Validation Workshop on the ECOWAS Bioenergy Policy:

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Bioelectricity production and prospects for Africa

Dr Smail Khennas
Senior energy and climate change expert
Smail_khennas@yahoo.fr

Summary:

- Importance of bioelectricity
- Environmental impact
- Feedstocks
- Technologies
- Costs
- Policy options to promote bioelectricity
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Importance of bioelectricity:

- Globally, an estimated **72 GW** of biomass power capacity was in operation at the end of 2011, a **9 percent increase from 2010**.
- In 2011, the **electric power sector** produced 51 percent of biopower capacity and 49 percent of biopower generation while **commercial** and **industrial** sectors made up the remaining percentage.[5]

Environmental impact

- If grown in a **sustainable manner**, biomass is **carbon-neutral** energy source: greenhouse gas (GHG) emissions, from converting biomass to energy are equivalent to the amount of CO2 absorbed by the biomass plants during their growing cycles. If coupled with future **carbon capture and storage** (CCS) technology biopower could be a **net carbon-negative energy source** by removing carbon from the atmosphere.[12]
- According to IEA: biopower produced through gasification with carbon capture and storage (BECCS) : GHG emission reductions of more than **6.5 gigatons (Gt) per year by 2050**.

Life cycle GHG emissions of electricity generation technologies (gCO2eq/kWh

	Lowest (25%)	AVERAGE	Highest (25%)
Coal	883	1001	1141
Natural gas	427	477	543
Biopower	-3	52	69

About 20 times less emissions than coal and 10 times than natural gas

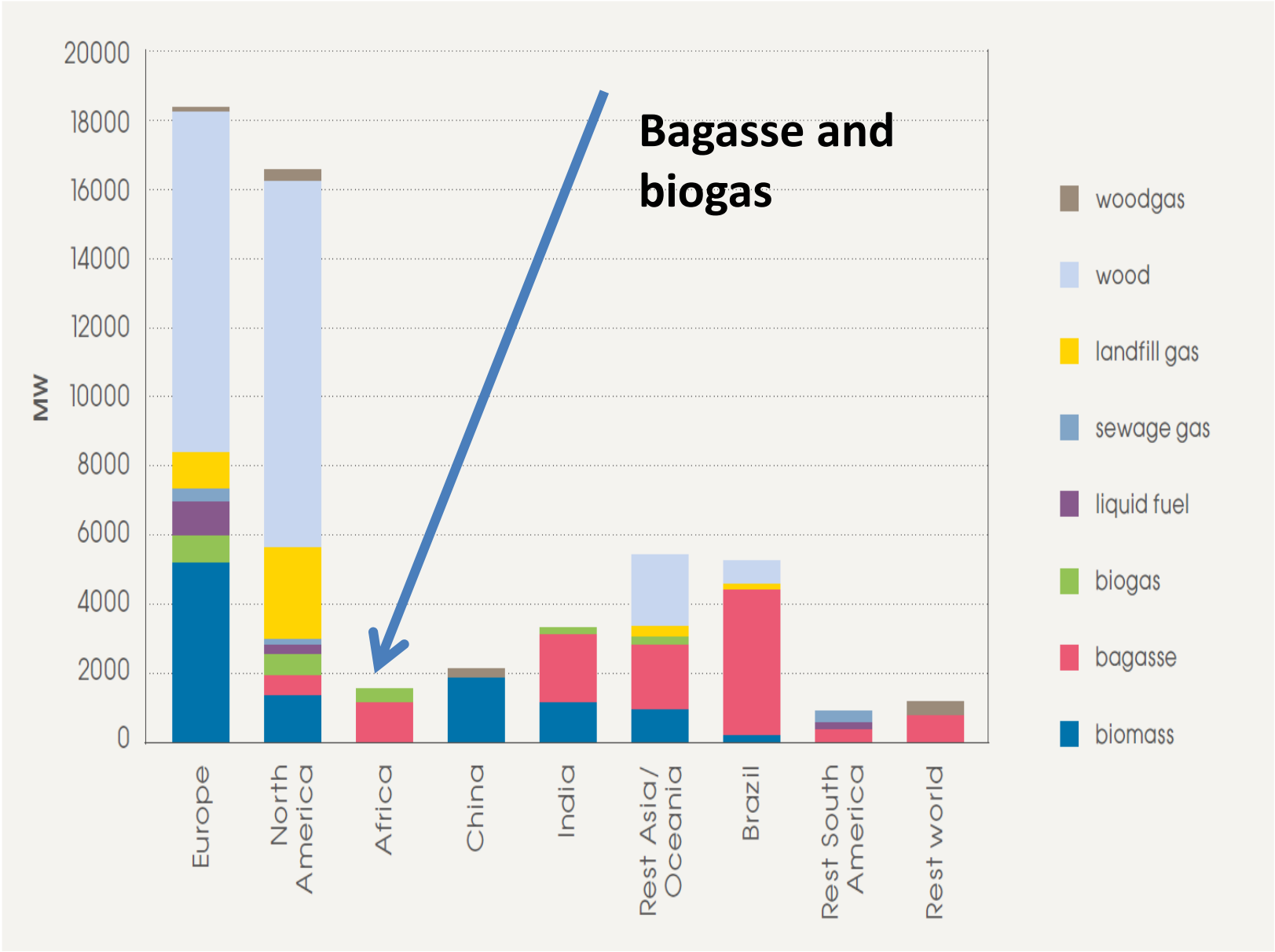
Source: Avoided GHG are primarily from using methane from landfill and biomass wastes NREL 2012

