IWA-IDB INNOVATION CONFERENCE
ON SUSTAINABLE USE OF WATER:
Cities, Industry and Agriculture


Cobalt Water Global
A Total Water Consultancy

A knowledge-based decision support tool for selecting sustainable wastewater treatment technologies in today's global complexities


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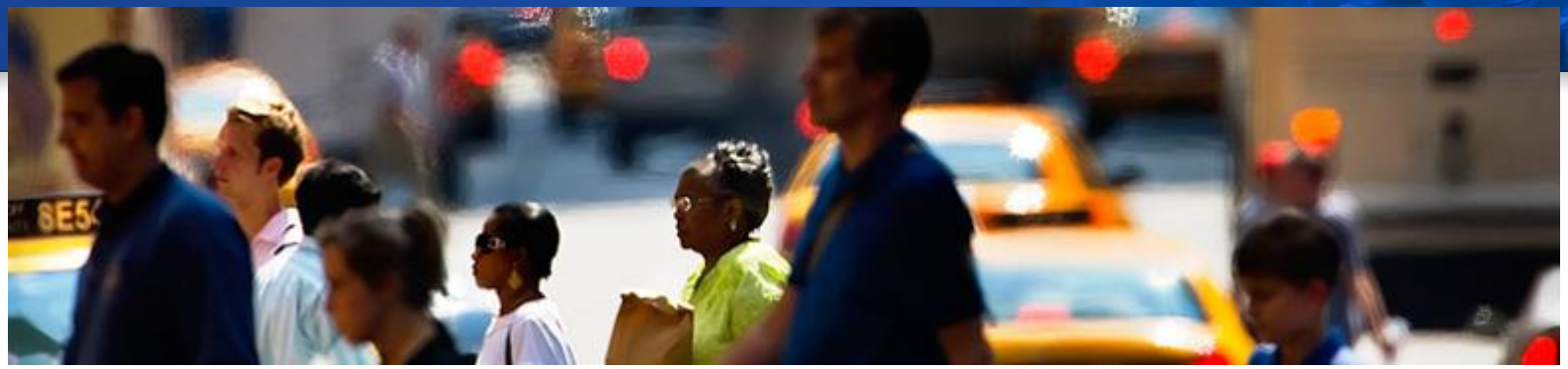
Today's Challenges in the Water Sector



