LoSENS

Research in Networks:
Local Sustainable Energy Networks in Senegal

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ECB, 23rd of October 2019

IfaS Institut für angewandtes Stoffstrommanagement

Trier University of Applied Sciences

HOCHSCHULE TRIER

Local Sustainable Energy Networks in Senegal

- Applied Research Project: funded by the Federal Ministry for Research and Education
  - CLIENT II – Internationale Partnerschaften für nachhaltige Innovationen
  - Funding: 1,9 Mio €

  Objectives:
  - Development and implementation of a strategic cooperation in the sector of sustainable energy systems between Germany and Senegal.
  - Exchange of applied technical knowledge and technology tranfer as a national strategy support in energy efficiency and renewable energy sectors.

- **Model Regions in Senegal:**
  - **City of Saint Louis** (210.000)
  - **Commune of Balinghor** in the region of Ziguinchor (3.000)

- **Project Duration:** 01.04.2019 to 31.03.2022 (36 months)

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

LoSENS – Industrial Partners

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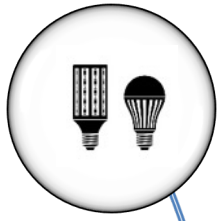
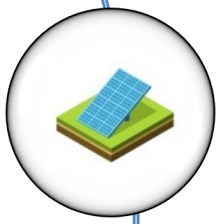
LANZ MANUFAKTUR



Sustainable public lighting in Saint Louis

- Installation of 100 energy efficient LED- Street lamps
- Test of adaptability to the needs and standards required for comfort and safety
- Energy savings and their impact on mitigating the budget constraints of the municipality.

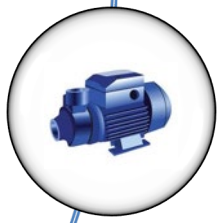
KLE energie gmbh
DIENSTLEISTUNGEN UND PROJEKTMANAGEMENT FÜR ERNEUERBARE ENERGIEN



PV-Plant with Battery Storage

- Development of a 100 kWp PV-Plant including a Battery storage capacity of 100 kWh
- Auto-consumption and decentralization of energy supply
- Increase of network stability

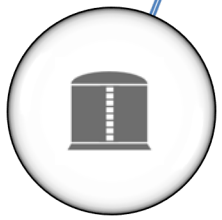
KOCKS INGENIEURE



Energy Efficient Pump Management

- Implementation of a pump management system for municipal supply and disposal facilities
- Evaluation of ecological and economic savings effects