Feedstocks, technology and costs

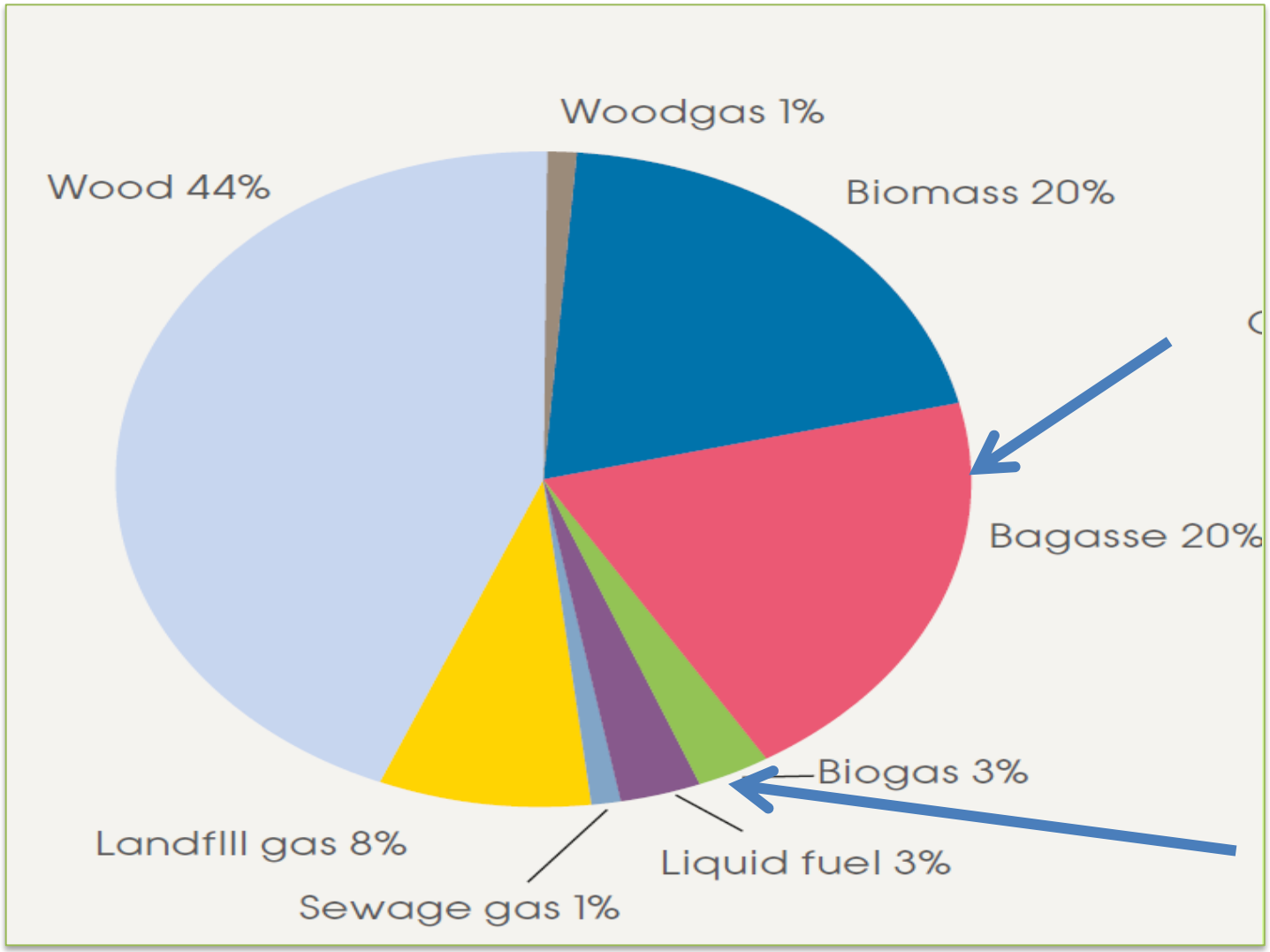
Feedstocks:

- Large range of feedstocks including co-firing (fossil fuels and biomass). Greatest potential lies in the **sugar cane and wood processing industries**, as the feedstock is readily available at low cost and the process heat needs are onsite
- In Africa, **bagasse and biogas** are the main feedstocks for electricity generation. In Europe and North America: feedstocks from wood industries

Feedstocks, technology and costs



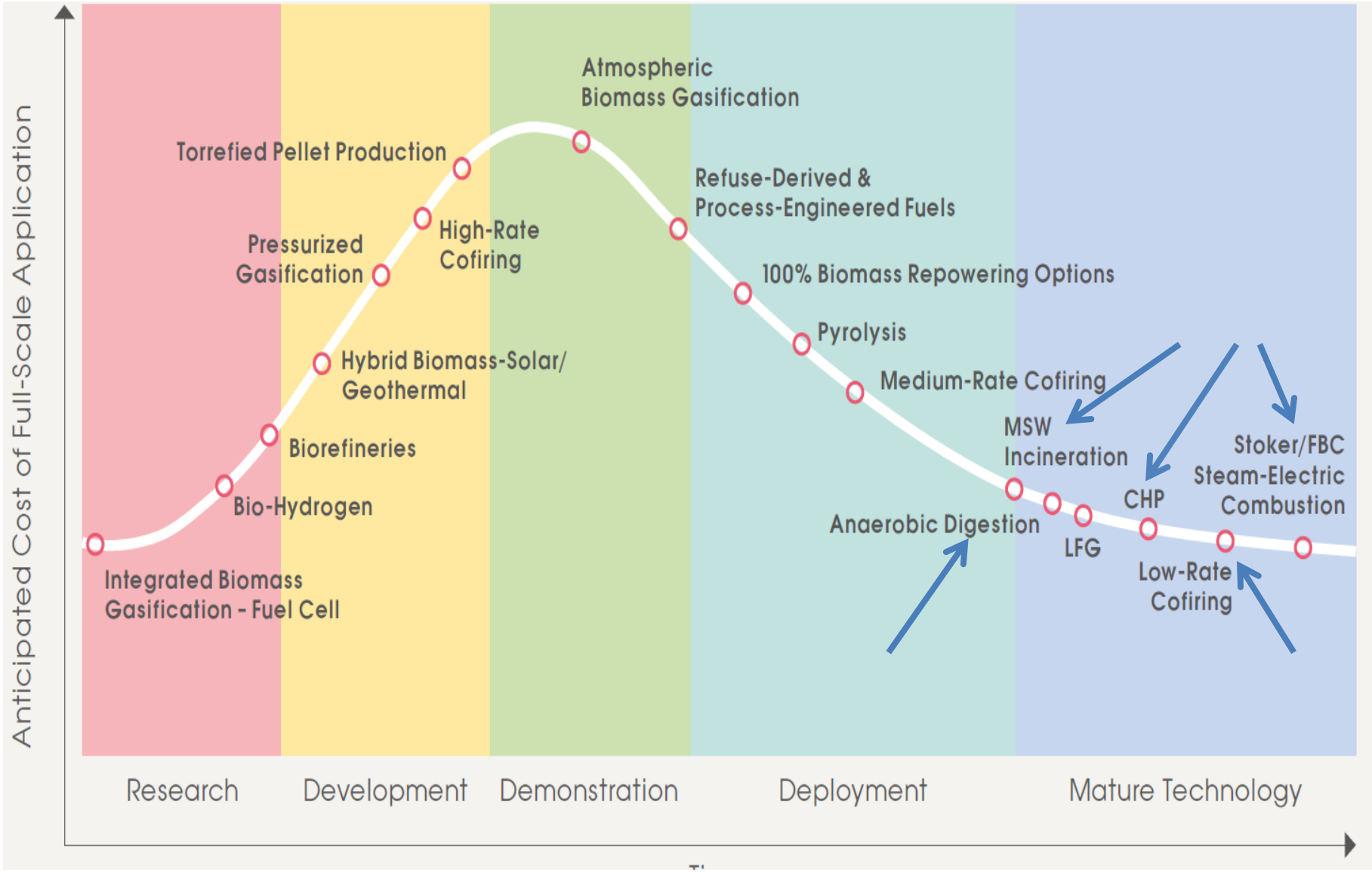
Feedstocks for electricity generation and Africa



