HYDRO AND EOLIC PLANTS

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EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research,
Development and Education



Hydraulic engines 1

Milan Bělík

Hydraulic engines

- potential energy
- kinetic energy
- potential + kinetic

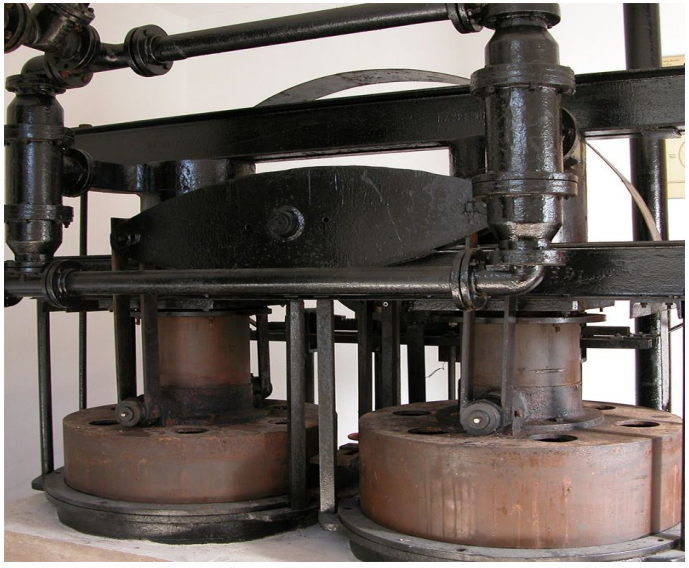


Historical hydraulic engines

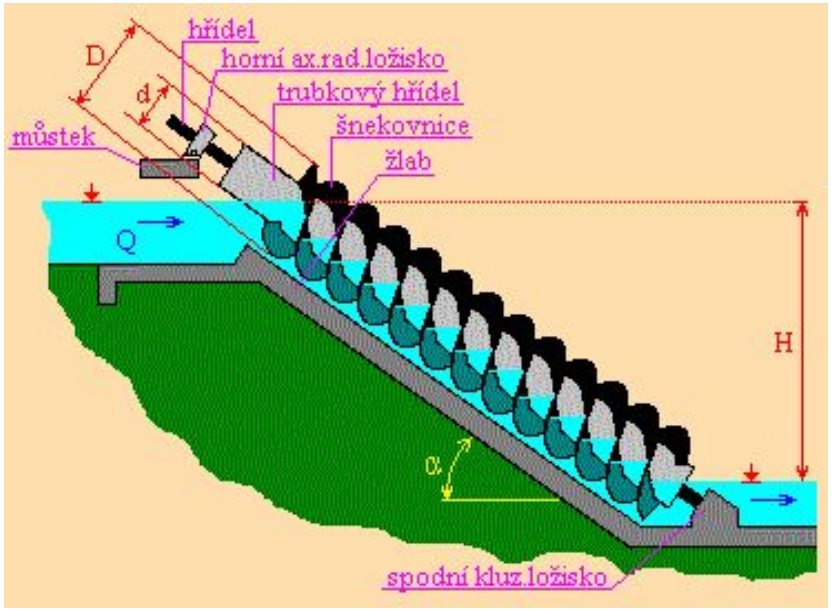
- Archimedes spiral
- watercolumn engine
- water spiral
- water trompa
- water trkac

- Savonius turbine
- Tesla turbine
- Setur turbine
- Schneiderova hydrodynamic engine
- STO oscilator
- Linear Pelton