greentec

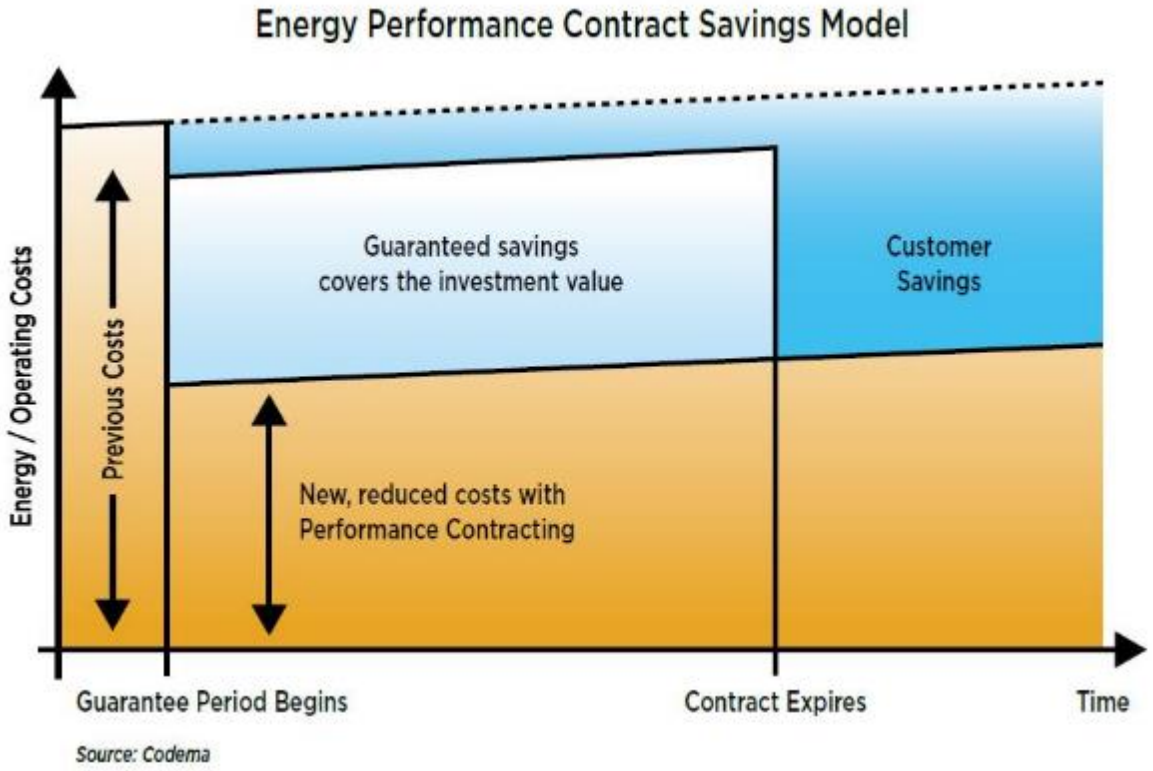


Feasibility Study: Biogas Plant

- Technical feasibility study for the treatment of organic waste using biogas technology
- Design of a biowaste recycling plant for the city of Saint-Louis

LED Public Lighting

- Lifespan: >80.000 hours
- Luminous Efficacy: 147 Lm/W
- Operating External Temperatures: -25 up to + 60°C