Source: www.nyc.gov

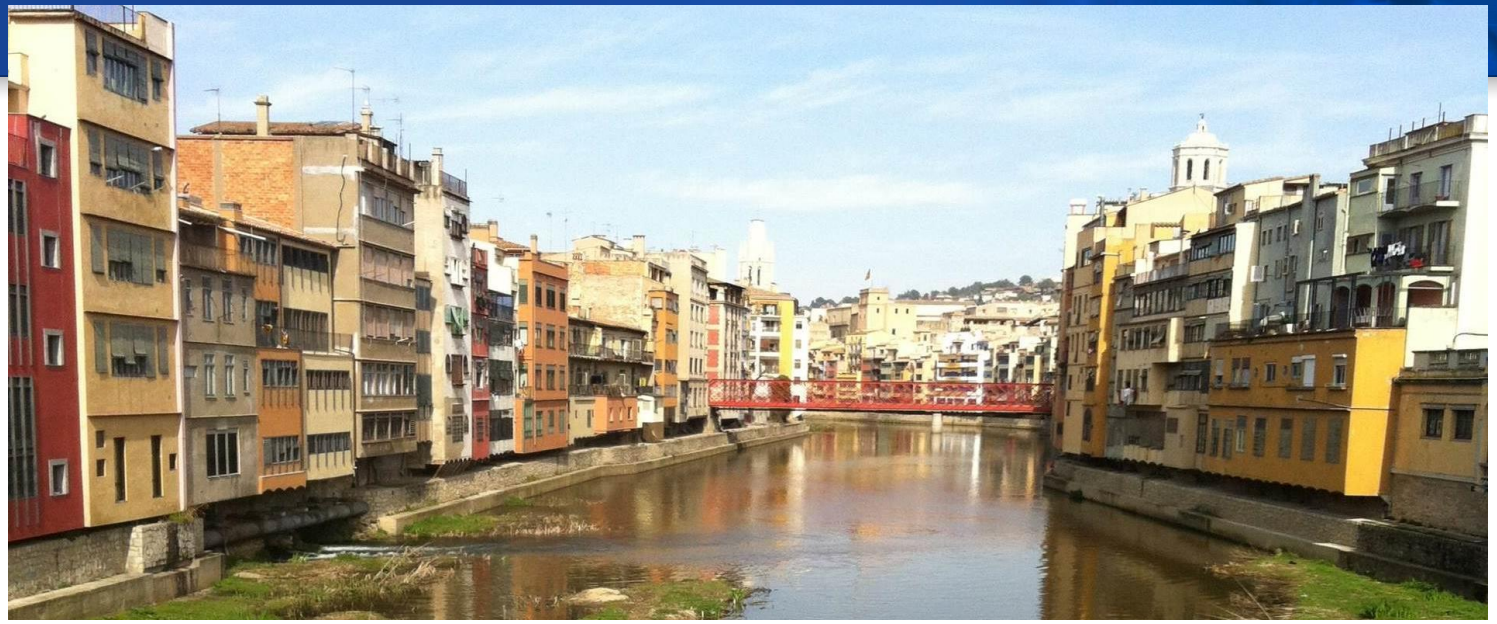
Fast Growing Urban Environment

- Rapid urban development across many parts of the world:
  - China, India, and countries in the Middle East, Africa, and Latin America

- New wastewater treatment plants (WWTPs) are needed to keep up with demand and meet the public health and ecological standards that are increasingly being enforced.

Today's Challenges in the Water Sector

Today's Challenges in the Water Sector



Stricter Water Quality Standards

- Where growth is not as fast, like in the **U.S.** and **Europe**, new WWTPs are in less demand; however, there is still need to **retrofit** existing WWTPs to meet more stringent water quality regulations.
- Stricter WQ stds drive **technology**

