



DANISH IP FAIR

Inventions from Danish Research Institutions

Inventions represented at Danish IP Fair 2018

Energy and Environment

This document contains one-pagers for all inventions within **Energy and Environment** presented at the Danish IP Fair 2018. You can use this document to identify meeting partners at the event. Each invention is marked with a unique ID at the top right of the page. Use this ID to look up and book a meeting with the inventor(s) at the Danish IP Fair website - www.dipfair.dk.

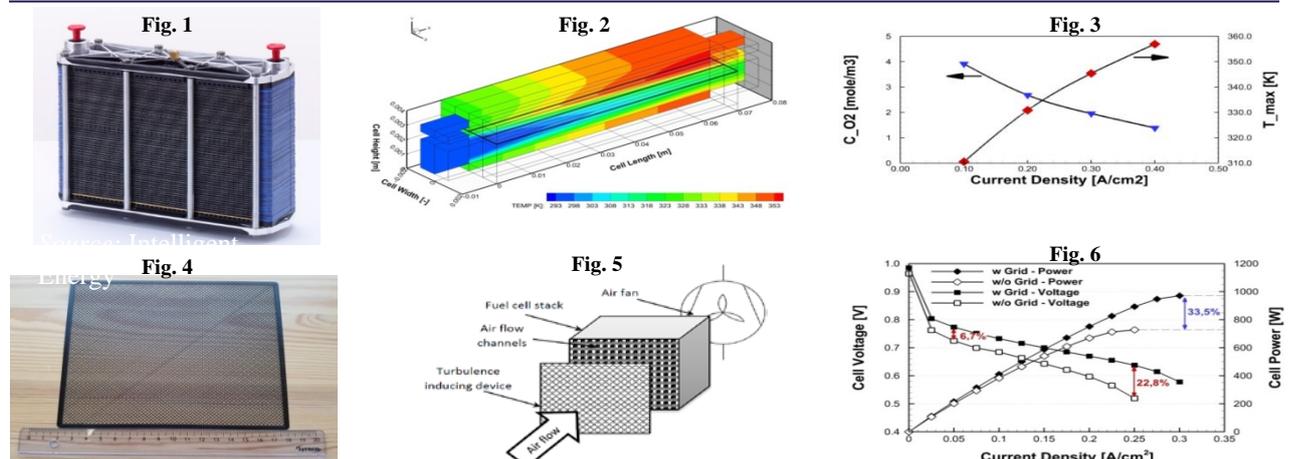
The document will be updated regularly in the period February-April, so ensure to re-visit the website for the newest version.

For further guidelines regarding meeting bookings please consult the menu Matchmaking on the website.



TurbuGrid – a turbulence inducing device

- Significantly improving performance & scalability of air-cooled fuel cells



Value Proposition/USP

Air-cooled proton exchange membrane fuel cells have been commercialized for mobile/stationary applications such as telecom back-up power, and are being considered as range-extenders for battery powered vehicles because of their simplicity. However, wider market use of these air-cooled fuel cells has been limited due to high cost and size restrictions. But not any more!

Proof of Concept tests, has shown that by

- Adding a simple turbulence inducing grid, costing less than 1 USD in mass production,
- Improved power density/efficiency of at least 33,5% for a retro-fitted fuel cell stack is achieved,
- When optimized for mass production cost reductions of a new fuel cell stack by 50%, maybe more, can be attained.

Business Opportunity/Objective/Commercial Perspectives

As scaling and performance of air-cooled proton exchange membrane fuel cells can be improved dramatically, while reducing overall costs of the fuel cell products. This invention of a simple turbulence inducing grid, provides the basis for a market breakthrough, for air-cooled proton exchange membrane fuel cells, both in the current market applications, and opening up for new markets.

The turbulence inducing device enables manufacturers to produce

- Air-cooled proton exchange membrane fuel cells, with much higher rating, and/or
- Smaller foot print fuel cells, with at least same rating as current products, opening up for uses, where space/weight is highly restricted.

Technology Description/Technology Summary

Air-cooled low temperature proton exchange membrane fuel cells (Fig. 1) suffer from low limiting current density, resulting in low power density. A detailed computational fluid dynamics analysis (Fig. 2), has revealed that the underlying reason for the low current density is membrane overheating (Fig. 3). The electrolyte membrane in the center of the fuel cell can not withstand temperatures above 90 °C, which is encountered already at very low current density (around 0.4 A/cm²), severely limiting efficiency and scalability.