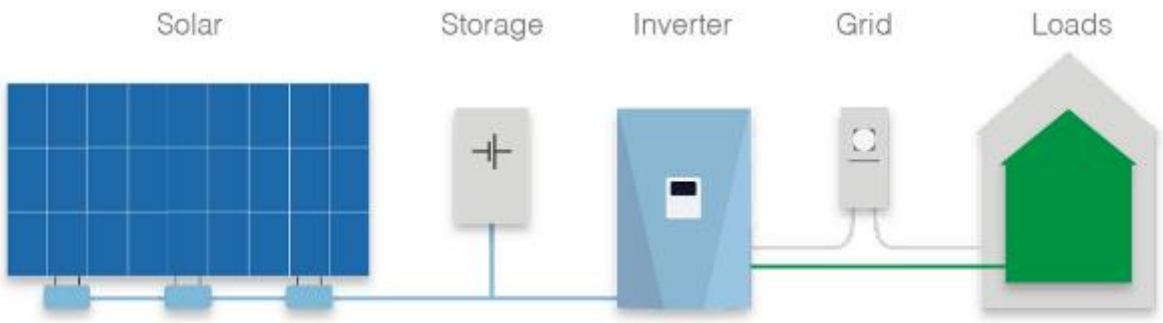
Raled LAMP RL3

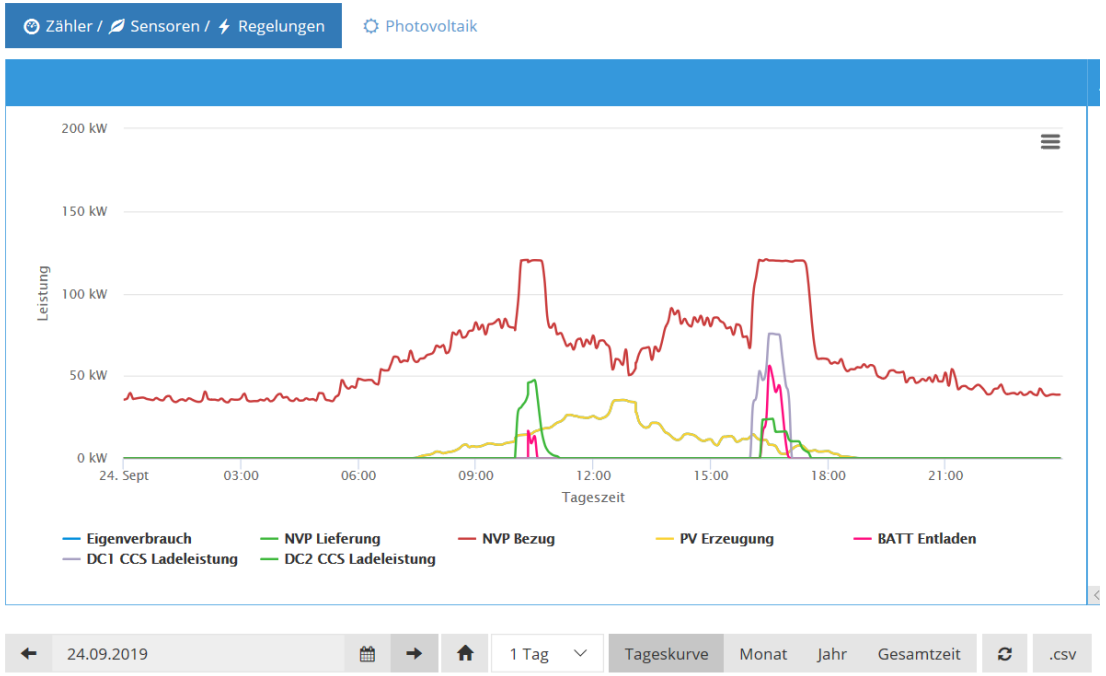
Source: Lanz Manufaktur

PV-battery Plant

KLE energie gmbh
DIENSTLEISTUNGEN UND PROJEKTMANAGEMENT FÜR ERNEUERBARE ENERGIEN

- 100 kWp PV-Plant