Today's Challenges in the Water Sector

Credit: REUTERS/Tim Wimborne

Climate Change / Water Scarcity / Technology

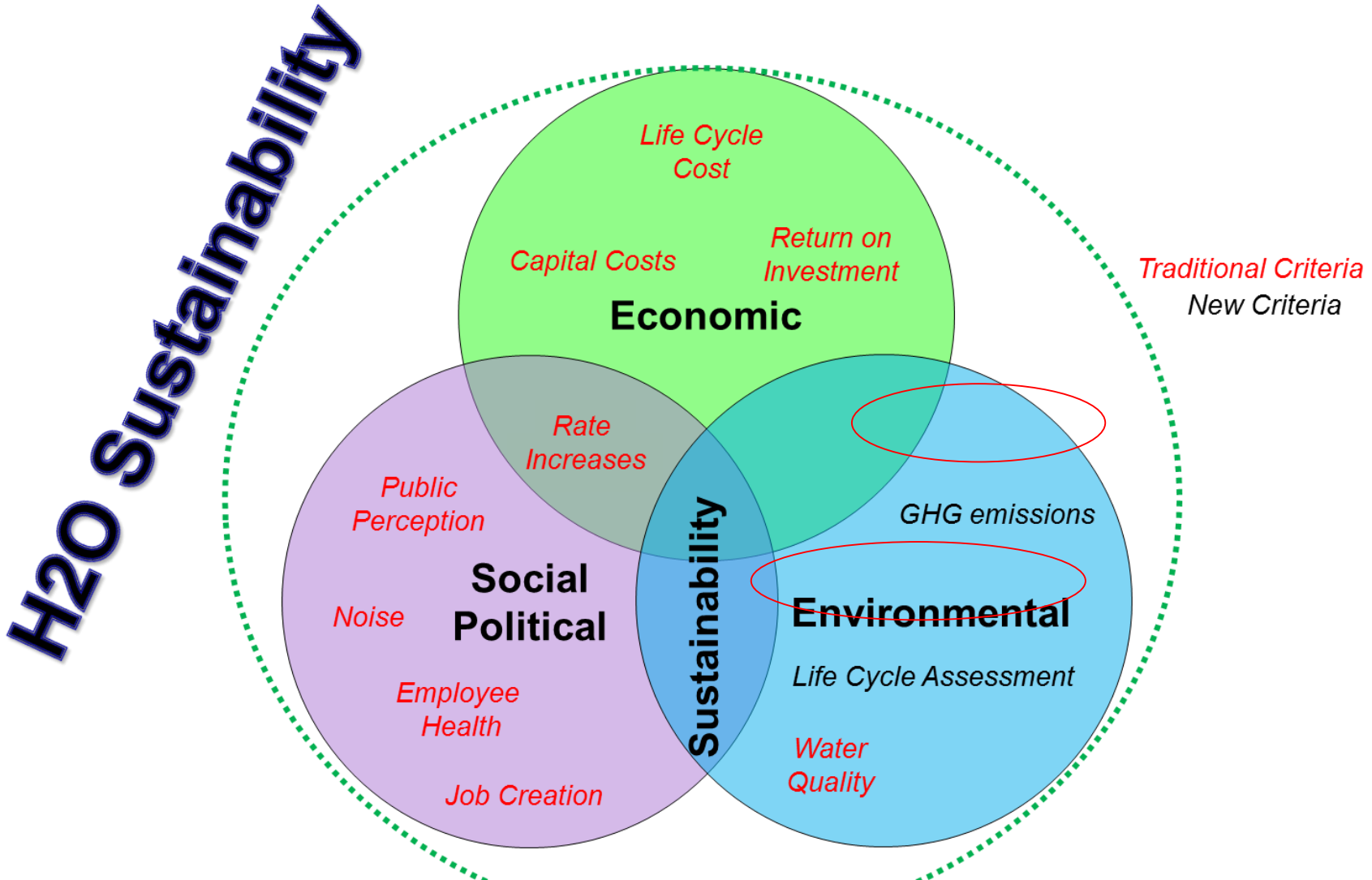
- Climate Change impacts water and vice versa (ie. Water / Climate / Energy Nexus)
- Increasing need for **water reuse** drives **technology**

