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Welcome

Floating Solar example from the Netherlands

Co chairs
Bjorn Prudon
Johan Bakker
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Presentation ecological impact FPV (Bjorn) – 10 min
Questions & discussion – 15 min
Presentation new development FPV (Johan) – 10 min
Questions & discussion – 15 min

More information: www.innozowa.com

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Floating Solar (FPV) in the Netherlands

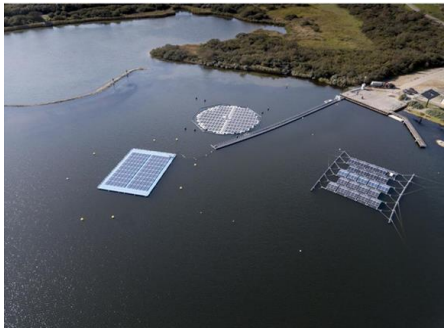
National goal; 35 TwH (solar and wind) by 2035

Combine solar with existing "landuse, -functions" (roads, landfills, **water**)

Potential area (theory) &

Type water	Indicatie golfhoogte	Totaal oppervlak (km²)
Binnenwater		
Bassin	-	10
Rivier, kanaal, sloot, haven, gracht, beek	-	1.192
Watervlak golfcategorie 1-2 Overig	0m tot 0,6m	868
Watervlak golfcategorie 1-2 Natura 2000	0m tot 0,6m	545
Watervlak golfcategorie 3 Natura 2000	0,6m tot 1,2m	5.380
Overig binnenwater	-	14
Buitenwater		
Noordzee binnen gemeentegrens	Golfhoogte groter dan 2,0m	959
Noordzee buiten gemeentegrens	Golfhoogte groter dan 2,0m	57.994
Totaal		66.962

….. reality



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FPV in inland water/ urban areas

Primair functions

Waterretention & Environment (blue-green area's)

Chances	Challenges
• Unused space in high density areas • High demand of green energy close by • Proporty value of water = 0 euro	• Energy-production • Shallow water (5-8 ft) & maintenance • Ecological impact

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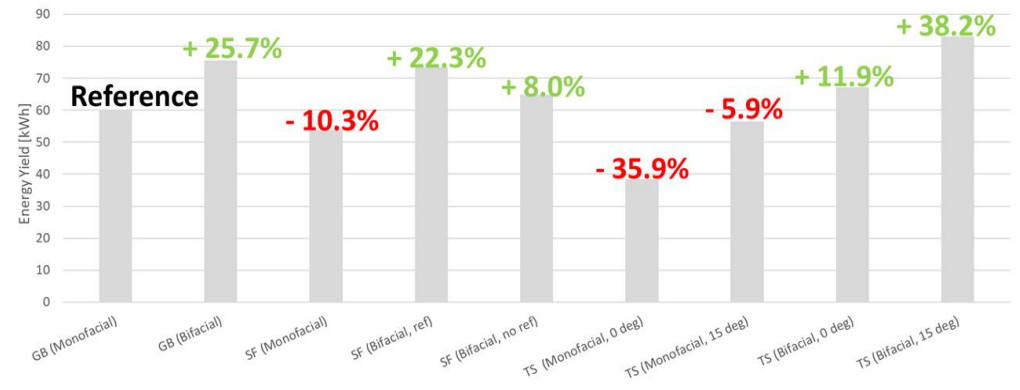
Project INNOZOWA

2018 – 2021 First pilot installation on test location

- 3 installations (groundbased (GB as reference), south faced (SF) & tumbler system (TS)
- 9 differtent PV-systems (mono-, bifacial, tilt, reflectors)
- Sun tracking (TS) and Movable (SF) → no impact on maintenance
- **First yearround measurements ecological effects**



