl sulfide, ethyl-benzene, hexane, methyl ethyl ketone, tetra chloroethylene, toluene, trichloroethylene, vinyl chloride, and xylenes.	0.01–0.6
Sulphides (hydrogen sulfide, dimethyl sulfide, mercaptans are naturally occurring landfill sulphides mixture, which gives it rotten-egg smell)	0–1
Hydrogen	0–0.2
Carbon monoxide	0–0.2

Remedial Solution for Existing Landfill

Biogas Management

- Analysis and Quantification of Biogas for Landfill site
- Customize treatment approach in phase manner
- Infrastructure development and installation of gas collection system at site
- Collection of the methane gas produced during decomposition of the waste by cover the landfill with more wide upper liner, to prevent escape of landfill gas, with better gas collection system
- Feasibility study for the methane from the landfill
- Leachate Collection and Management
  - Collection and treatment and disposal
  - Collection of the leachate and recirculation of the same to the dump for proving the better moisture to the dump

LANDFILL BIOGAS: the Possible Solution

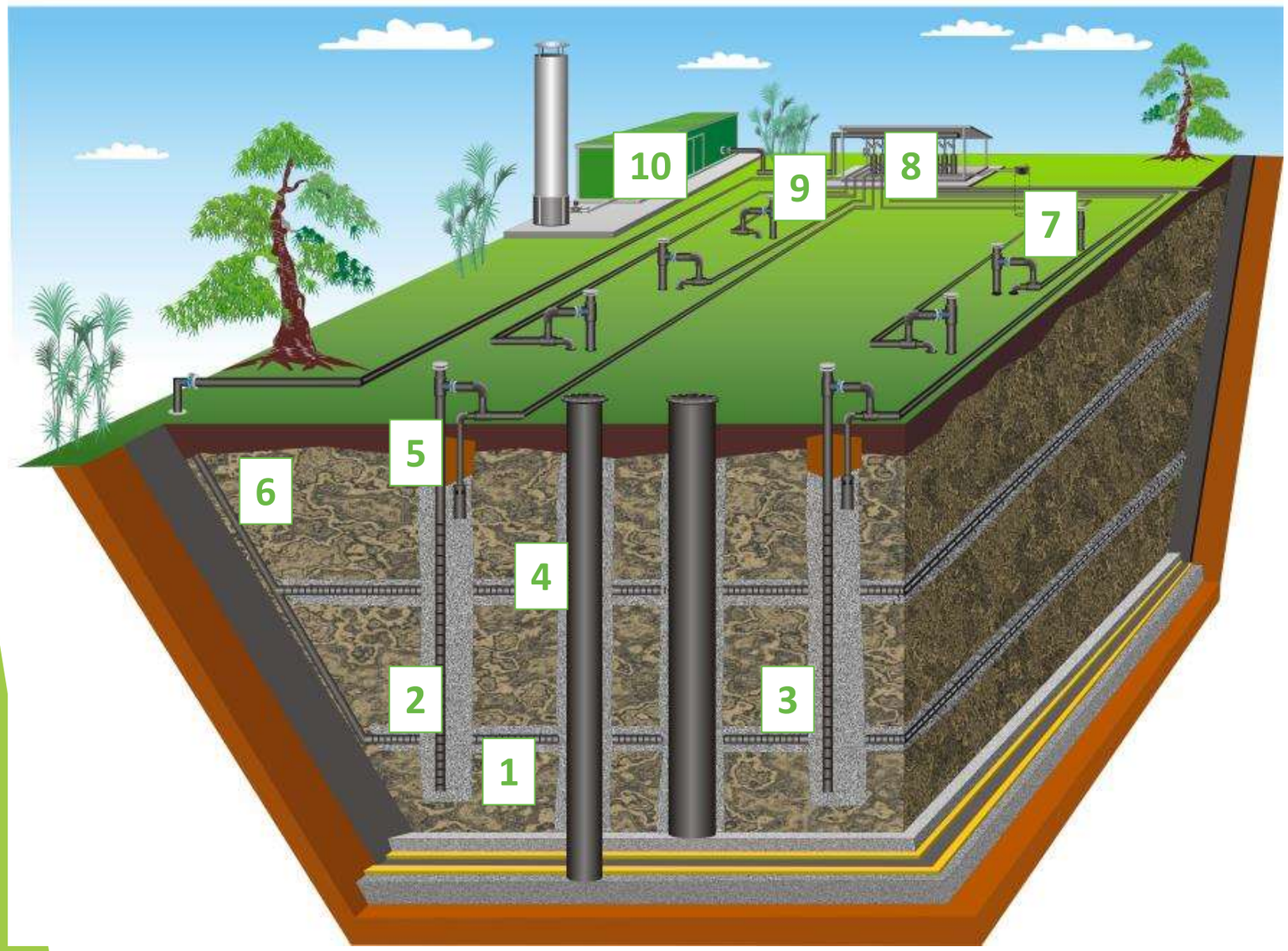
This gas can be captured and use mainly in 3 different way:

1. Reduced in a biofilter (only for very old landfill and poor-quality biogas);
2. Burnt in a flare (common solution);
3. Used for thermal/electric energy production(more convenient);
4. Park Development – Recreational

INDRAPRASTHA PARK created over an area of 34 ha., stretching 2.7 k.m. along the Ring Road. An example of transforming sanitary **landfill site** into living, breathing and verdant landscapes

Conveco Srl. – Biogas Solution far Existing and Upcoming Landfill sites

LANDFILL BIOGAS ENGINEERING SYSTEM



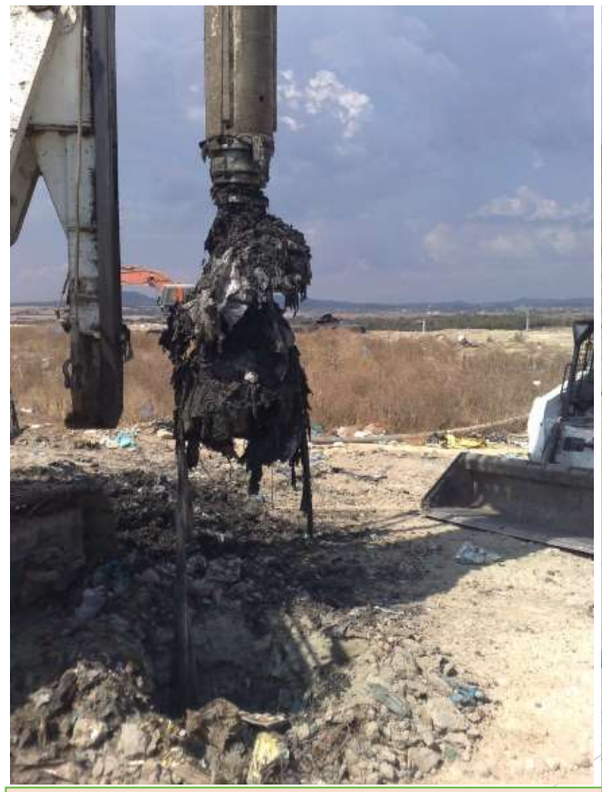
1. Biogas extraction well
2. Biogas vertical slotted pipe
3. Biogas horizontal extraction pipeline
4. Biogas wellhead
5. Condensate discharger
6. Horizontal biogas regulating valve
7. Secondary biogas collection pipeline
8. Biogas regulating station
9. Primary biogas collection pipeline
10. Biogas extraction and combustion plant

Quantification of Biogas Production and Forecasting Energy Yield

The landfill biogas production forecast through model to determine the generation of methane, carbon dioxide and hydrogen produced from the waste mass, waste composition and moisture content using a multiphase first order decay equation, for both methanogenic and acetogenic decay.

