

Theoretical pilot

Micro-hydropower in France

Using the energy potential of La Couze Pavin for B&B Le Pont du Roy

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Introduction



Micro-hydropower offers decentralised, low-impact renewable energy. Le Pont du Roy, a historic B&B, faces high energy costs and wants to reduce reliance on fossil fuels.

Objective:
Assess the feasibility of a micro-hydro system to meet the site's energy needs sustainably and economically.

Figure1: La couze Pavin

Methodology



Figure 2: On-site measurements

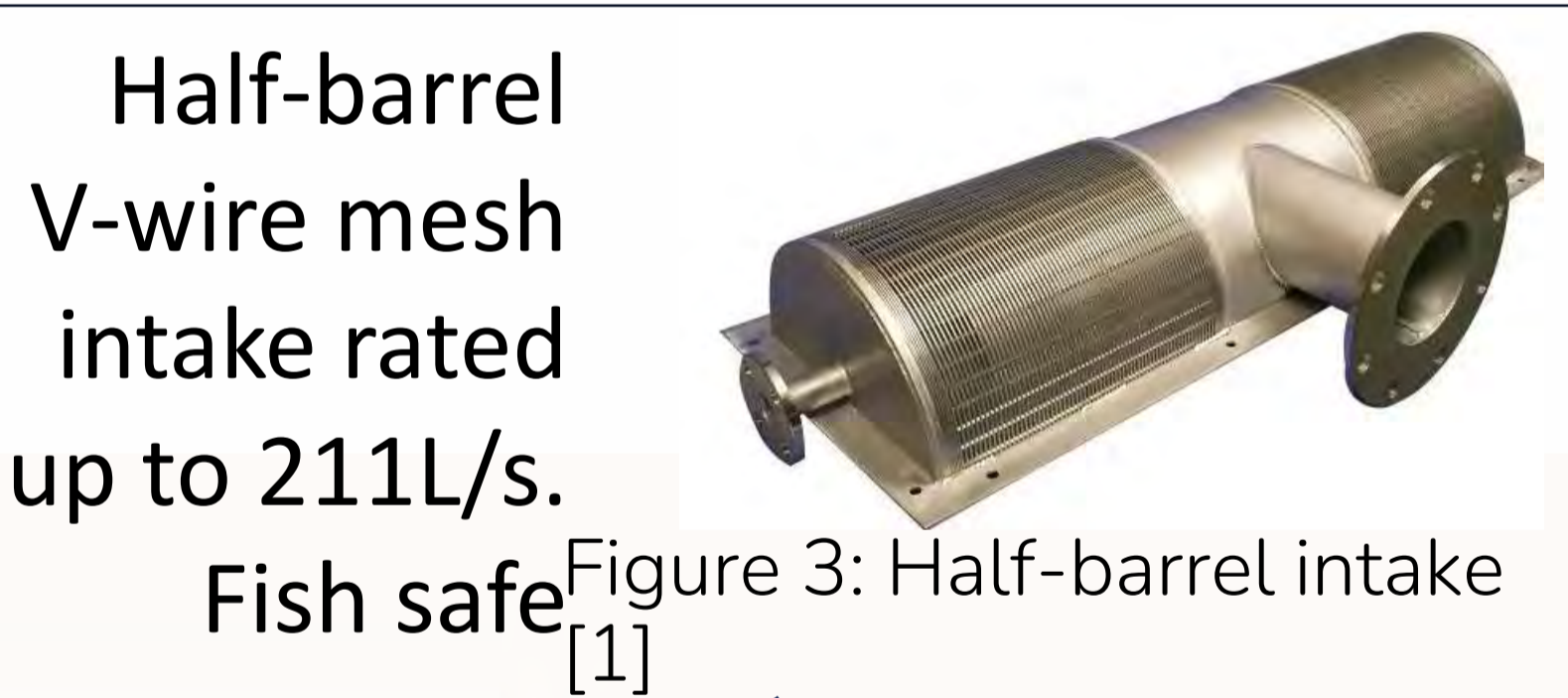


Figure 3: Half-barrel intake [1]