Today's Challenges in the Water Sector

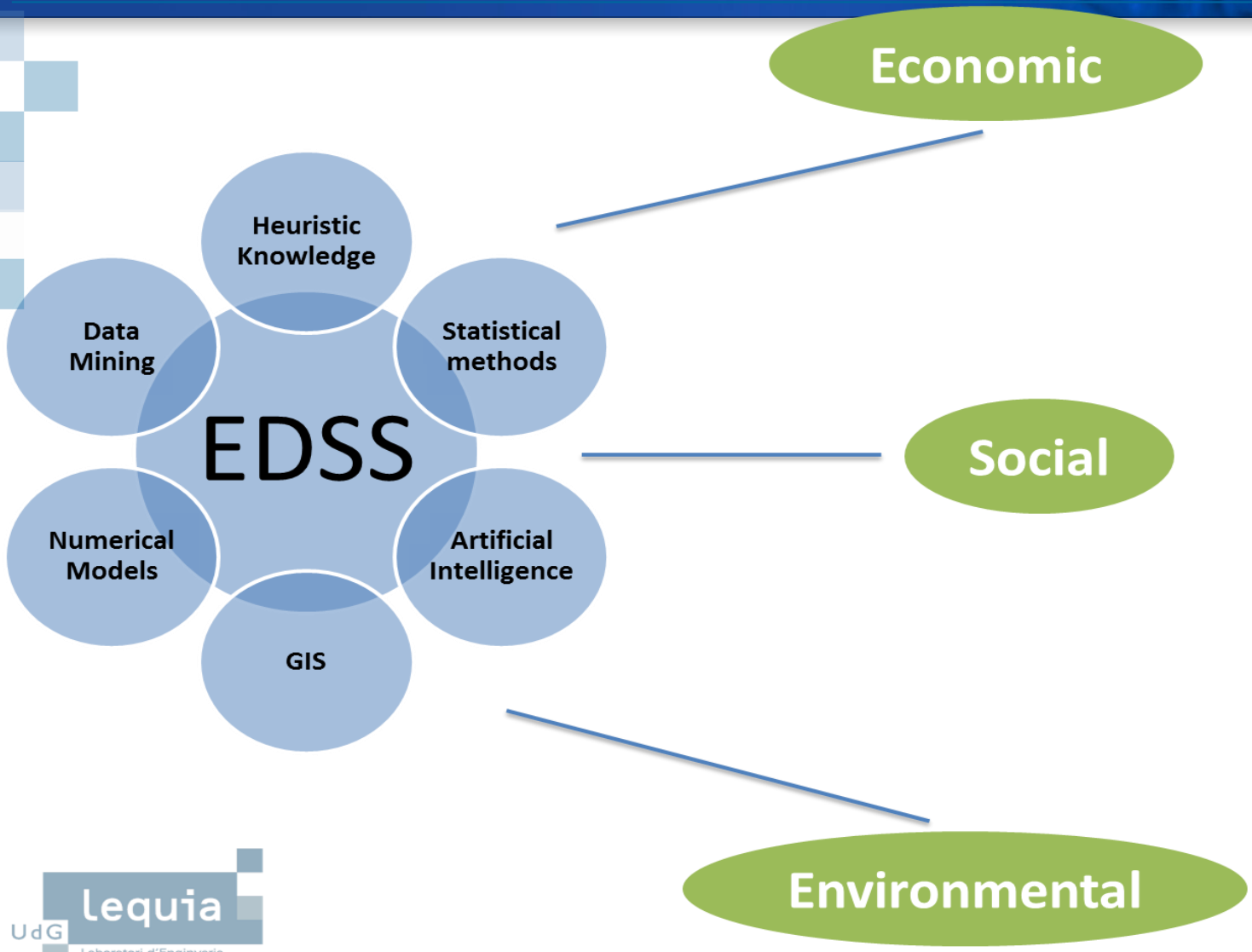
Treatment Technology

- Growing number of **leading edge** technology alternatives to **conventional** wastewater treatment
- **Physical** need for **technology evaluation** based on:
  - Urban Growth: leading edge, conventional
  - Stricter WQ Stds: leading edge, conventional
  - Climate Change / Water reuse: leading edge
- Technology selection is important because **technology performance** (ie. Energy, sludge, chemicals) impacts **bottom line**