Gas extraction/Captation system

- Installation of an active gas extraction system. (Horizontal/vertical gas wells, trenches, fans/pumps, regulation station, torch) ¸
- Establishment of passive gas extraction system. (Various forms of oxidation filters at or adjacent to the landfill, ventilation systems, etc.) ¸
- Different options for utilizing collected landfill gas (conversion to electricity, used for production of heat, upgrading it for vehicle fuel or flare it



- *EXTRACT THE BIOGAS FROM THE WASTE MASS;*
- *USE VERTICAL OR HORIZONTAL CAPTATION SYSTEM.*
- *VERTICAL WELLS DRILLED BY PROPERLY MACHINE OR PREPARED DURING WASTE STORAGE.*
- *HORIZONTAL PIPES INSTALLED DURING WASTE STORAGE.*

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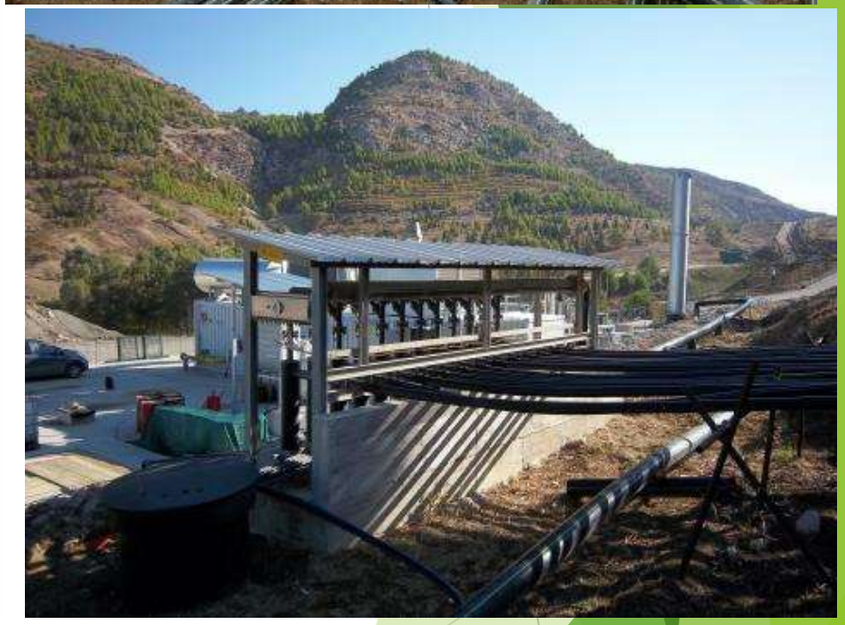
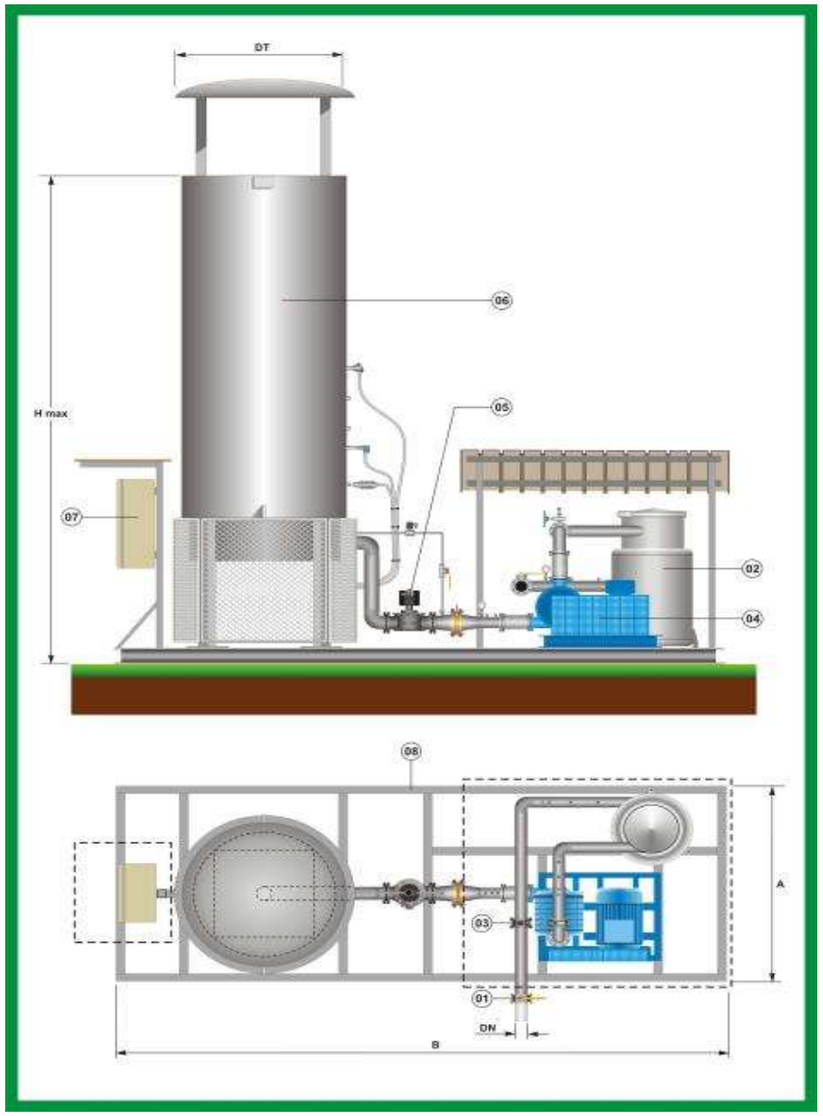
BIOGAS TRANSPORTATION