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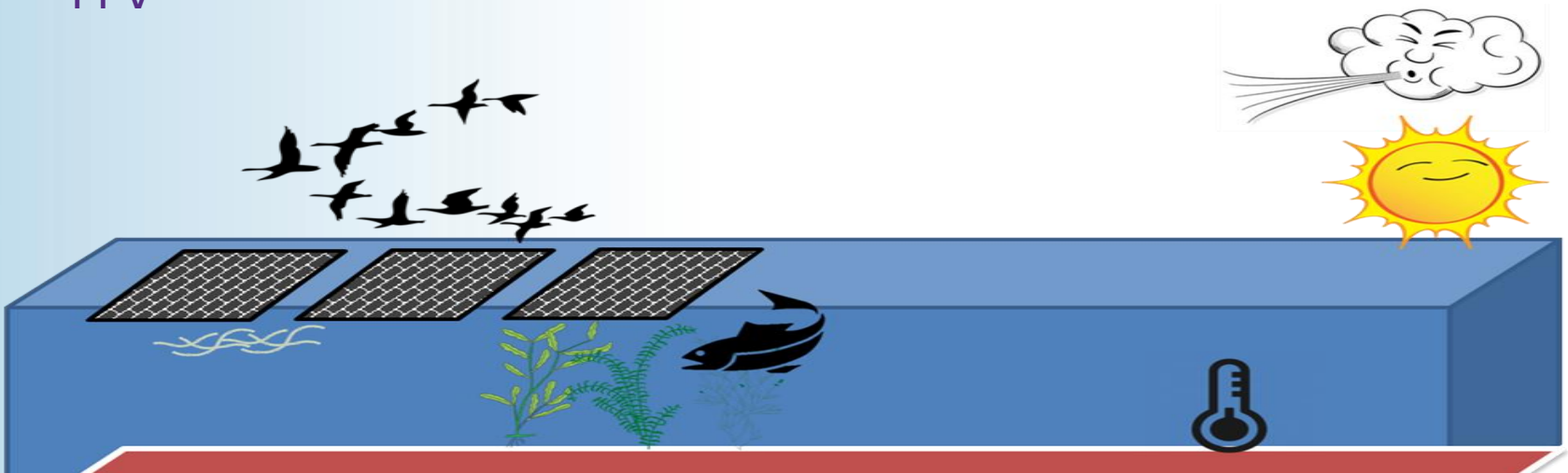
Ecological impact FPV?

Fact

- FPV has an effect on light-climate under water and wind dynamics
- (Almost) no literature/studies on effect available (<2018)

Question (2018-2019);

- What physical, chemical, biological effect can we measure
- Combinations of ecological effect (positive/negative)
- Translate effects and mitigate/compensate measures tot new design FPV



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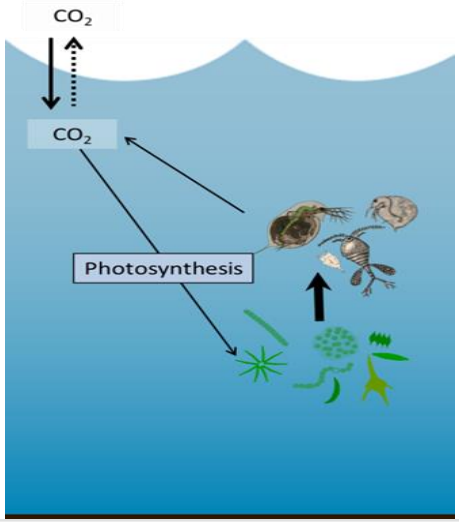
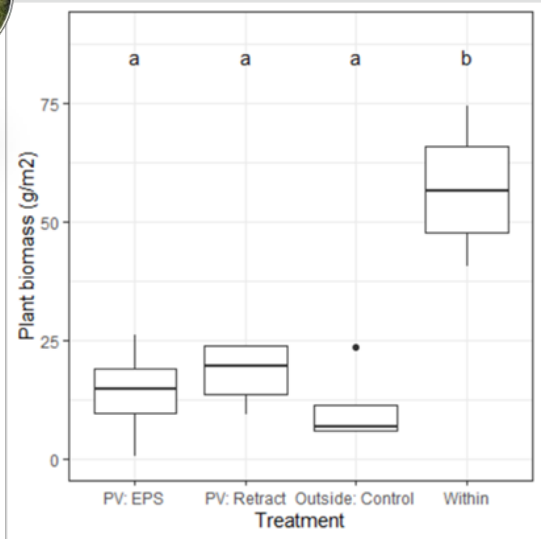
Production of water systems