- Battery storage capacity of 100 kWh
- Smart Inverters
- Energy Management System
- Peak Shaving & Auto-consumption oriented supply





Source: KLE Energie GmbH

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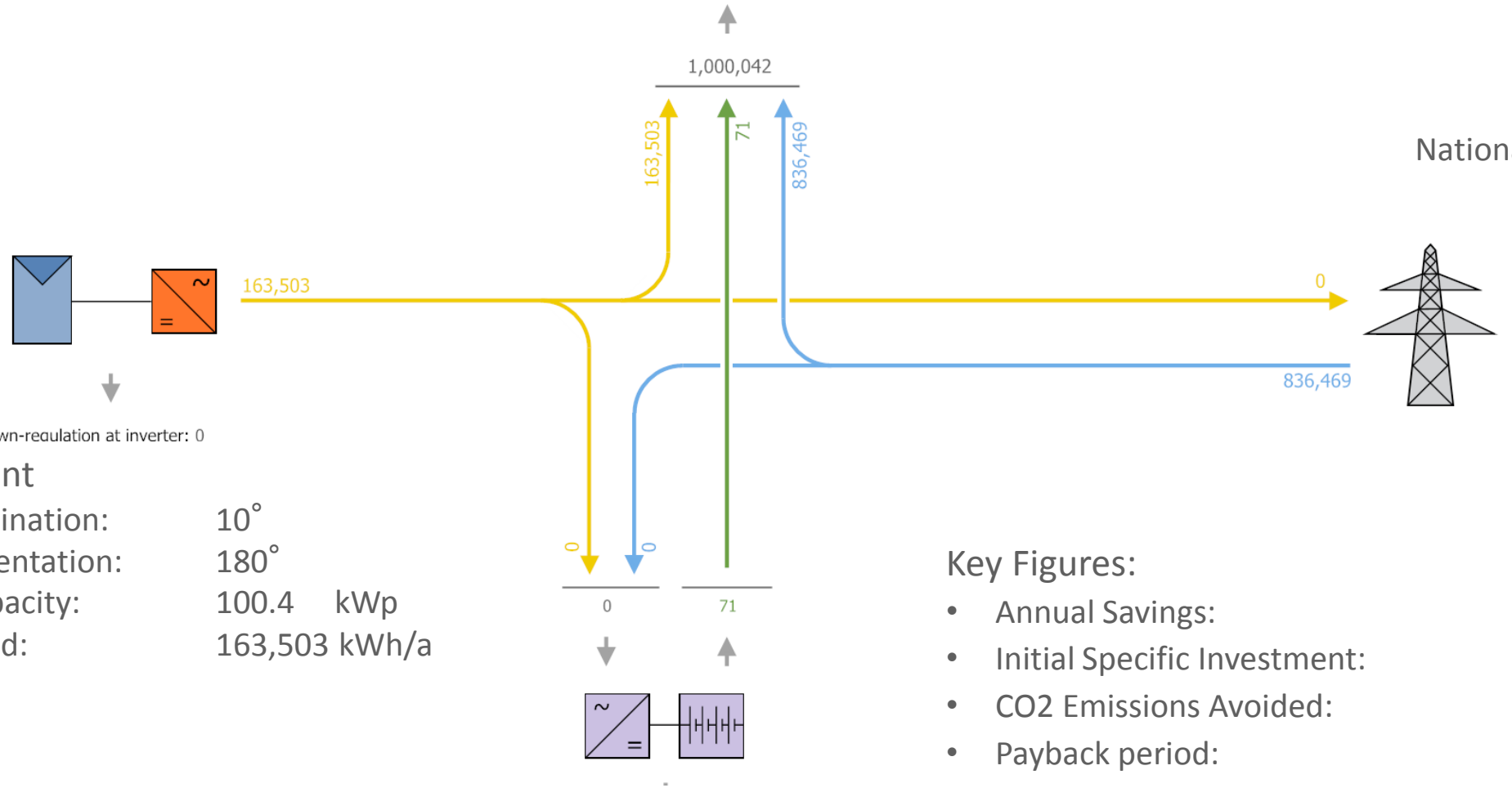
PV-battery Plant