Fish ladder ensures natural movement for fish
Figure 4: Example Fishladder [2]

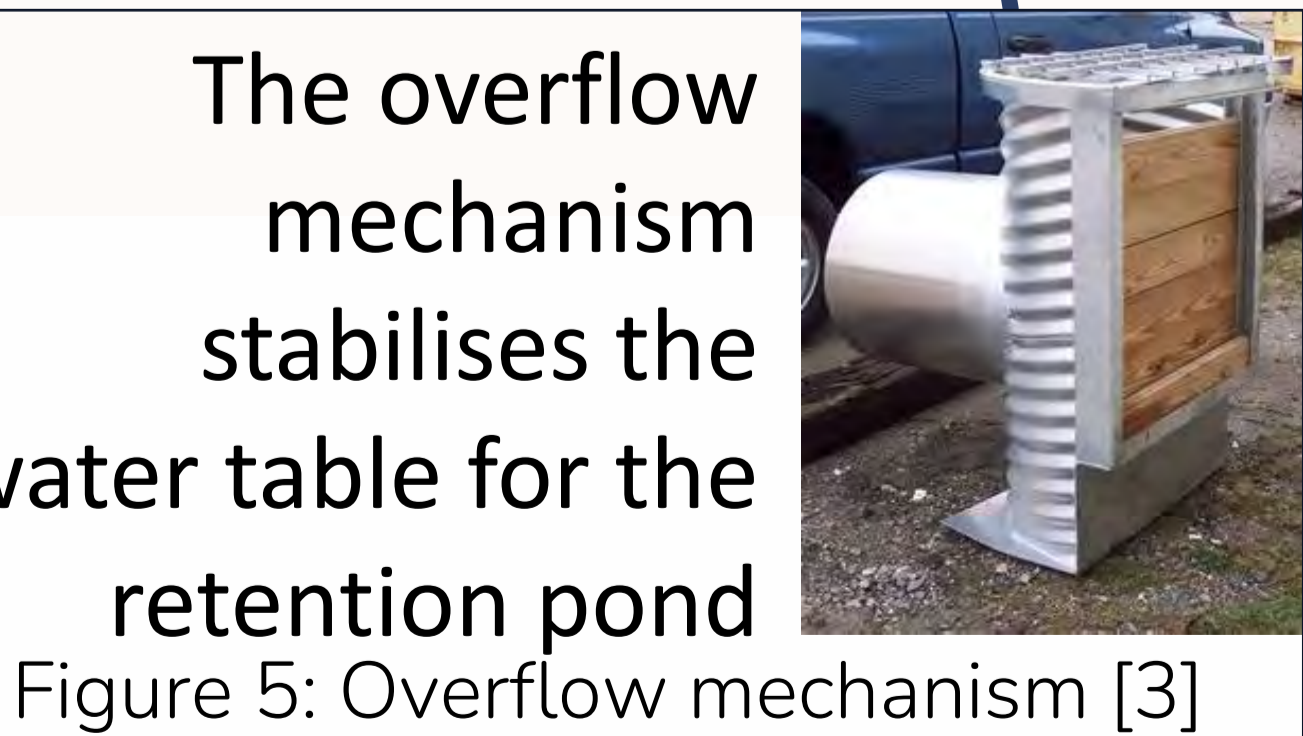
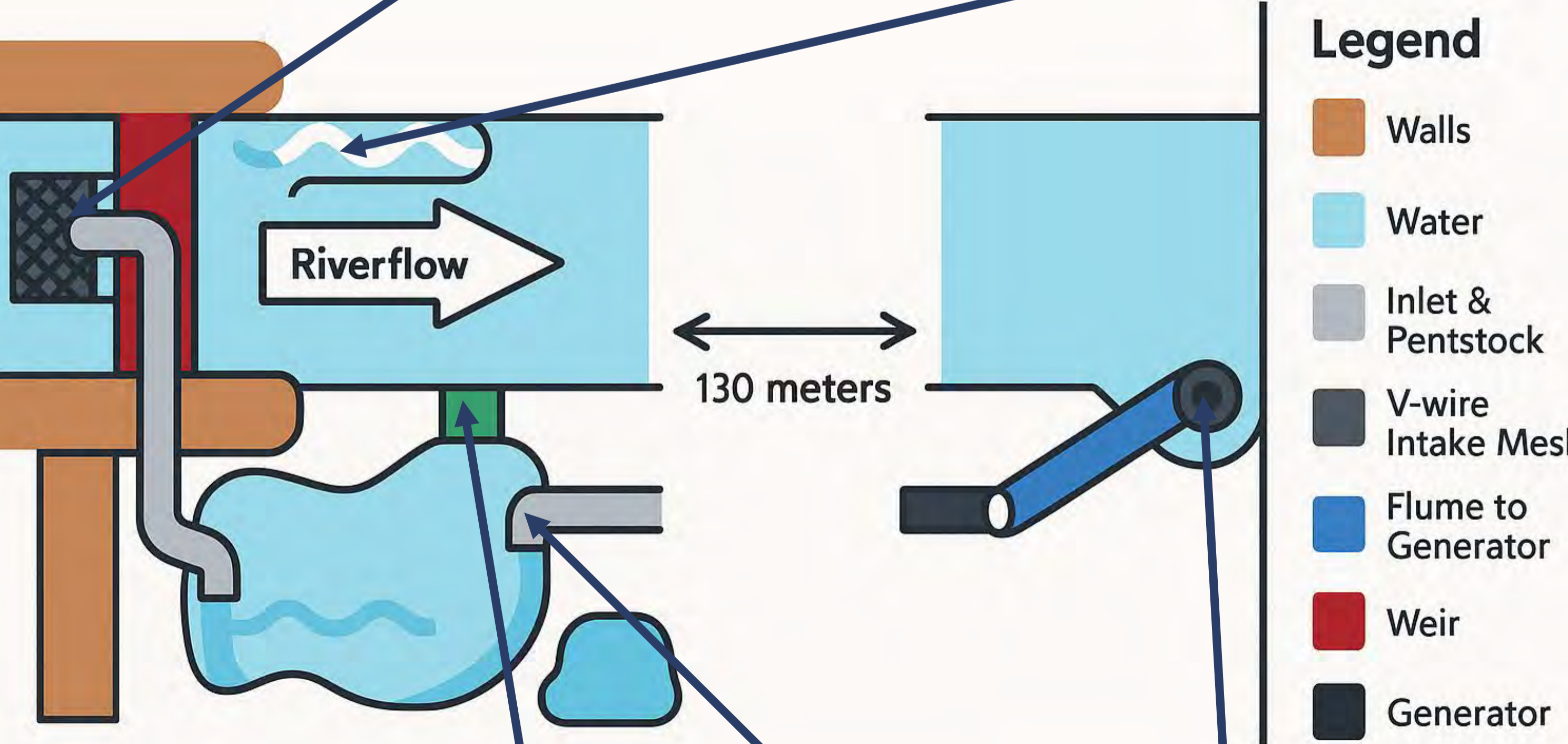


