EPA Model

- For a landfill with a known and changed year-to-year solid waste acceptance rate, the annual gas generation can be calculated using EPA's modeling equation.

$$Q_t = \sum_{i=1}^{n} 2.k.L_0.M_i.(e^{-kt_i})$$

  - Q_t = expected gas generation rate (m^3/yr)
  - L_0 = methane generation potential (m^3/ ton waste)
  - M_i = mass of waste dumped to the landfill at i^{th} year
  - k = methane generation rate constant (1/yr)
  - t = age of landfill (yr)

EPA Model

Parameter	Range	Suggested Values
L_0 (m/t)	0 - 310	140 - 180
k (yr)	0,003 - 0,4	Wet Climate 0,1 - 0,35 Med. Moist. Climate 0,05 - 0,15 Dry Climate 0,02 - 0,1

EPA Model

- For example gas generation rate in the 1th year,

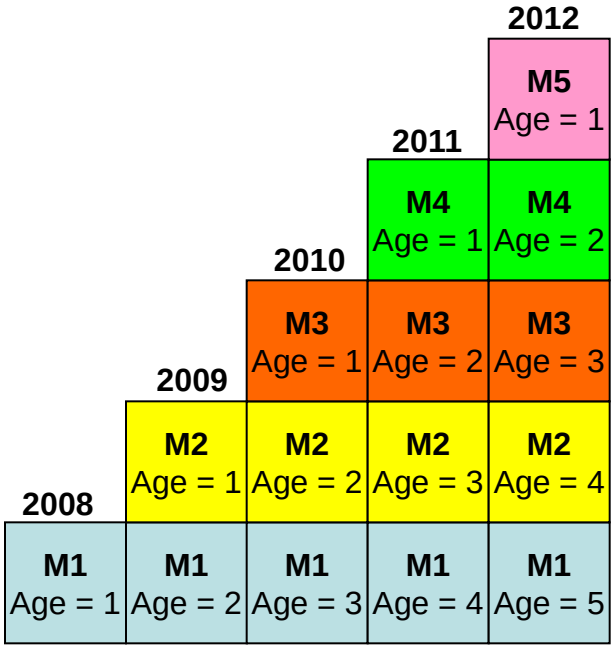
  $Q_1 = 2 * k * L_0 * M_1 * (e^{-k.1})$

- Gas flow rate in the 5th year,

  $Q_5 = 2 * k * L_0 * (M_1 * e^{-k.5} + M_2 * e^{-k.4} + M_3 * e^{-k.3} + M_4 * e^{-k.2} + M_5 * e^{-k.1})$