Archimedes spiral





Archimedes spiral – MVE Kaceřovský mlýn



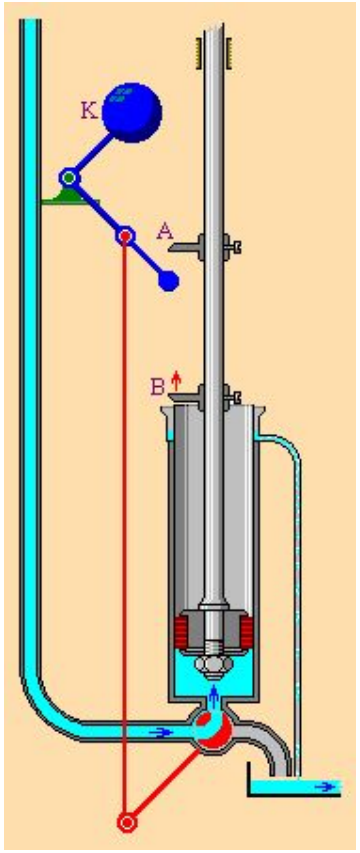
Typ vodního motoru	Plnění stroje – hltnost [%]									
	10	20	30	40	50	60	70	80	90	100
Archimédův šroub	25	74	77	79	82	82	83	83	84	85
Kaplanova turbína	15	70	85	88	90	90	90	90	88	85
Francisova turbína	–	–	15	58	72	78	82	82	82	80
Bánkiho turbína	–	40	60	68	72	74	75	74	72	70





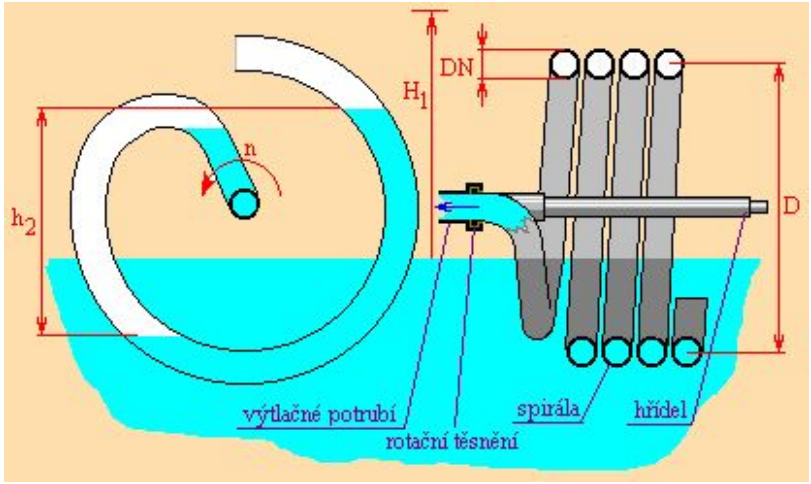
Water column engine

- **1749, Karol Hell (Slovensko)**





Water spiral



Průměr spirály:

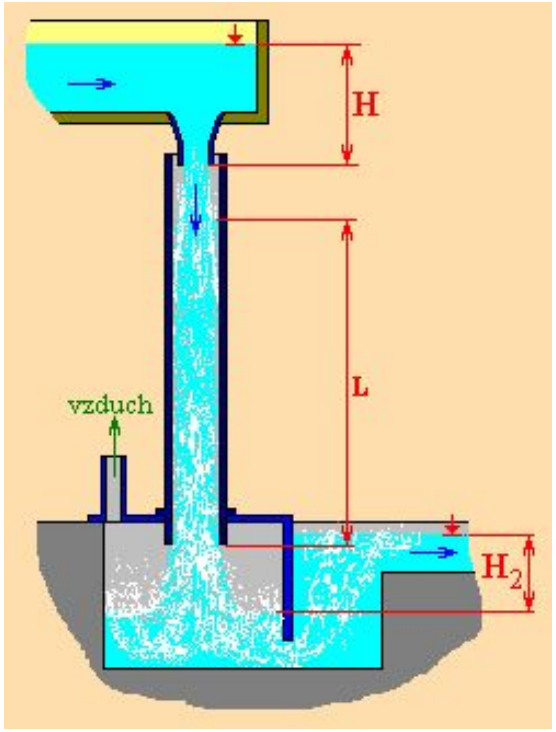
D [m] = 2 x **H** $_1$ [m] / **Z** [ks]

Dopravované množství:

S [mm ^{2}] = 0,785 x **DN** ^{2} [mm]
s [m] = 1,2 x **D** [m]
n [ot./min] = 5,7 / **D** [m]
q [ltr./min] = **s** [m] x **n** [ot./min] x **S** [mm ^{2}] / 1000

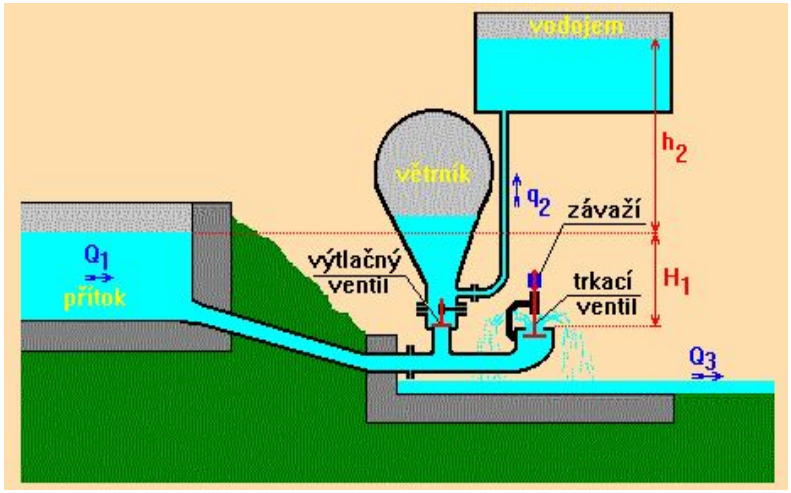
- **D** - střední průměr spirály [metry]
- **H** $_1$ - výtlačná výška [metry]
- **h** $_2$ - rozdíl hladin v závitu [metry]
- **Z** - počet závitů [ks]
- **q** $_1$ - vytlačené množství vody [ltr./min.]
- **n** - počet otáček [ot./min.]
- **s** - dráha vstup. konce trubky pod hladinou [m]
- **DN** - světlost trubky [mm]
- **S** - plocha vnitř.otv.trubky [mm ^{2}]