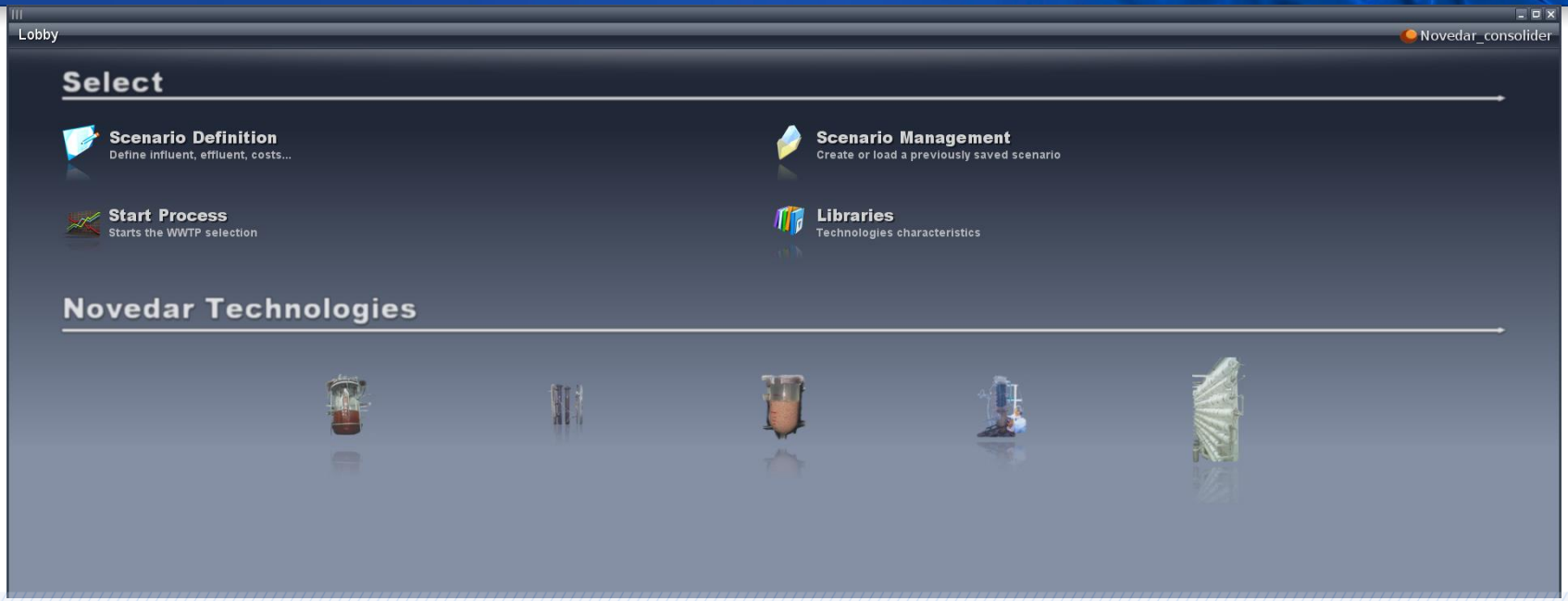
Today's Challenges in the Water Sector



Need EDSS to help integrate, process, and interpret data for WWTP technology selection



Novedar_EDSS Software



TECNIO
Be tech. Be competitive

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lequia
UdG
ECO-INNOVATIVE WATER SOLUTIONS

NOVEDAR_Consolider

a research consortium of nine Spanish universities, and two Dutch universities

Innovative tool pushing the State-of-the-art

NOVEDAR_Tool does what is already being done, **BUT ALSO:**

- Streamlines technology evaluations by integrating technology **performance**, **cost**, and **environmental impact** data all into **one platform**

TIME = € Business Case

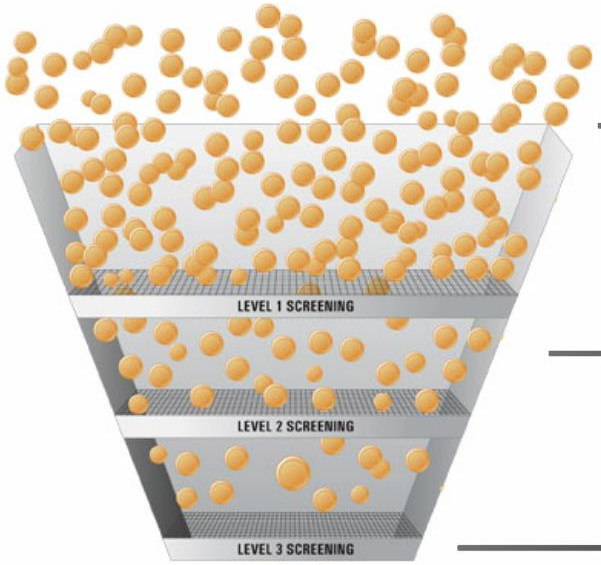
Input Data

Can define the following for any given scenario:

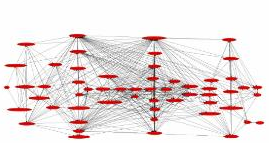
- Influent Data
- Effluent Requirements
- Priorities
- Cost Benefit Data
- LCA Emission Factors
- Sludge Management Options
- Pathogens and Target Compounds