- THE **SECONDARY LINES** CONNECT THE WELLHEADS TO THE COLLECTORS. MADE IN HDPE
- THE **COLLECTOR** IT'S USED TO CONVOY MANY SECONDARY LINES IN ONE PRIMARY LINE

BIOGAS SUCTION



- THE **EXTRACTION PLANT** ALLOW TO SUPPLY REQUIRED NEGATIVE (AND POSITIVE) PRESSION TO BIOGAS.
  - MAIN COMPONENT ARE BLOWER, SENSOR, ACTUATOR AND CONTROL LOGIC.
- DESIGNED BASING ON LANDFILL PECULIARITY AND BIOGAS USAGE GOAL

BIOGAS COMBUSTION

- THE **FLARE** ALLOW THE POLLUTANT REDUCTION BY COMBUSTION OF LANDFILL BIOGAS
- REQUIRED BY INTERNATIONAL LAW.

BIOGAS PRETREATMENT

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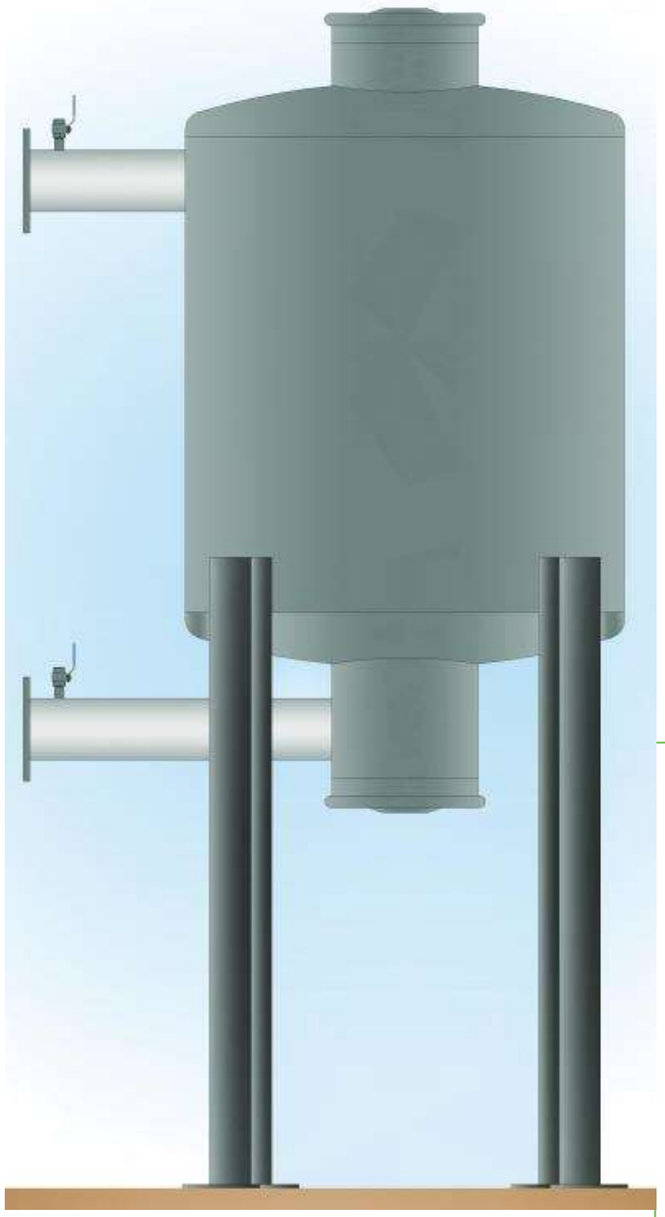
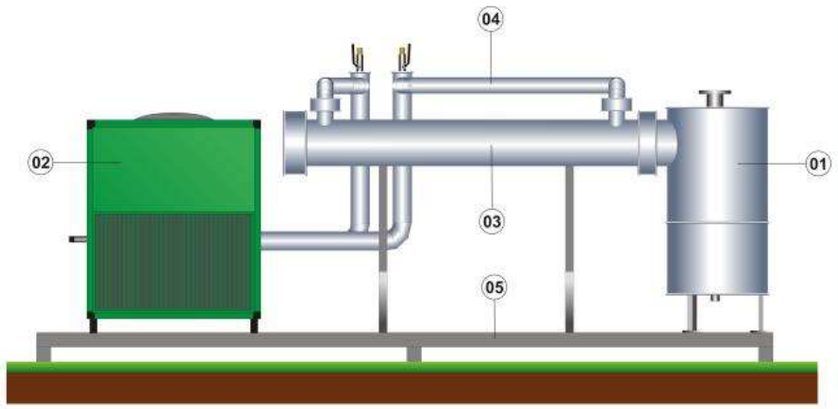


- **HEAT EXCHANGER** AND **CHILLER** ALLOW TO REMOVE MORE THAN 90% OF CONDENSATE BY BIOGAS FLOW.
- INCREASE THE EFFICENCY.
- REDUCE THE SOLUBLE POLLUTANT.
- **FILTER** AND **SCRUBBER** PROVIDE A MECHANICAL OR CHEMICAL SEPARATION OF SOME POLLUTANT



- **PREATREATMENT** CONSIST MAINLY IN CONDENSATE REMOVAL SYSTEM AND VARIOUS KIND OF FILTER (WITH ASSISTENCE OF PROGECO SRL).
- USED ESPECIALLY FOR ENGINES FEEDING BIOGAS.

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BIOGAS EXTRACTION AND COMBUSTION PLANT (INCHT – SKID)

BIOGAS AS A RESOURCE

PRETREATMENT

FILTERS + SCRUBBING

DRYING + CONDENSATE REMOVAL

SILOXANE REMOVAL

ACTIVATED CARBON FILTERS

BIOGAS AS A RESOURCE

PRETREATMENT

BOOSTING UNIT

ENGINES

BOOSTING UNIT and FLARE STACK

REFERENCES

CONVECO 1987 - 2014

Legend

1.ITALY: > 350 plants

2.SWITZERLAND: 2 plants

3.SPAIN: 15 plants

4.CROATIA: 1 plant

5.MONTENEGRO: 1 plant

6.ALBANIA: 1 plant

7.GREECE: 22 plants

8.ROMANIA: 13 plants

9.BULGARIA: 4 plants

10.TURKEY: 11 plants

11.ALGERIA: 1 plant

12.JORDAN: 1 plant

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Thank you

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