Figure 5: Overflow mechanism [3]



Figure 6: Sluice [4]

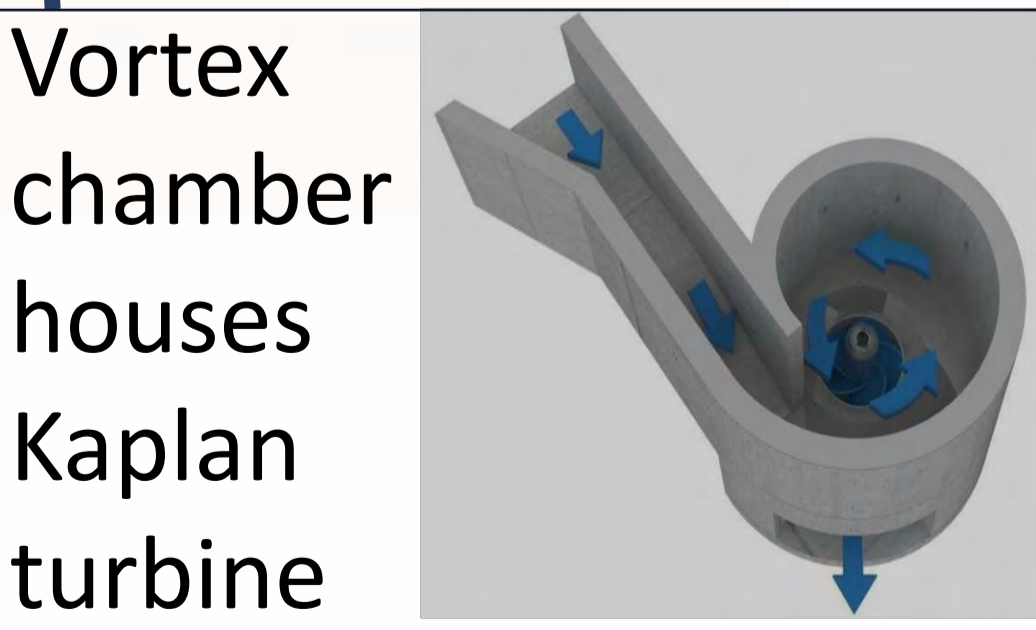


Figure 7: Vortex chamber [5]

Results

Resource & Demand
Low Q₉₅ %: **515 L/s** Legal eco-Min: **304 L/s** [6]
Gross head: **2.8 m**; Design flow: **0.156 m³/s**;
Annual energy output: **22,000–24,000 kWh**;
Peak demand: **9–11 kW**;
Average electricity use: **1,079 kWh/month**.