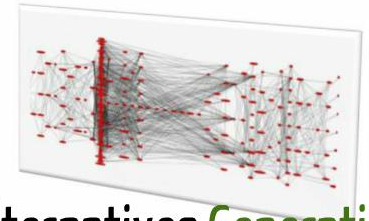
Start Engine

Alternatives: Response surface



Most Potential PDF Alternatives according user priorities and scenario

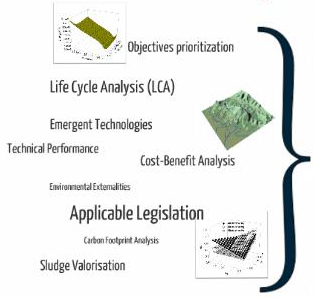




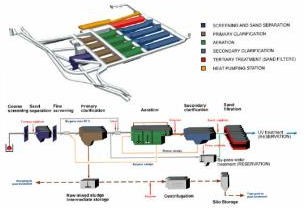
Step 1. WWTP Alternatives Generation

Step 2. WWTP Alternatives Selection

Step 3. WWTP Alternatives Evaluation

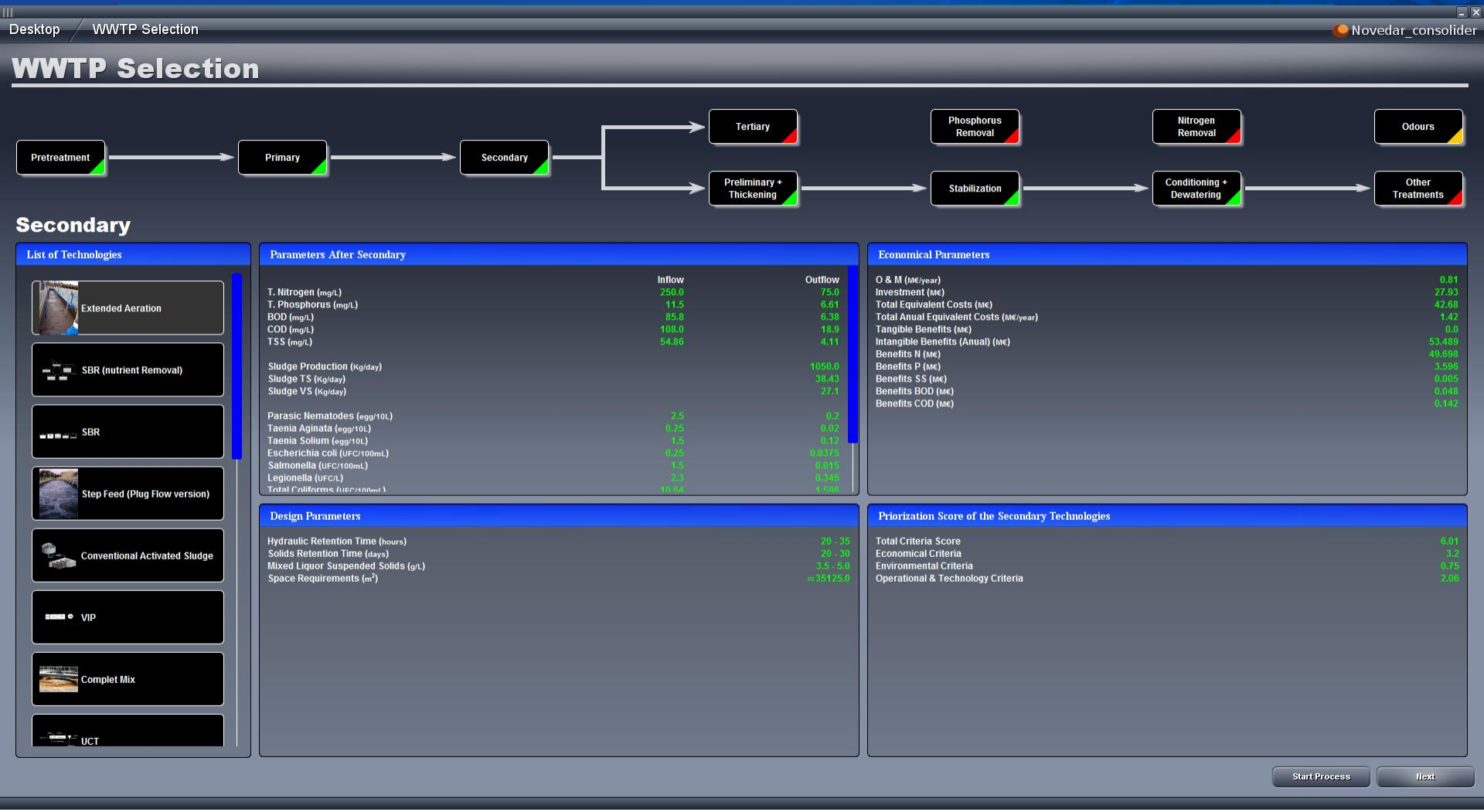


$$SCORE1 = \sum_{i=1}^{n} w_i v(x_{i,1})$$



Most Suitable WWTP according to the defined scenario

Output / Technology Selection



Summary

Desktop / WWTP Selection / Summary — Novedar_consolider

Selected Technologies

PreTreatment Technologies


Well with Grinder


Fine Screens Drum Screens


Aerated Grit Chamber

T. Nitrogen (mg/L)	250.0
T. Phosphorus (mg/L)	11.5

Primary


Combination Flocculator-Clarifier

T. Nitrogen (mg/L)	250.0
T. Phosphorus (mg/L)	11.5
BOD (mg/L)	85.8
COD (mg/L)	108.0
TSS (mg/L)	54.86

Secondary


Extended Aeration

T. Nitrogen (mg/L)	75.0
T. Phosphorus (mg/L)	6.61
BOD (mg/L)	6.38
COD (mg/L)	18.9
TSS (mg/L)	4.11
Parasic Nematodes (egg/10L)	0.2
Taenia Aginata (egg/10L)	0.02
Taenia Solium (egg/10L)	0.12

Sludge Line Technologies


Grinding


Rotary-drum Thickening


Anaerobic Mesophilic Digestion


Centrifuge

Costs

Costs	