System Load (ex: UGB)

- Annual Consumption: 1 GWh
- Peak Load: 151.7 kW



National Grid Tarrif: **13 €ct/kWh**

PV plant

- Inclination: 10°
- Orientation: 180°
- Capacity: 100.4 kWp
- Yield: 163,503 kWh/a

Key Figures:

- Annual Savings: **21.000 €/a**
- Initial Specific Investment: **1.100 €/kWp**
- CO2 Emissions Avoided: **80 tCO2eq/a**
- Payback period: **5,1 y**

Batteries:

- Load Capacity: 54 kW
- Storage Capacity: 100 kWh

All values in kWh

Efficient Pump Management System

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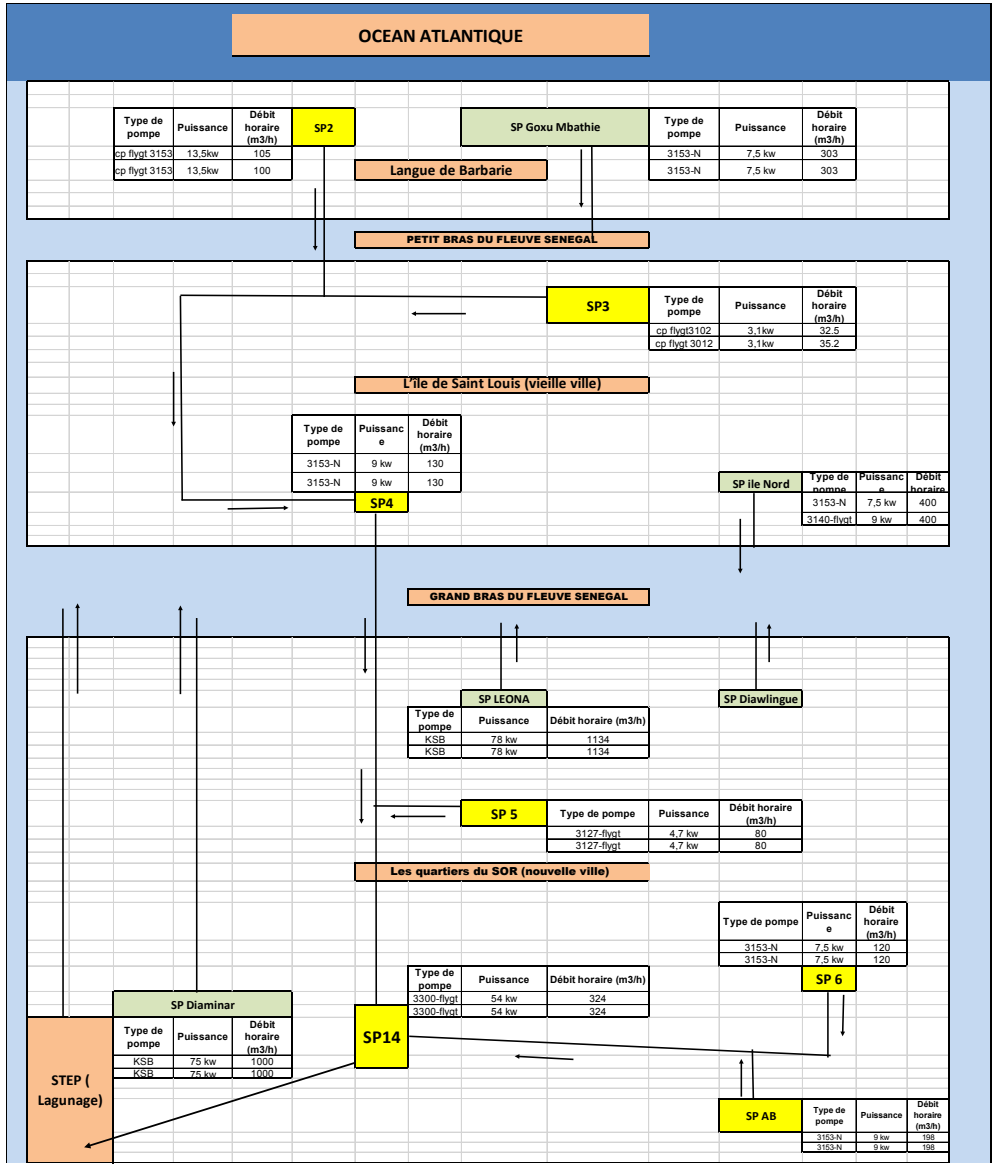
Pre-analysis A



Source: ONAS, Saint Louis

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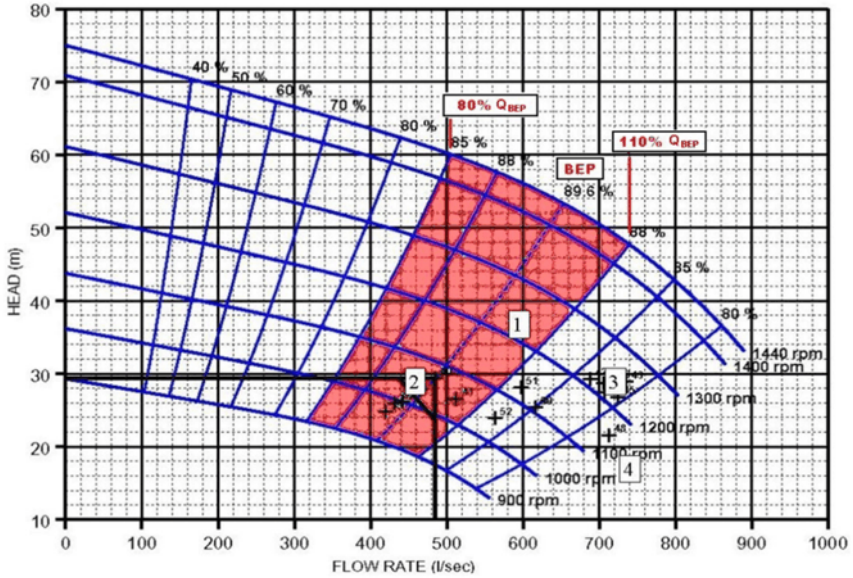
Efficient Pump Management System

η: 40%

η: 79.6%



Source: KSB SE & Co. KGaA (2019)

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Efficient Pump Management System