Nutrients (P/N), algeas
→ no differences

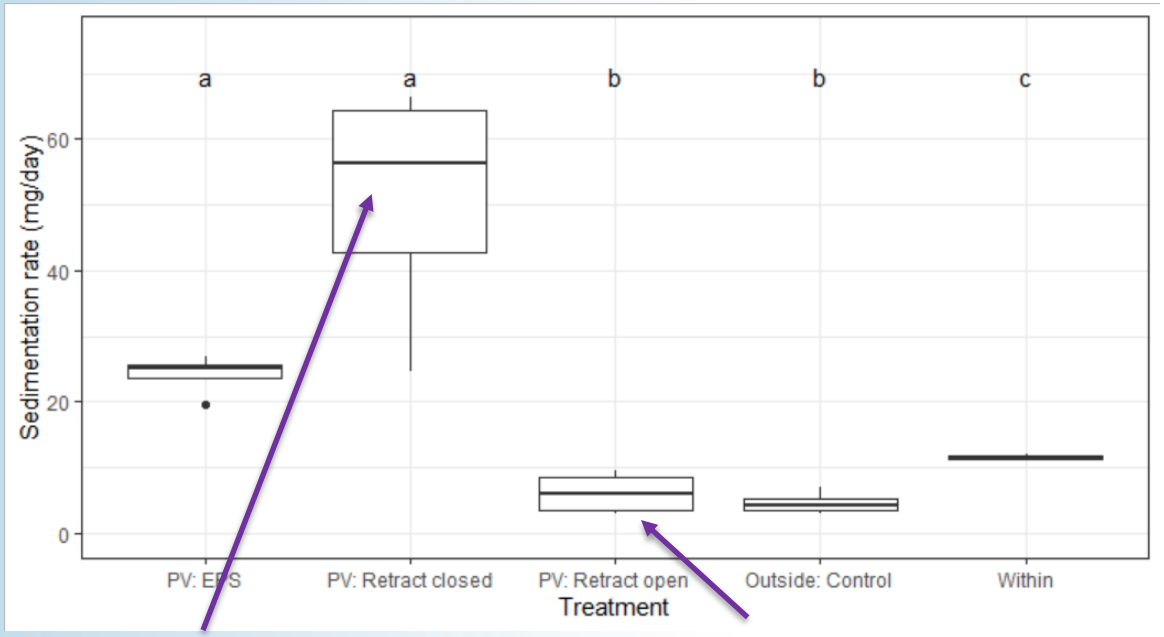
Water vegetation
→ huge difference (species & biomass)





Sedimentation

Increased sedimentation especially under closed FPV-system



Closed FPV-system **Open FPV-system**

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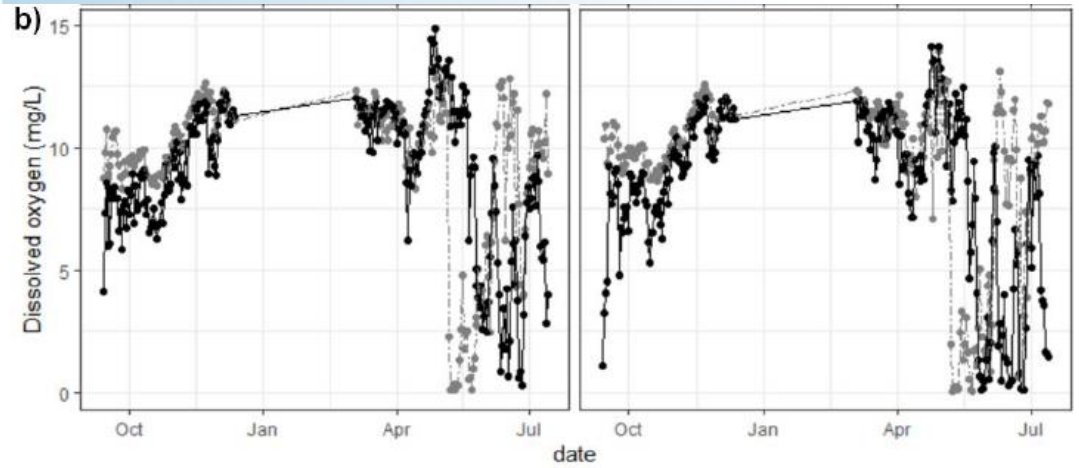
Oxygen dynamics

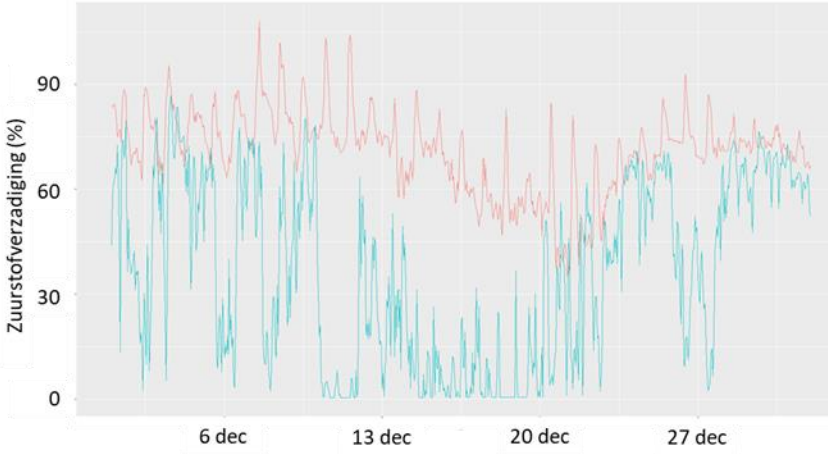
Hypoxia events (O_2<6mg/L):