O & M (M€/Year)	2.46
Investment (M€)	29.75
Benefits	
Reuse Water (€/m³)	0.0
Biosolid Valorization (€/Kg)	0
Biogas Benefits (€/day)	5.31

r (Tax Returns)	4.0
Expected Lifetime (Years)	30.0

$$NPV = \sum_{i=0}^{t} \frac{Bi\text{-}Ci}{(1+r)^{\wedge}i}$$

	Cost Benefit Analysis	Cost Benefit Analysis Env. Ext.
Total Equivalent Cost (M€)	80.4	80.4
Accumulate Benefit (M€)	0.06	53.96
Net Profit Value (NPV) (M€)	-80.36	-26.46

LCA

Life Cycle Assessment

1. Eutrophication (Kg PO_4^3 - eq/m^3)	4.101606
- 1. Energy use (Kg PO_4^3 - eq/kWh)	0.001707
- 2. Chemicals consumption (Kg PO_4^3 - eq/Kg)	2.0E-6
- 3. Direct emissions(Water) (Kg PO_4^3 - eq/Kg)	0.356778
- 4. Direct emissions(Sludge) (Kg PO_4^3 - eq/Kg)	5.0E-6
- 5. Direct emissions(Air) (Kg PO_4^3 - eq/g/m^3)	3.73625
- 6. Avoided impact (Kg PO_4^3 - eq/Kg)	0.006863
2. Global Warming (Kg CO_2 - eq/m^3)	155.939119
- 1. Energy use (Kg CO_2 - eq/kWh)	0.243485
- 2. Chemicals consumption (Kg CO_2 - eq/Kg)	7.53E-4
- 3. Direct emissions(Water) (Kg CO_2 - eq/Kg)	0.0
- 4. Direct emissions(Sludge) (Kg CO_2 - eq/Kg)	0.004905

Operation Characteristics

Operation Simplicity	3
Control over the Process	2
Operation Flexibility	2
Operation Reliability	2
Problem Frequency	2
Need for Skilled Staff	2
Innovation Degree	2