Examples of bio-electricty power plants in Africa(apart from bagasse)

- 11 wood based power plants, with a total installed capacity of almost 30 MW, in Ghana, Congo, Ethiopia, Tanzania, Namibia and Swaziland, several new plants planned or under construction (Platts McGraw Hill Financial, 2015).
- in South Africa, the Durban municipality has implemented a landfill gas-to-electricity project with an installed power generation capacity of 7.5 MW (IEA, 2014b).
- Several biogas-generation projects initiated in Kenya, such as producing off-grid electricity from biogas generated by manure utilizing slaughterhouse waste to produce biogas for electricity production; also 20 kW of electricity from vegetable waste (IRENA, forthcoming b).

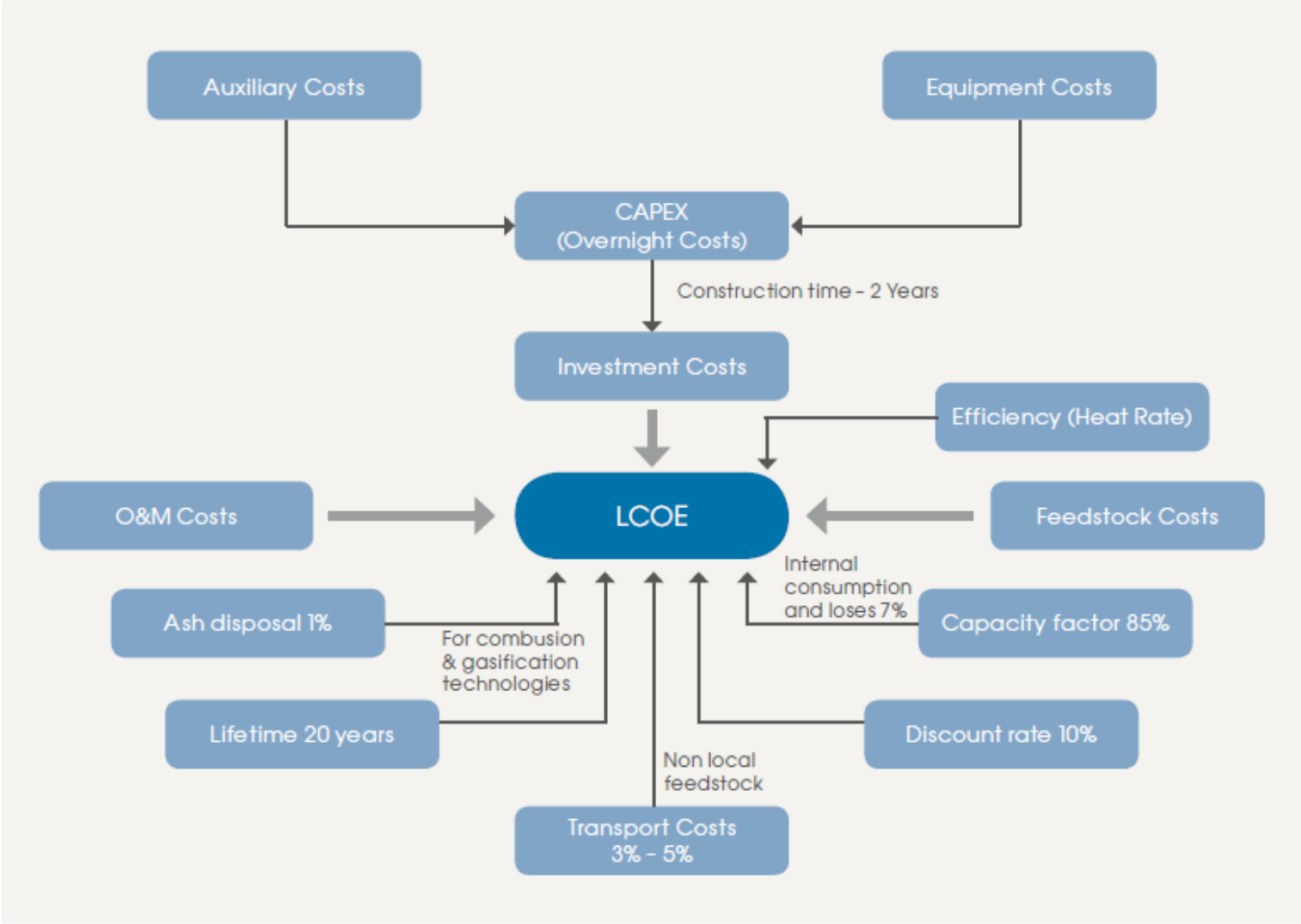
Technologies



Capital costs and LCOE (mature technologies)

	Investment costs (US$/kW)	LCOE (US$/kWh)
Boiler combustion	1880-4260	0.06-0.21
CHP (cogeneration)	2170-4500	0.07-0.21
Landfill gas (MW)	1917-2436	0.09-0.12
Co-firing	140-850	0.04-0.13
Digesters	2574-6104	0.06-0.15

LCOE


Auxiliary Costs
Equipment Costs
CAPEX
(Overnight Costs)
Construction time - 2 Years
Investment Costs
Efficiency (Heat Rate)
O&M Costs
LCOE
Feedstock Costs
Internal
consumption
and loses 7%
Ash disposal 1%
For combusion
& gasification
technologies
Capacity factor 85%
Lifetime 20 years
Discount rate 10%
Non local
feedstock
Transport Costs
3% - 5%

Assessing mature technologies for Africa

Landfill gas and digesters are proven technologies, but can be limited in scale by feedstock availability