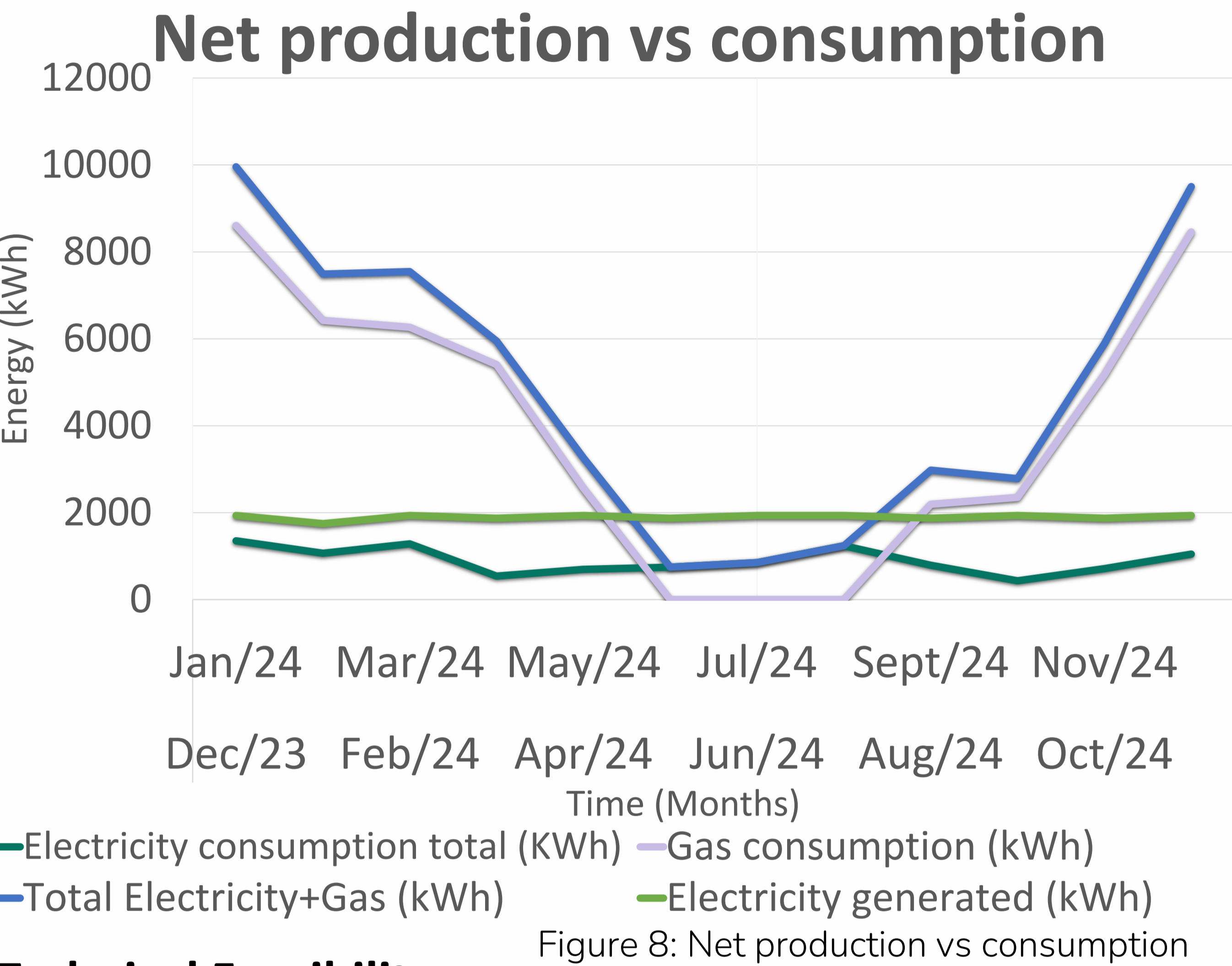


Figure 8: Net production vs consumption

Technical Feasibility
144 m, 0.45 m diameter penstock; net head **2.6 m** at turbine. A 5 kW Kaplan turbine (**80% efficiency**);
15 kWh battery storage for reliability. Smart grid prioritises local use, heating, then grid export.

Environmental & Legal
Minimal impact: **fish screens, ecological bypass, buried penstock**. No rare/protected species recorded at site; closest Natura 2000 area >1 km away. Water rights are possible via historical mill use, but permits are required.

Economic
CAPEX: **€56,300–€75,800** (international vs. European supply).
Payback: **18–24 years**.
Subsidies or higher energy prices can shorten the payback to **15–20 years**