Water trompa



Water trkac

- **1796 - Joseph Michel Montgolfier**



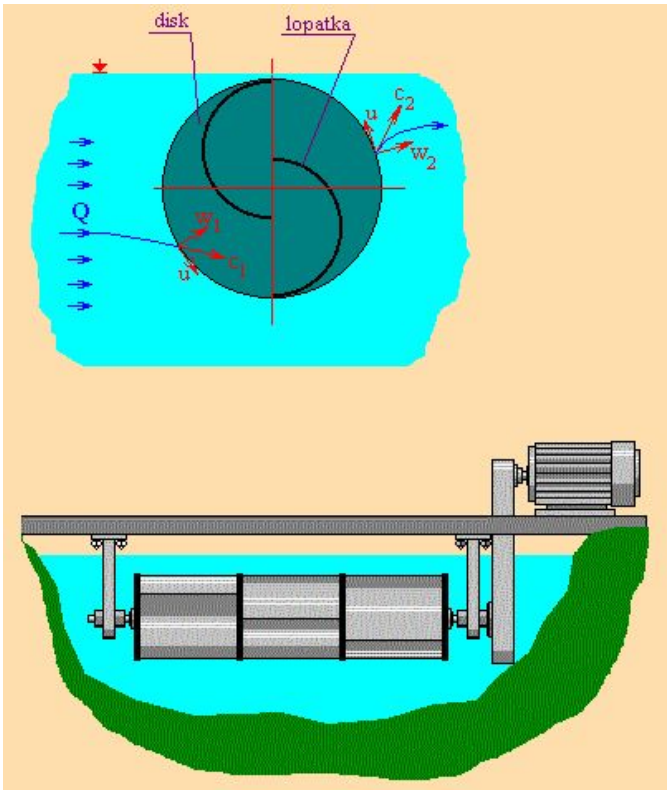




Savonius turbine

- **1922 – Sigurd Johannes Savonius**







Tesla turbine

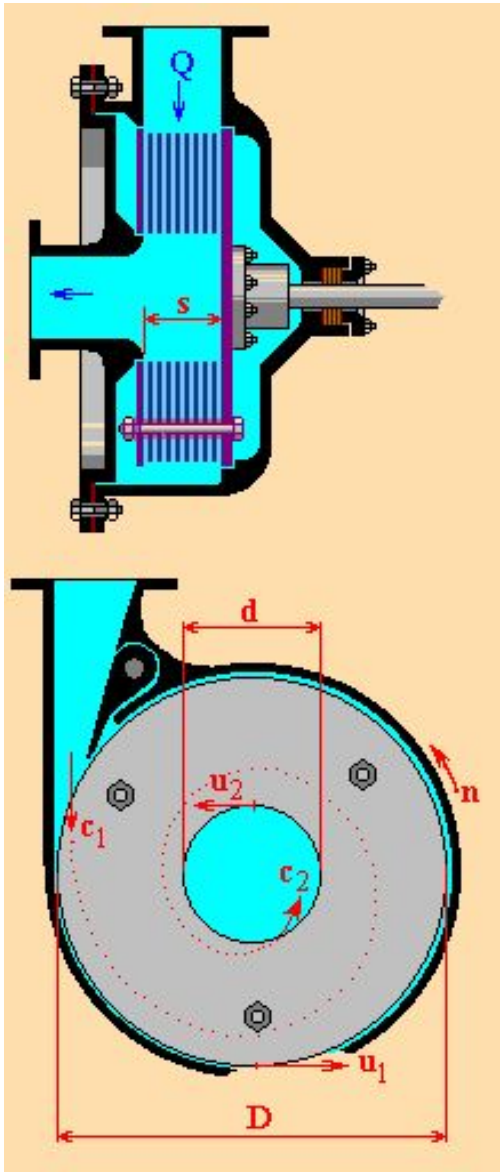
- **1913 – Nikola Tesla**

$$c_1[m/sec.] = 0{,}5 \times \sqrt{19{,}62 \times H[m]}$$

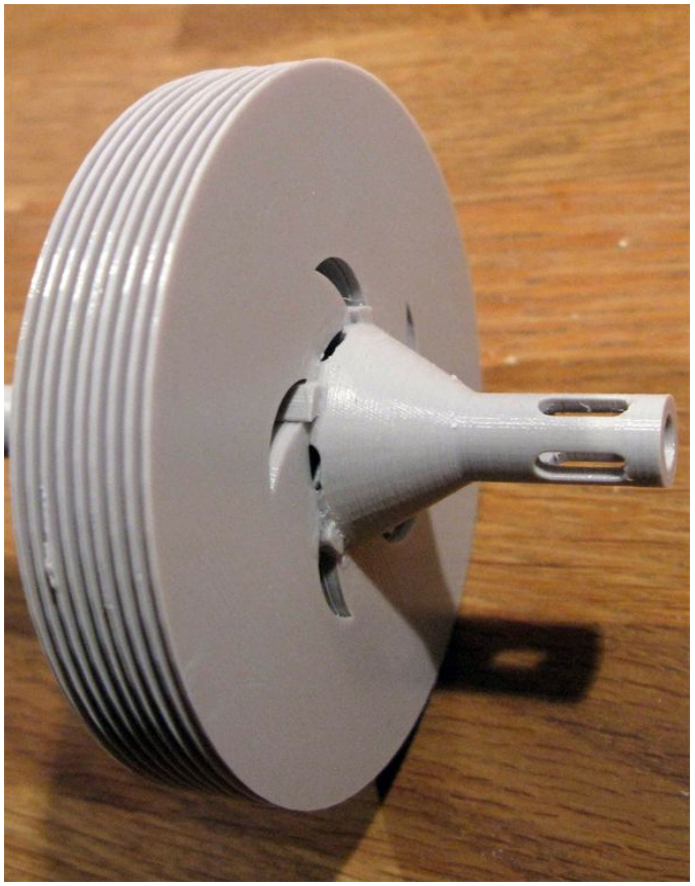
$$u_1[m/sec.] = 0{,}5 \times c_1[m/sec.]$$