- Largescale plants using municipal solid waste (MSW), agricultural waste and industrial organic wastes: 8 000 to 9 000 tonnes of MSW/MW/year.
- Biogas is readily used as a fuel in power or combined heat and power units
- potential to be used as a substitute for natural gas after appropriate cleaning and upgrading (IEA Bioenergy, 2011)

Policy options to promote Bio-electricity

- **Bio-energy policy framework and specific focus on bioelectricity**
- **Market and regulatory barriers** : removing investment uncertainty for private sector, reduce gap between policy and incentive programmes
- **Loan guarantees:** funding large projects become more feasible, relieve project developpers from a degree of risk
- **Fiscal incentives**: VAT, import duties, tax exemption for a certain number of years (typically 5)
- **Price on carbon emissions**: fossil fuel power plants face no direct financial consequences for CO_2 emissions.

Policy options to promote Bio-electricity

- **Renewable portfolio schemes**: ensuring inclusion of biopower as a renewable energy source and setting targets (mandatory??)
- **Certifiable standards for bioelectricity production**:
  An independently certifiable standard: focus on supply chain and feedstock production
  A certification system would monitor and guarantee biomass is sustainable by addressing undesirable LUC, pollution, etc.
- **Government funding or financial incentives for RD&D** can advance biopower technology adaptation to the African context.

Thank you for your attention

Merci pour votre attention

smail_khennas@yahoo.fr