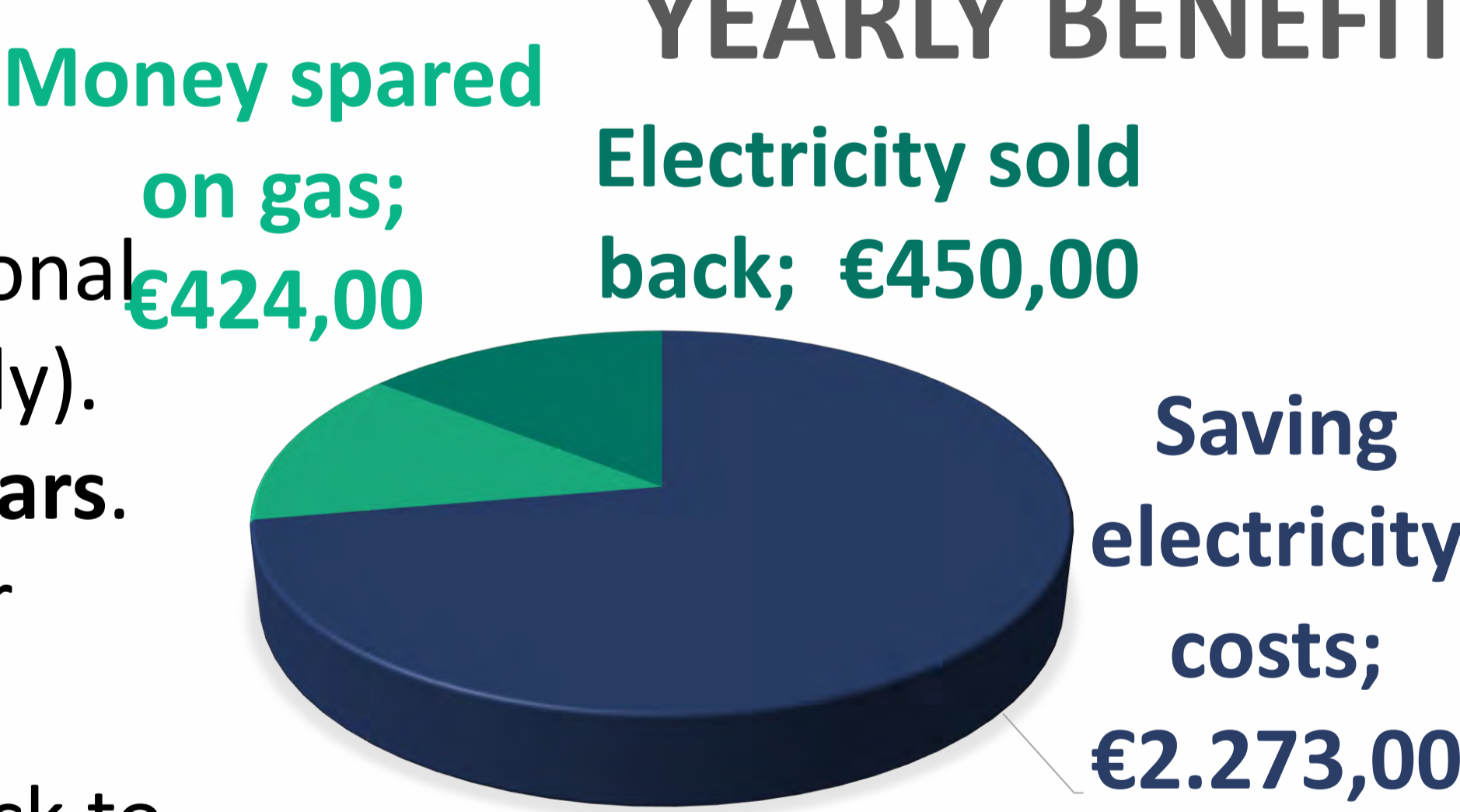


Figure 9: Yearly benefit (euro)

Conclusion

- Technically feasible and environmentally manageable
- Meets all on-site electricity demand, with extra for heating/export
- Financial viability depends on subsidies and/or low-cost procurement

Next Steps: Conduct a detailed ecological survey, confirm water-use rights and obtain refined supplier quotes before proceeding

References

[1] Qiusuo. Wedge Wire Screen Water Intake. <https://www.wedgewire-screen.com/technology/wedge-wire-screen-water-intake-design.html> [2] Tesla valve as a fish ladder in Pichoux Gorge, Switzerland <https://nl.pinterest.com/pin/274086327312690782/> [3] Alum. Flashboard Riser by Southeastern Pipe & Drain System in Aiken, SC <https://www.alignable.com/aiken-sc-2/southeastern-pipe-drain-system-2/alum-flashboard-riser> [4] Wall mounted Penstock or Sluice Gate model FX4 by paravalves. <https://paravalves.com/fx4-wall-mounted-penstock> [5] Principle scheme of gravity-vortex micro-hydroelectric power station https://www.researchgate.net/figure/Principle-scheme-of-gravity-vortex-micro-hydroelectric-power-station-6_fig2_369431430 [6] Hydroélectricité | Ministères Aménagement du territoire Transition écologique. <https://www.ecologie.gouv.fr/politiques-publiques/hydroelectricite>