$$u_2[m/sec.] = c_2[m/sec.] \leqq 1[m/sec.]$$

- **H** ... spád [m]
- **Q** ... průtok [ltr./sec.]
- **D** ... vnější průměr oběžného kola [mm]
- **d** ... vnitřní průměr oběžného kola [mm]
- **c1** ... vstupní rychlost vody [m/sec.] (na obr. se nejedná o žádný otvor ve skříni)
- **c2** ... výstupní rychlost vody [m/sec.]
- **u1** ... obvodová rychlost na půměru **D** [m/sec.]
- **u2** ... obvodová rychlost na průměru **d** [m/sec.]
- **s** ... šířka oběžného kola [mm]

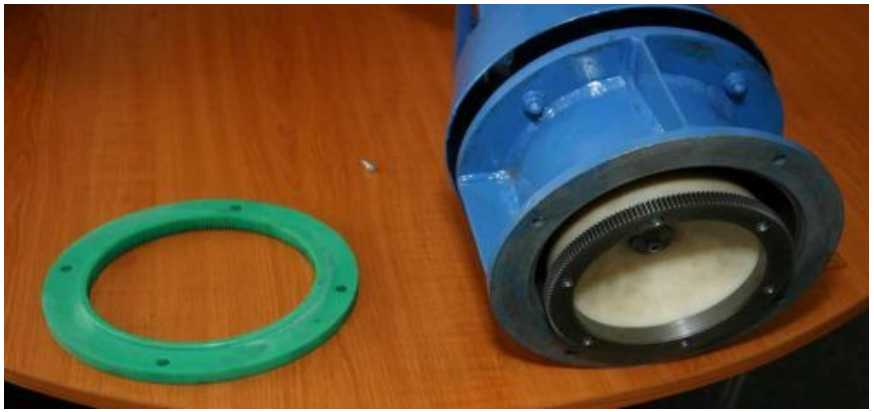


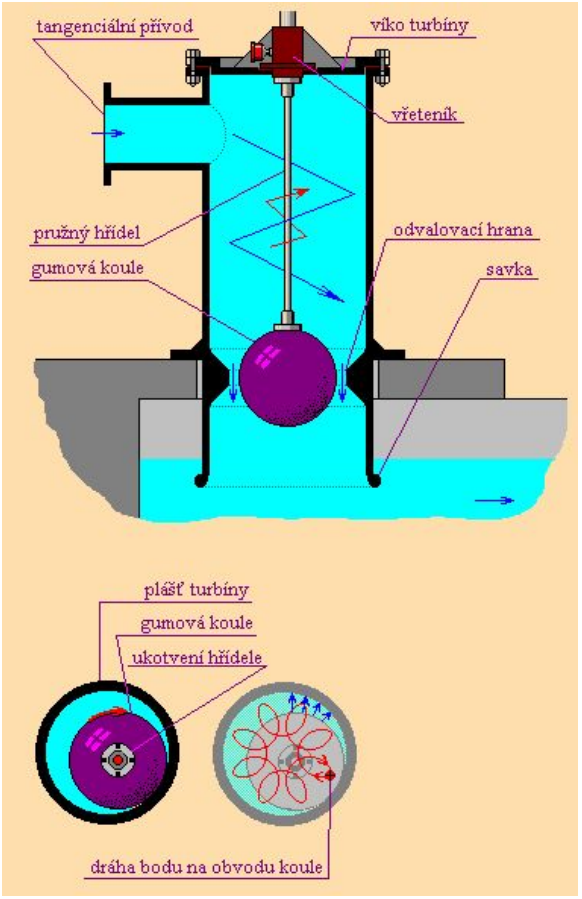


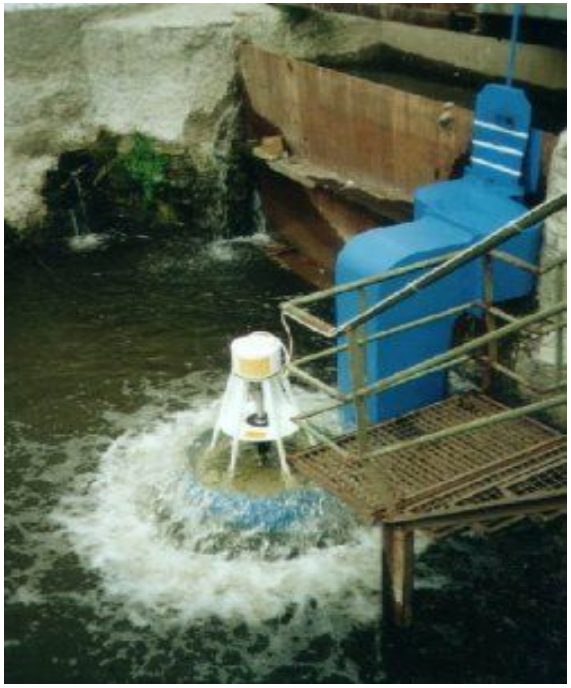


Setur turbine

- **1994 – Miroslav Sedláček (patent)**







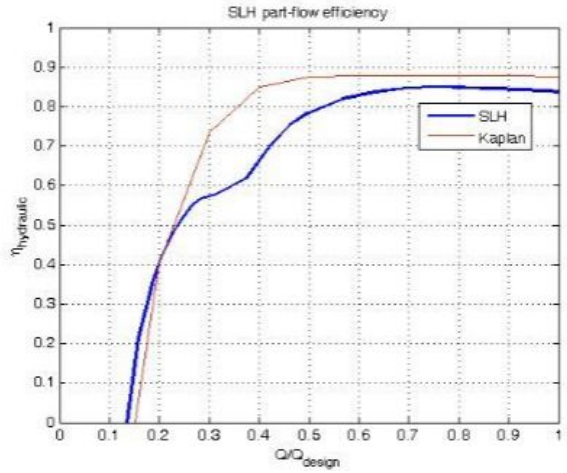


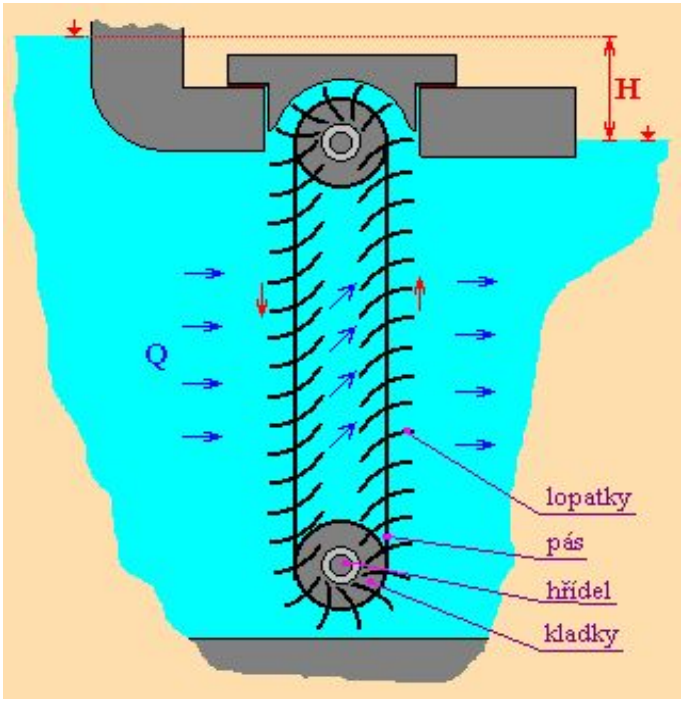




Schneider hydrodynamic engine

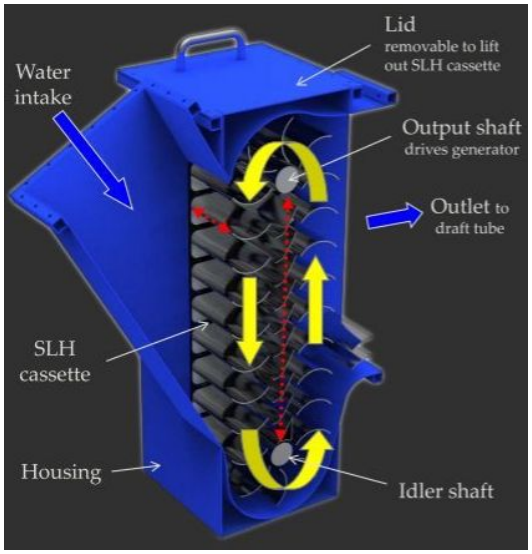
- **1982 – Daniel Schneider (California)**