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Catalogue of measures C

Status Quo - Data Collected in SQU														
Parameter	*[Unit]*	*FRANKLIN (SUBMERSIBLE PUMP)*	*ARMSTRONG (SERIES 4030, 10X8X13)*	*ARMSTRONG (SERIES 4030, 10X8X13)*	*ARMSTRONG (4030-100-290)*	*CRANE PUMPS (4C/GB/C)*	*ARMSTRONG (4030-100-330)*	*CRANE PUMPS (5A/GB/C)*	*CRANE PUMPS (3D/GB/C)*	*ARMSTRONG (SERIES 4030, 6X5X10)*	*LOWARA (SV160) Vertical Multistage Centrifugal Pumps*	*SPX Clyde Union Pump (SDJ 200/350) Chilled water pump*	*Holden & Brooke Ltd. (100-400) Low Pressure Hot Water*	*Crompton Parkinson R160R*
Ec_p (Old)	kW	26.1	64.7	60.0	30.4	11.2	22.0	21.9	8.4	11.2	2.7	132.3	45.3	37.1
Est. average annual op. Time	h/a	5776	5776	5776	5776	5776	5776	5776	5776	5776	5776	5776	5776	5776
Electricity consumption	kWh/a	150,536	373,904	346,675	175,498	64,608	127,236	126,647	48,695	64,782	15,844	763,986	261,894	214,079
Water flow	m^3/h	46	417.6	361.8	324	94.6	129.6	129	80.6	171	9	642	140.4	318
Water flow	m^3/s	0.013	0.116	0.101	0.090	0.026	0.036	0.036	0.022	0.048	0.003	0.178	0.039	0.088
Head	m	150	22.8	30.5	20	20	25	35	20	12.3	65	50	38	15
Pump Set Efficiency	%	72%	40%	50%	58%	46%	40%	56%	52%	51%	58%	66%	32%	35%
Energy Efficient Pump-Sets - Data Provision by KSB OMAN														
Model	*[Unit]*	*UPA 200-14/8b UMA 150E 37/22*	*ETN 200-150-315 GBSAA11GD503704B*	*ETN 200-150-315 GBSAA11GD504504B*	*ETN 200-150-250 GBSAA11GD303004B*	*ETN 100-080-250 GBSAA11GD301854B*	*ETN 125-100-315 GBSAA11GD301854B*	*ETN 100-080-315 GBSAA11GD302204B*	*ETN 065-050-125 GBSAA11GD200752B*	*ETN 125-100-200 GBSAA11GD301854B*	*MovitecV 010/08-B4F13EE100B5WW*	*Omega 200-420 B GB G F*	*ETN 100-080-200 GBSAA11GD302202B*	*ETN 150-125-250 GBSAA11GD301854B*
Ec_p (New)	kW	25.6	30.9	35.9	21.2	6.4	11.1	15.7	5.4	6.9	2.4	97.9	18.1	15.1
Electricity consumption	kWh/a	148,068	178,474	207,342	122,195	37,150	63,938	90,809	31,338	40,096	13,674	565,281	104,366	87,227
New Pump Set Efficiency	%	73%	84%	84%	83%	80%	80%	78%	81%	82%	67%	89%	80%	86%
Technical and Economic Feasibility														
Energy savings potential	kWh/a	2,468	195,429	139,334	53,302	27,458	63,298	35,837	17,357	24,686	2,169	198,705	157,528	126,853
Monetary savings potential	OMR/a	69	5,472	3,901	1,492	769	1,772	1,003	486	691	61	5,564	4,411	3,552
Price quote by KSB	OMR	2,807	10,124	11,540	8,392	5,878	6,190	6,785	2,766	5,847	1,721	10,535	6,476	6,106
Static PBP	a	40.6	1.9	3.0	5.6	7.6	3.5	6.8	5.7	8.5	28.3	1.9	1.5	1.7
GHG Abatement Potential	$t\ CO_{2eq}$	2.1	166.1	118.4	45.3	23.3	53.8	30.5	14.8	21.0	1.8	168.9	133.9	107.8

