Motivation and Potential in Luxembourg

- 16/27 of the kinetic energy is useable (Betz-factor)
- 175 GWh/a technical potential of hydropower
- 103 GWh Betz-factor restricted
- 52,5 GWh for an efficiency of 30% (5,9 MW p.a.)
- 86,78 GWh national wind and Solargeneration in 2011
- River hydropower generation 88,27 MW/Mio. Pers. (Germany 54,67 MW/Mio. pers.)

Mechanical Concept

- Two vertical hydrofoils move horizontally in a river
- The inverse motion of both foils damps the influence of disturbing forces
- Vertical setup allows:
  - Adaption to water depths
  - Simple removal of flotsam
  - Simple maintenance of the mechanism

Electrical concept

- Experimental data (Université Laval) for sinussoidal motion leads to an alternating generation and consumption of electricity. An average positive generation of 1.3 kW (min. -2.6 kW max. 5.3 kW) for a flow speed of 2m/s, 2 NACA foils (180 degree phase shifted) 0.164 cm x 24 cm (blue graph)
- The combination of three phase shifted generation profile-pairs lead to an in average positive generation of 3.7 kW (min. 0.3 kW max. 8.3 kW), for a flow speed of 2m/s, 3 x 2 NACA foils of 164 cm x 24 cm (red graph)
- The modular concept includes a condensator to damp the fluctuation in the generation and can include more hydrofoil pairs
- The chain concept can include several foils per chain

Inspiration and existing systems

(from the Université Laval Kinsey/Dumas/Deschênes, Canada)

- Single hydrofoil efficiency 20% (f=0,83), Dual hydrofoil efficiency 30% (f=0,92), Inter-wing length 1.3 m, amplitude 0,62m
- Raft mass 2000kg
- Tested in a lake in Canada
- Simulation of the motion with ANSYS Fluent

Next steps

ANSYS Fluent Simulation:
- Testing motion speed
- Testing time dependant angle of incidence
- Testing different profiles
- Develop optimization:
  - Efficiency, Max. power
  - Test performance of controllability

Lab setup in Netpower DemoLab:
- Test motion of the foils
- Test performance of generators
- Test several foils per chain
- Measure losses of mechanics
- Install sample setup for field test

Field test at the locations of SEO
(Société Électrique de l’Ouest)
- Test technology on a weir
- Test performance in open flow
- Include advice of experienced staff
- Feed in in Luxembourgish grid
- Longer field test over several days