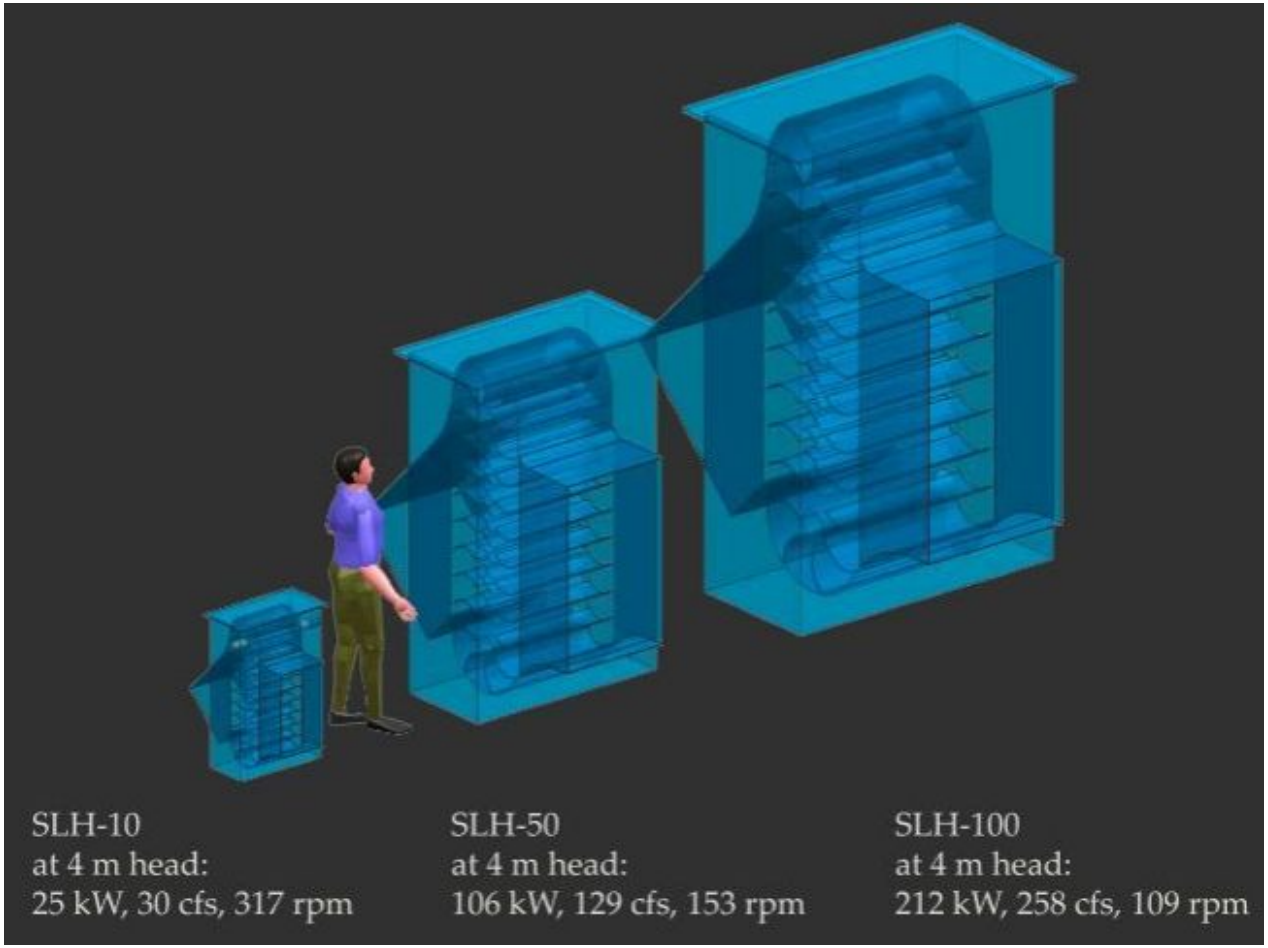




Natel Schneider linear hydroengine (SLH)

- **Natel Energy Inc.**



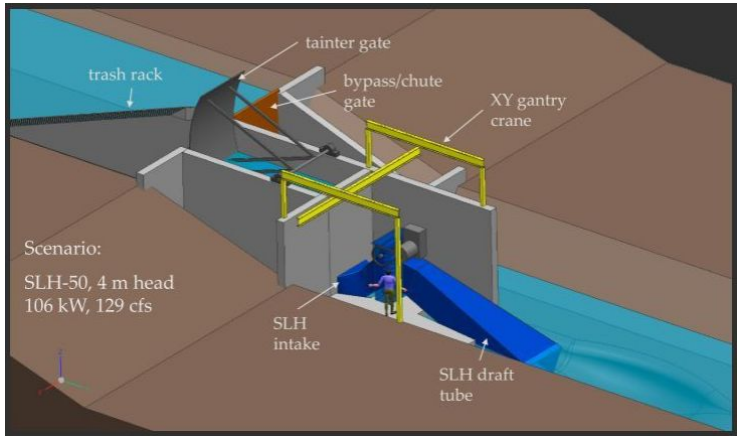


Buckey Pilot Plant