- FPV: 157 times
- Reference point: 87 times

➢ Under FPV; 80% more !!

➢ Also during winter….





Ziar, Hesan… ***Teurlincx, Sven***, et al. *Progress in Photovoltaics: research and applications* (2021)

Wiinter 2020-2021

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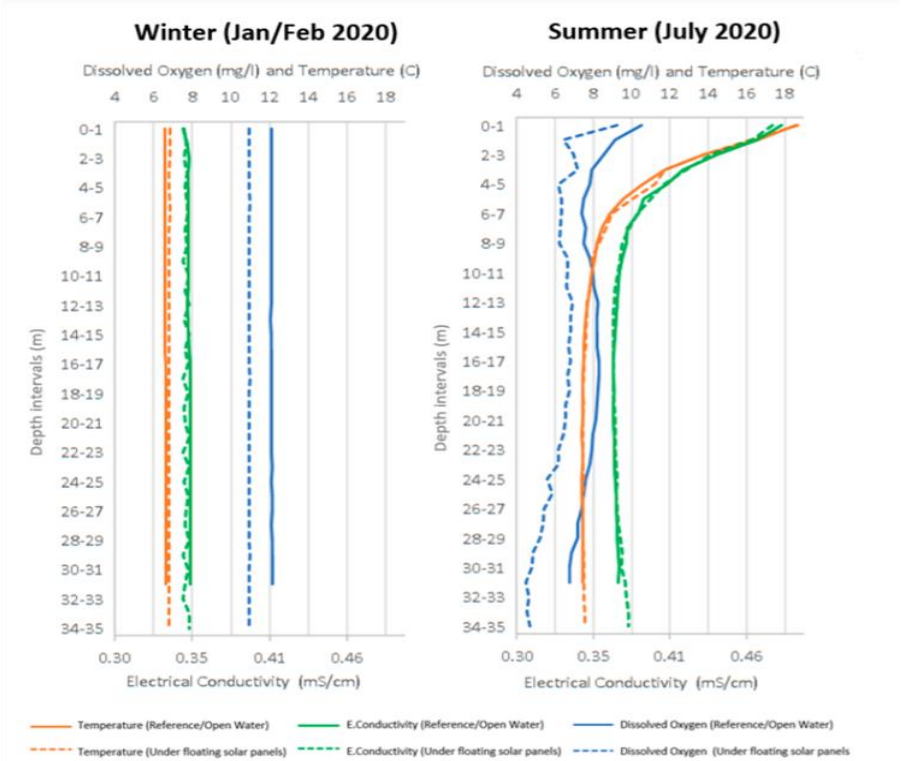
Oxygen-dynamics in deep water bodies

Deep water bodies (> 30ft) with high coverage FPV-systems

Same results of oxygen-dynamics (near surface)

de Lima, Rui L. Pedroso, et al. *Sustainability* (2021)