The TurbuGrid (Fig. 4) was placed in front of the fuel cell, mixing the air stream passing through the fuel cell (Fig. 5). Thereby eliminating the temperature hot spot inside the fuel cell, and reducing fuel cell temperature, so the current density, power density and fuel cell efficiency could be significantly improved (Fig. 6), thus enabling significant cost savings on new Air-cooled proton exchange membrane fuel cells.

Development Phase/Current State

Proof of Concept has been made in the laboratory on standard, air-cooled stacks from Ballard Power Systems, optimizing the effect of turbulence generating grids, placed at varying distances from the fuel cell stack.

The inventors

Torsten Berning,
Associate Professor

tbe@et.aau.dk

Contact Information

Lars Halkjær,
Technology Transfer Manager
+45 9940 7343, lah@adm.aau.dk

Seeking

- Licensee / IPR Sale
- Research Collaboration

Patent pending

healthycrop.world

- *Fusarium* resistant GM Soybean, Maize, Rapeseed and Cotton



Towards a pesticide-free agriculture
Nepenthesin is a naturally-occurring enzyme in the pitcher secretions of the carnivorous Nepenthes plants (to the left). Enhanced expression of Nepenthesin in crops hinders growth and toxin production of Fusarium and other fungi. healthycrop.world provides GM crops with this ability, enabling reduced use of fungicides and better farm economic results.

Value Proposition

Worldwide breeders: major GM crop seeds with a unique add-on functionality. Farmers: Towards a pesticide-free agriculture. Improve yield and produce quality. Avoiding loss of crops. Reduce the need of rotation of crops. Reduced field work. Reduce risk and cost during transport and storage. Avoid formation of mycotoxins fatal to animals. Society: Sustainability, lowered risk of toxicosis.

Commercial Perspectives

The global seed market grows 7-10% CAGR to reach to ~€100 billion in 2022. "The Big 4" GM crops (see headline) will be then be grown on ~210 million ha constituting a seed value at ~\$40-60 billion. We license pre-breeding material that seed breeders worldwide may exploit in their proprietary seeds. Our target is to enter licenses valued at ~2% of the turnover of ~5% of this market.

Technology Description

The invention provides a GM plant with a recombinant DNA construct comprising a gene encoding for Nepenthesin - an enzyme having aspartyl protease activity. Enhanced expression of Nepenthesin confers enhanced fungal disease resistance (*Fusarium* and *Aspergillus*) by inhibiting the fungal production of phytase, an enzyme essential for releasing phosphate required for fungal growth. The result is hindered growth of the fungi and reduced toxin production. As the mechanism is via "starvation", the risk of fungal resistance is low.

Development Phase

The invention has Proof-of-Concept based on transgenic model Barley (*Hordeum vulgare*). This includes documentation for the characteristics of the Nepenthesin-encoded Barley, the phytase-mediating effect of the transgenic plant, as well as the plant's ability to resist inoculation with *F. graminearum* and *F. culmorum* including absence of toxins (deoxynivalenol, nivalenol and zearalenone). A business and development plan has been compiled, and a team of scientists and business executives are eager to get this invention on market.

The inventors

Henrik Brinch-Pedersen, Professor
Zelalem Eshetu Bekalu, Postdoc

Contact Information

Jan Mousing
Business Manager
+45 51337395
Jan.mousing@au.dk

Seeking

- Funding/Investors
- Licensee
- Partner/Research Collaboration
- IPR Sale

Nepenthesin and other proteases [.....] ID: TECH-2017-631-027. Priority date 20 September 2017