- **2010 – Buckey (Arizona)**
- **Turlock irrigation canal**

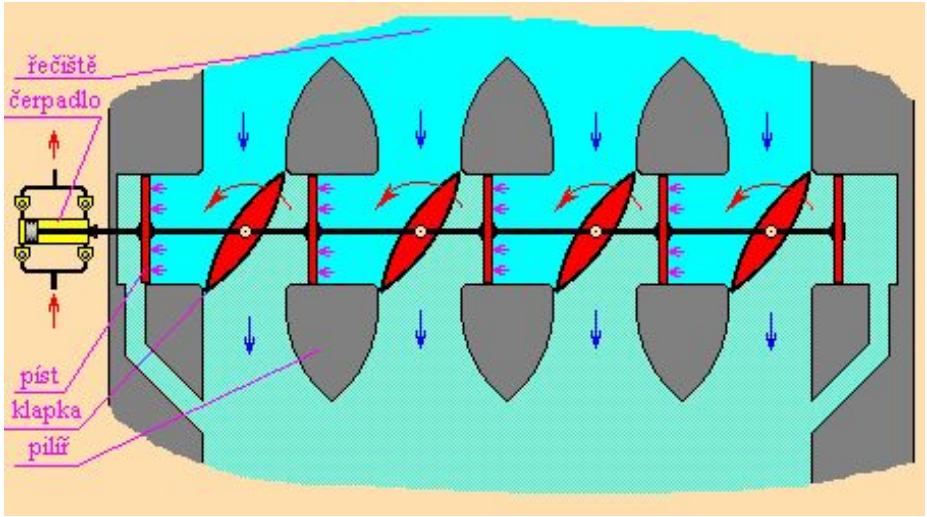








STO oscilator



Linear Pelton

- **2017 – Natel Energy**