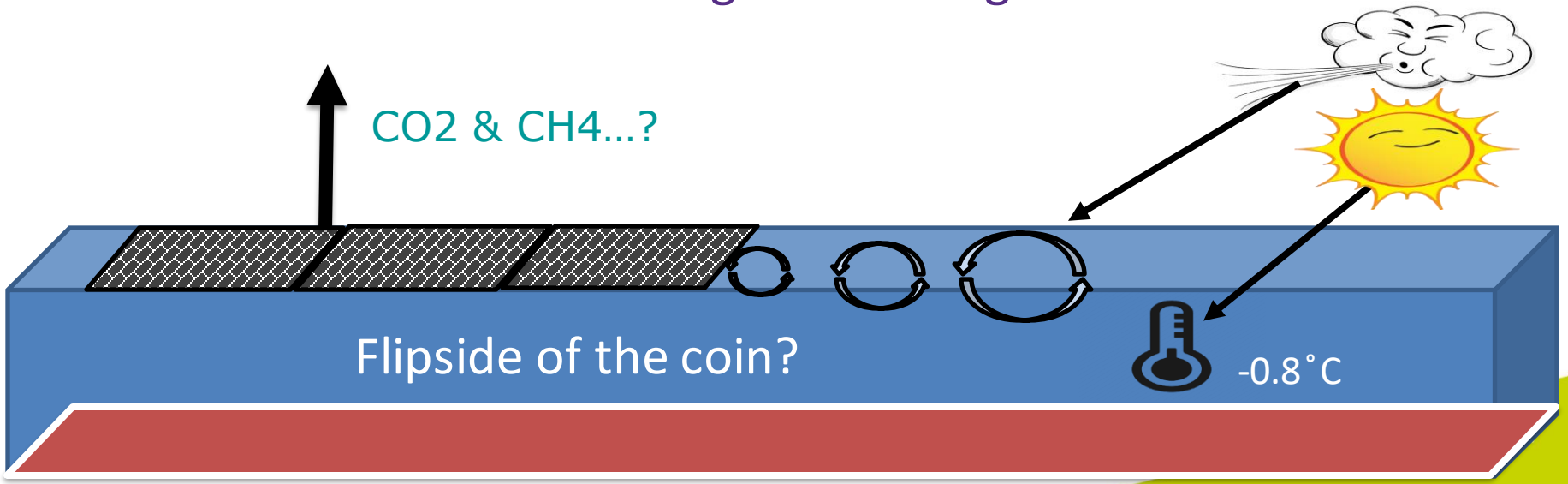


Results: less light and …. less wind

- Shift of plant species and bio mass → >3x more organic sedimentation
- More low-oxygen / anoxic conditions

Combined →

- Decomposition of organic material without oxygen and an increased chance of **more** greenhouse gas emissions….



Take out

First study (2018-2021)

- FPV potential (including sun tracking)
- Ecological impact
- Greenhouse gass emission?
- Flexible FPV system
  - No impact on maintanance
  - Potential to prevent ecological impact?

Follow up…. New research (2022-2024);

- Coverage versus ecological effect + greenhouse gass
- New insights for: cost reduction, optimalisation FPV-system & shared use
- The bigger picture…

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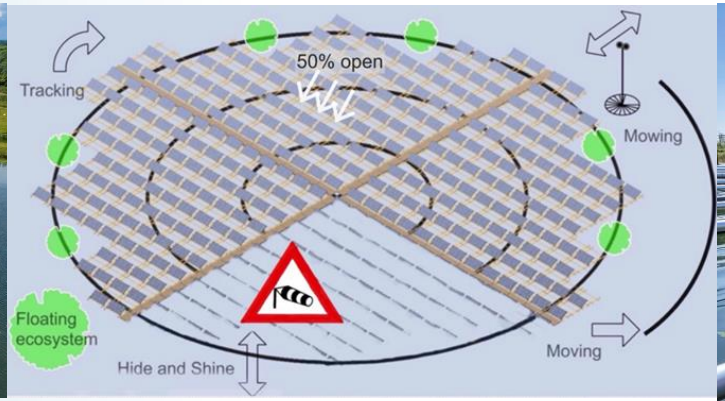
Follow up (2022-2024)

Integral design scale up installation

- Variabel (50%-70%) coverage (light)
- High heels (wind)
- Bow thrusters (suntracking & sediment)
- Automated maintanance water vegetation
- Field displacement (eco-crop rotation)

Scale up!
+ greenhousegas

Flexible
suntracking + displacement



learned lessons
open & high heels

Water as leading principle

To determine coverage, effect, additional solutions

Keeping balance (in space & time)

- FPV always has an ecological effect → What this means on the long term is yet unknown;
- FPV must be seen as an additional pressor on existing ecological quality of waterbodies and their surroundings;
- System services provided by water (fe. cultural /recreation, production /drinkingwater), reglulating climat-function) are already under pressure;
- Ecological quality and systems services of water alter in time.

Additional solutions should be taken to;

- Compensate negative inpact (build back better)
- Adapt to new challenges/opportunities/situations (get smarter)

Discussion

1) It's a no-brainer that floating (PV)structures on water have an ecological impact.

2) There is no time to wait for scientific proof of possible effects on ecology and greenhouse gas emissions. We can and must smarten up now

3) The ecological effects of "using water" do not always have to be negative. Strategies for floating solar/ development need to be more inclusive and environmentally aware