A Two-terminal Active Inductor Device

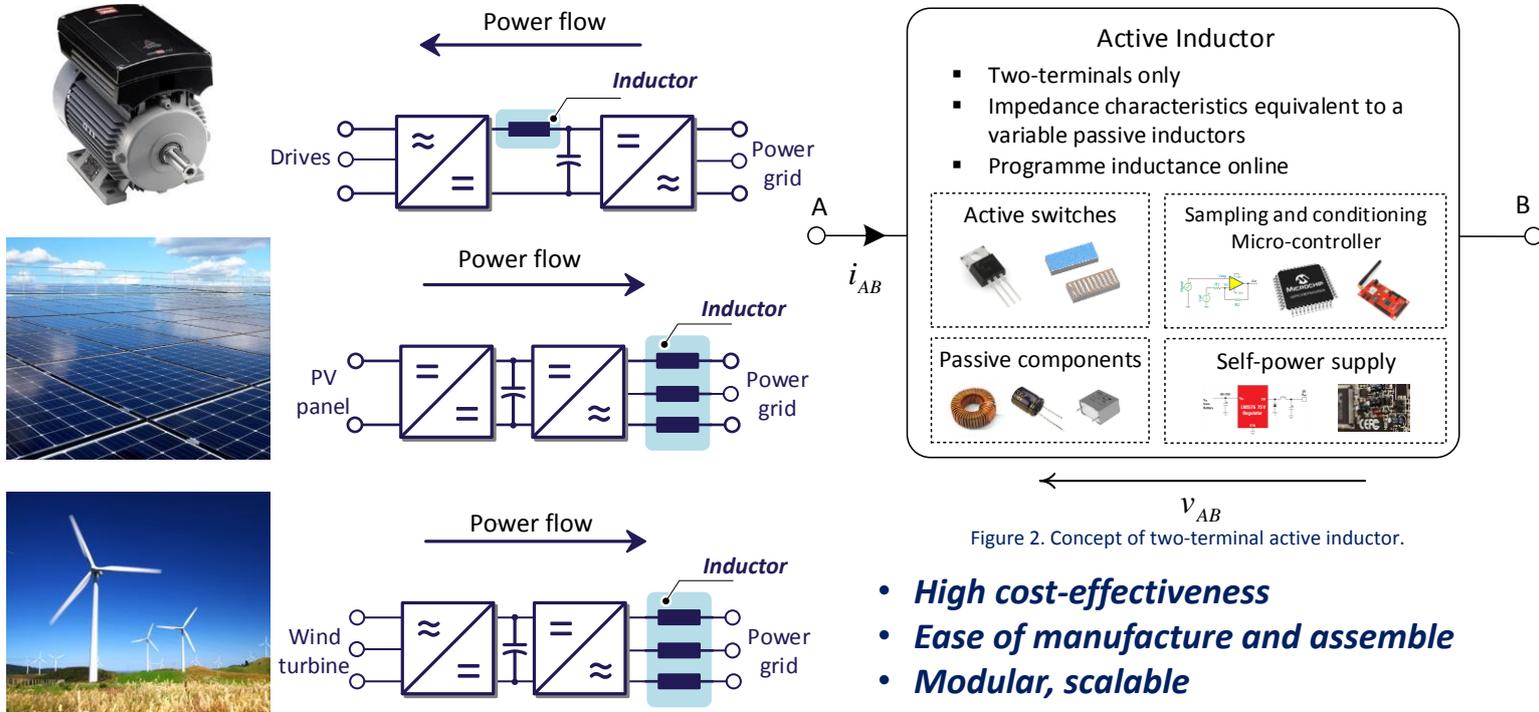


Figure 1. Applications for the inductor.

Figure 2. Concept of two-terminal active inductor.

- **High cost-effectiveness**
- **Ease of manufacture and assemble**
- **Modular, scalable**
- **Online tuning of parameters**

Value Proposition/USP

- The invention offers a two-terminal active inductor device, with demonstrated capability to achieve variable inductance, potentially reducing the cost, size and weight by 50% compared to a passive capacitor of same rating.
- To end-user, the two-terminal active inductor will look the same as a conventional inductor, as it has two terminals, so it can easily replace existing inductor in any product.
- The two-terminal active inductor device can be produced with wireless connection. And as the inductance can be programmed online, manufacturers are enabled to optimize production, and reduce the number of product variants.

Business Opportunity/Objective/Commercial Perspectives

- Inductors is a 5 billion dollar industry by 2022 from "Global discrete inductors market report" by Global Industry Analysts, Inc, 2016.
- The invented variable active inductor can directly replace passive inductors in general AC and DC power electronic applications.
- Producing these new two-terminal active inductor device, requires standard electrical production skills. The products can easily be implemented in current production facilities. Or form the basis of a startup.

Technology Description/Technology Summary

- This active inductor has two terminals with no need for additional connection, making it possible to be packaged as a conventional inductor.
- Significantly reducing the required inductance and increasing the energy density, while improving the performance, efficiency, reliability, and reducing the overall cost.
- Further, the inductance can be programmed online.