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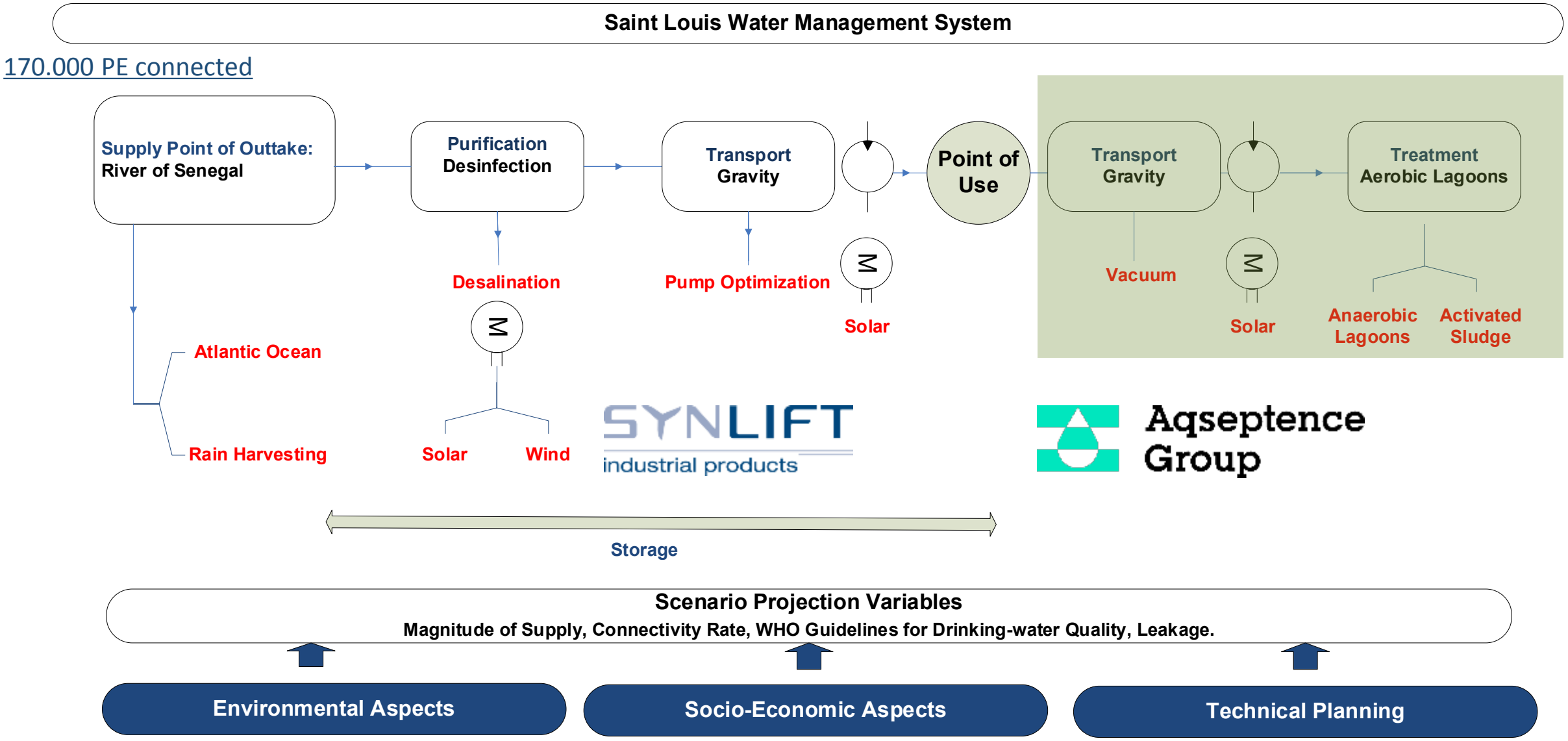
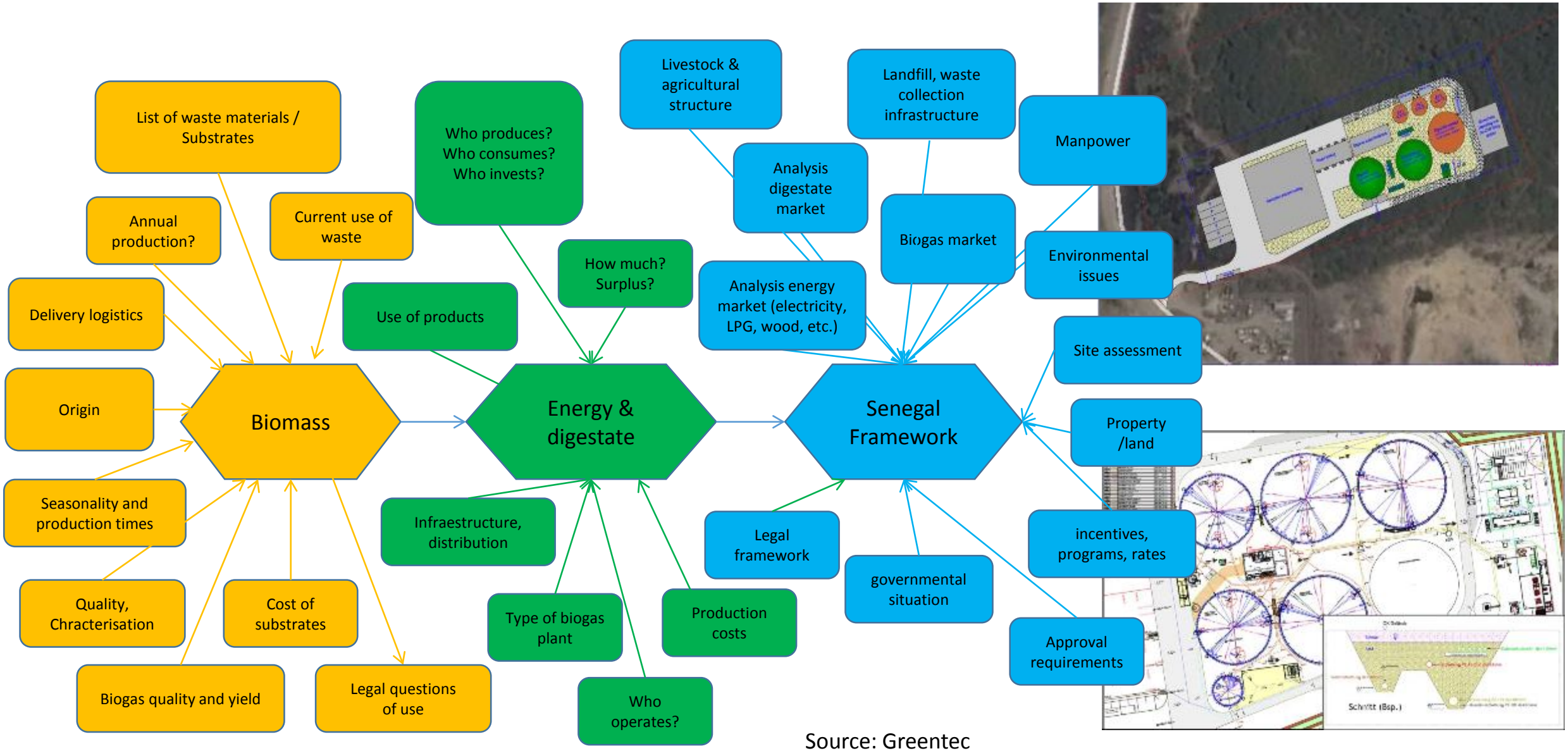
Saint Louis - Scenario Projections



Biogas Plant Feasibility Study



Source: Greentec

Partners in Senegal

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National Office for Sanitation & Wastewater Treatment

ONAS

Technical Support

Data Access and Approval Procedures

Stakeholder-management

Dissemination of Project Results

Ministerium of Environment & Sustainable Development

République du Sénégal
un Peuple, un But, une Foi

OLAC

Implementation of Training & Educational Programs

Master Plans beneficiaries & Data acquisition

Partner-Universities

UNIVERSITE GASTON BERGER SAINT-LOUIS DU SENEGAL

LUX MEA LEX UNIVERSITE CHEIKH ANTA DIOP DE DAKAR

Partner-Communes

COMMUNE DE SAINT-LOUIS

Communes of Balingore & Saint Louis

شكرا جزيلا

Jarajeuf

Thank you

Vielen Dank

Merci beaucoup

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