EPA Model

Biogas Pyramid



$$Q_{2008} = Q_{M1;1}$$

$$Q_{2009} = Q_{M1;2} + Q_{M2;1}$$

$$Q_{2010} = Q_{M1;3} + Q_{M2;2} + Q_{M3;1}$$

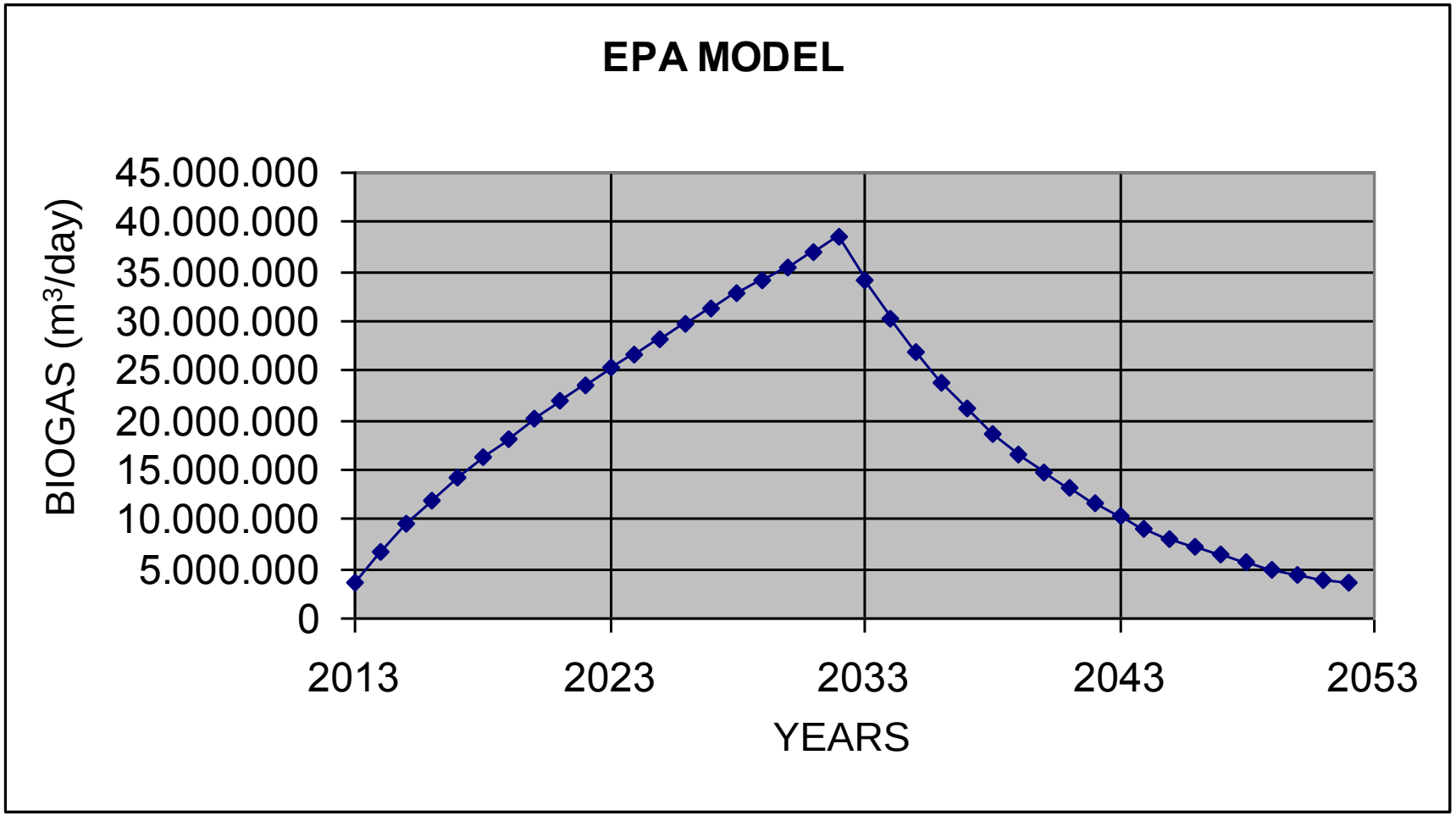
$$Q_{2011} = Q_{M1;4} + Q_{M2;3} + Q_{M3;2} + Q_{M4;1}$$

$$Q_{2012} = Q_{M1;5} + Q_{M2;4} + Q_{M3;3} + Q_{M4;2} + Q_{M5;1}$$

As the years pass by the amount of gas obtained from an individual waste mass decreases!!! This is due to the loss of biodegradable organic matter.

QM1;1 > QM1;2

EPA Model


EPA MODEL
BIOGAS (m3/day)
45.000.000
40.000.000
35.000.000
30.000.000
25.000.000
20.000.000
15.000.000
10.000.000
5.000.000
0
2013
2023
2033
2043
2053
YEARS

Tabasaran Model

$$G_t = 1{,}868 * C_{org} * (0{,}014 * T + 0{,}28) * (1 - 10^{-kt}) * M_t$$

G_t = **Cumulative gas production** (m^3/year)

C_{org} = Organic carbon (170 – 200 kg/ton waste)

T = Temperature (^{0}C) (30 – 40 ^{0}C)

k = Methane generation rate (1/year) (0,025 – 0,05)

t = Time (year)

M_t = Mass of waste dumped to the landfill at t^{th} year (ton/year)

Tabasaran Model

- For example gas generation rate of M_1 in the 1^{th} year,

$$G_{total,1} = 1{,}868 * C_{org} * (0{,}014 * T + 0{,}28) * (1 - 10^{-k.1}) * M_1$$

- Gas flow rate of M_1 in the 2^{nd} year,

$$G_{total,2} = 1{,}868 * C_{org} * (0{,}014 * T + 0{,}28) * (1 - 10^{-k.2}) * M_1$$

$$\mathbf{G_{2nd} = G_{total,2} - G_{total,1}}$$

Tabasaran Model