	Passive	Active
Inductance	100 %	≈ 10 % -500 %
Cost	100 %	≈ 50 %
Size	100 %	≈ 50 %

Development Phase/Current State

Proof of concept has been achieved in a partial functioning prototype. A programmable two-terminal active inductor is implemented for the DC-link filter of a 960 W three-phase diode rectifier. The required energy storage of the active inductor in this application is 42 % of the passive inductor to fulfill the same specification, while current ripple for both can be limited to 20 %.

The inventors

Huai Wang, Asso. Professor hwa@et.aau.dk
Haoran Wang, PhD Fellow hao@et.aau.dk

Contact Information

Lars Halkjær,
TTO Manager, +45 99 40 73 43
lah@adm.aau.dk

Seeking

- Funding/Investors
- Licensee
- IPR Sale

Patent Pending

A Two-terminal Active Capacitor Device

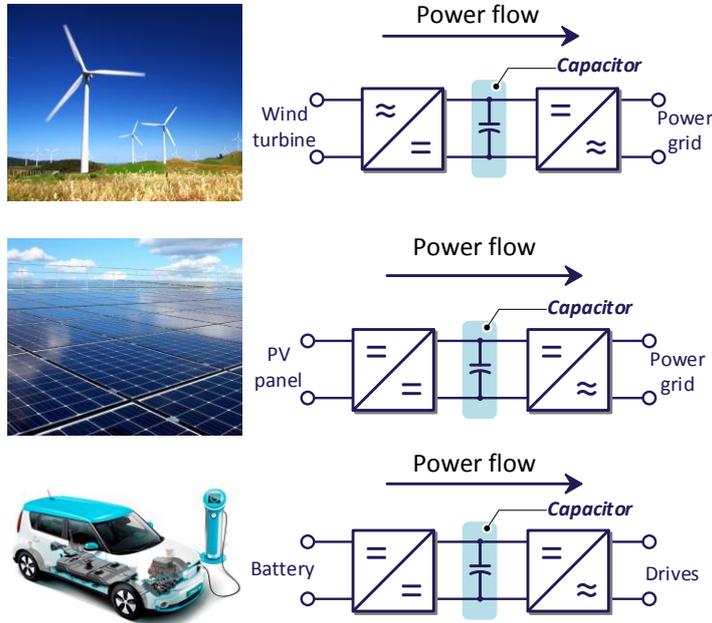


Figure 1. Applications of capacitor.

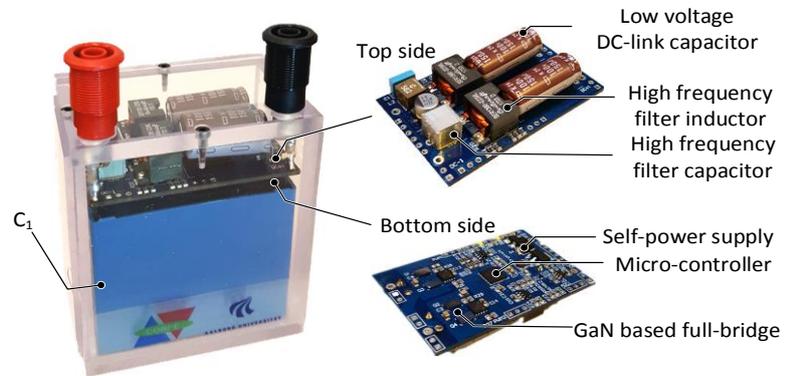


Figure 2. An active capacitor prototype uses 16.9% energy storage of a passive capacitor to fulfill the same design specifications.

- **High cost-effectiveness**
- **Ease of manufacture and assemble**
- **Modular, scalable**
- **Online tuning of parameters**

Value Proposition/USP

The invention offers a two-terminal active capacitor device for DC and AC applications, with demonstrated capability to achieve variable capacitance, more than doubling capacitor lifetime, or potentially reducing the cost, size and weight by 50% compared to a passive capacitor of same rating. To end-user, the two-terminal active capacitor device will look the same as a conventional capacitor, as it has two terminals, so it can easily replace existing capacitors in any product. Finally, the two-terminal active capacitor device can be produced with wireless connection. And as the capacitance can be programmed online, manufacturers are enabled to optimize production, and reduce the number of product variants.

Business Opportunity/Objective/Commercial Perspectives

- Capacitors is a 25.7 billion dollar industry by 2020 from "Global discrete capacitors market report" by Global Industry Analysts, Inc, 2015.
- The invented variable active capacitor can be used to replace passive capacitors in general power electronic applications, especially for AC and DC-link applications, online damping for stability, adaptive energy buffering, etc. Thereby making it applicable for major market segments includes power supplies, power transmission and distribution, drives, inverters, motors, etc.
- Producing these new two-terminal active capacitor device, require standard electrical production skills. The products can easily be implemented in current production facilities. Or form the basis of a startup.