Alternative Summary

BOD (mg/L)	≈4.4 - 8.36
COD (mg/L)	≈13.5 - 24.3
Nitrogen (mg/L)	≈75.0
Phosphorus (mg/L)	≈6.61
TSS (mg/L)	≈4.11
Hydraulic Retention Time (h)	20 - 35
RAS (% of influent)	50 - 200
SRT (days)	20 - 30
Mixed Liquor Suspended Solids (g/L)	3.5 - 5.0
Biogas Production (m^3/day)	≈13.19
Sludge Production (Kg/day)	≈1050.0
Operation Sludge Cost:	≈0.0
Total Equivalent Cost (M€)	≈80.4
Total Anual Equivalent Cost (M€)	≈2.68
Cost Benefit Analysis (M€)	≈-80.36
Cost Benefit Analysis Env. Ext. (M€)	≈-26.46

Secondary Alternative Score:

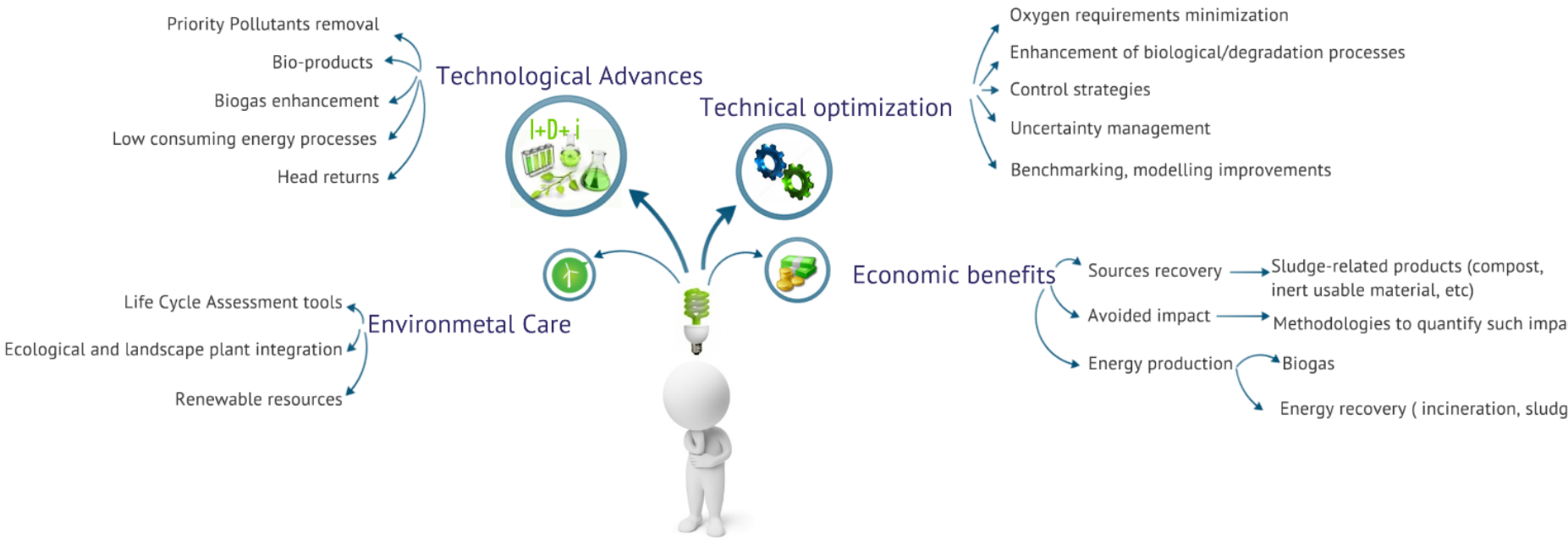
6.01

Robust Decision Support

EDSS provides scoring of viable secondary treatment alternatives based on any combination and weigthing of the following categories:

- Economic
    - O & M
    - Investment
- Non-Economic
    - Environmental
    - Aesthetic Impacts
    - Operational

Sustainability



Eco-Efficiency

NOVEDAR_EDSS

Technological (innovative and conventional), legislation, social, expert knowledge

CONCLUSIONS

• A decision support system is needed to address the complexity of technology selection

• It is essential to evaluate the sustainability of treatment alternatives

• Novedar_EDSS provides a framework for sustainable technology selection for:

  – Engages stakeholders

  – Meeting SDG6 sustainably

  – Applying the same principles and techniques for other technology selection applications

Thank You

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