Technology Description/Technology Summary

- This active capacitor has two terminals without any additional connection, making it possible to be packaged as a conventional capacitor.
- It is potentially reducing the cost, size and weight and improving the reliability performance.
- The active capacitor can be used for both DC and AC applications.
- Further, the capacitance of the active capacitor can be programmed online.

	Passive	Active
Capacitance	100 %	≈ 10 % -500 %
Cost	100 %	≈ 50 %
Size	100 %	≈ 50 %

Development Phase/Current State

Proof of concept has been achieved in a laboratorial prototype. A case study has demonstrated a programmable capacitance from 5% to 100% of maximum value. For a 500 W single-phase application, it is around 36% cost reduction with a target of 30 years of lifetime, compared to an optimal passive capacitor solution, while both DC-link voltage ripple can be limited into 5 %.

The inventors

Huai Wang, Asso. Professor hwa@et.aau.dk
Haoran Wang, PhD Fellow hao@et.aau.dk
Frede Blåbjerg, Professor fbl@et.aau.dk

Contact Information

Lars Halkjær,
TTO Manager, +45 99 40 73 43
lah@adm.aau.dk

Seeking

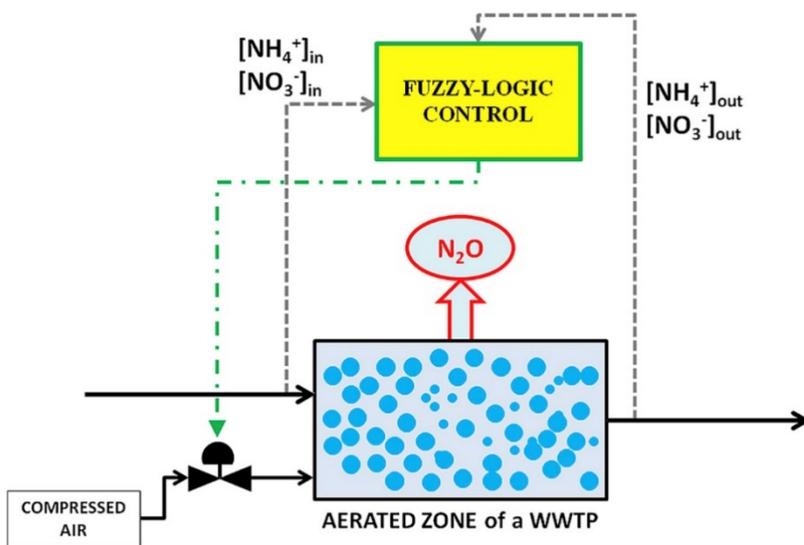
- Funding/Investors
- Licensee
- IPR Sale

Patent Pending

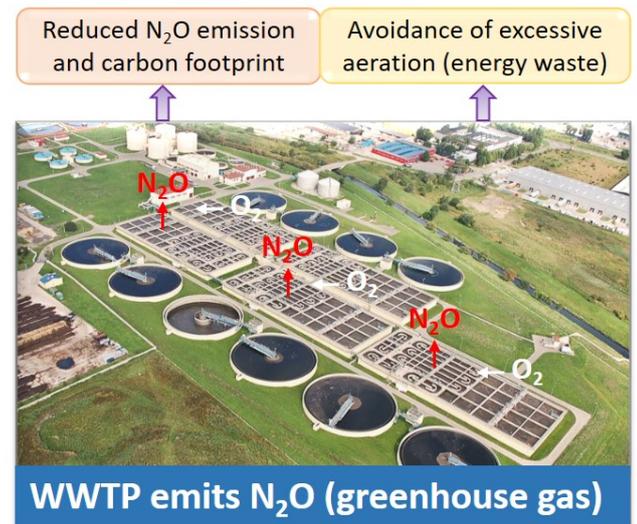
Control of N₂O Emissions by Aeration

- for a greenhouse gas neutral wastewater treatment plant

CONTROL CONCEPT



BENEFITS



Value Proposition/USP

Through manipulation of aeration, the control technology will reduce N₂O emissions from wastewater treatment plants (WWTPs) without significantly compromising C and N removal performance. By incorporating the control technology into the SCADA (supervisory control and data acquisition) system, WWTPs will be able to visualize real-time N₂O emissions and achieve significant N₂O emissions and carbon footprint reduction. According to Frost & Sullivan, process control technology accounts for 15 billion USD market in global water service and utility sector.

Business Opportunity/Objective/Commercial Perspectives

Potential customers are water companies and wastewater treatment facilities which are seeking or will seek practically feasible control technologies for N₂O emissions to reduce carbon footprint. The control technology will also minimize potential energy waste in the form of excessive aeration, thus reducing operational cost whilst ensuring satisfying treatment performance.

Technology Description /Technology Summary

Both N₂O emissions and effluent quality are considered as control objectives. The control technology uses real-time measurements of influent and effluent characteristics as well as temperature in the aerated treatment tank as input for the fuzzy logic controller. Based on the predefined control rules by mathematical modelling in conjunction with expert knowledge, the fuzzy logic controller generates output regulating aeration in the treatment tank.

Development Phase/Current State

The control technology for N₂O emissions has been patented and is now being tested at Avedøre WWTP. The control technology is being tailored for the SCADA system of Avedøre WWTP and will be evaluated comprehensively and improved progressively. The testing is expected to finish on July 31, 2019.

Further control technologies will be developed based on the performance of the patented control technology during the full-scale testing phase.

The inventors

Boiocchi R, Germaey K, Sin G*
*Associate Professor at DTU
Process and Systems Engineering Center
gsi@kt.dtu.dk

Contact Information

Gürkan Sin
Building 229, Søltofts Plads, Technical
University of Denmark, 2800 Kgs. Lyngby
Tel: +45 4525 2980, E-mail: gsi@kt.dtu.dk

Seeking

- Funding/Investors to support further development of new control strategies
- Partner/Research Collaboration to test/demonstrate control strategies
- IPR Sale

Intellectual property currently owned 100% by DTU (Patent No. 81602701DK00)

Solar Rechargeable Redox Flow Cells

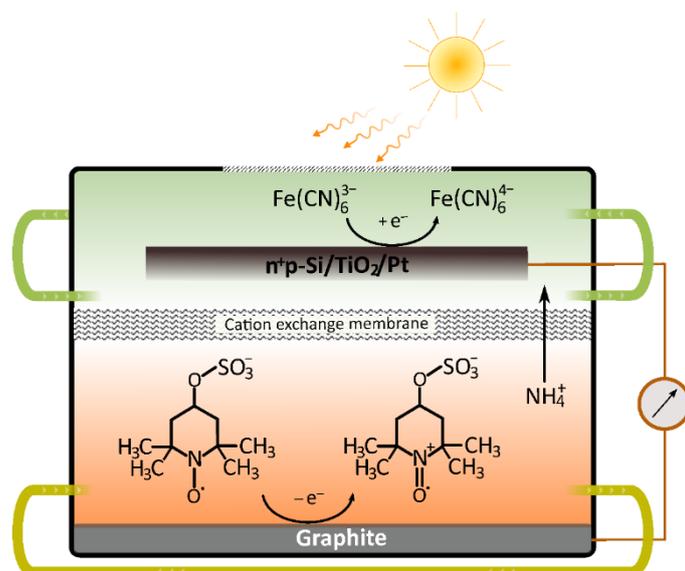
Since electrical energy from renewable sources does not match the instantaneous needs (non-dispatchable), it is necessary to develop storage systems.

Redox flow batteries are devices made up of an electrochemical stack, where electrical energy is converted into chemical energy (charge) and vice versa (discharge).

The advantage of redox flow batteries compared to conventional batteries is that the electrochemical energy is stored in liquid electrolytes. The storage capacity of a redox flow battery relies on the volume of electrolyte instead of the device's volume, while its power relies on the size of the battery, giving much flexibility.

Here, the solar charging process takes place via photoelectrodes that absorb sunlight and transform the electrolytes to their charged electrochemical form.

This technology will materialize in a device for charging the redox flow battery directly from sunlight, with a high level of efficiency.



Value Proposition

A solar rechargeable redox flow cell is a multi-functional device that can simultaneously capture and store solar energy cost-effectively, thereby giving it applications in domestic behind-the-meter and off-grid energy storage systems. The main advantage lies in its integrated nature (one device) which can be superior to comparable multi-step technologies.

Business Opportunity

This technology is of interest to redox-flow battery manufacturers and solar panel manufacturers. The technology could be licensed if these companies want to develop their own device or cooperation in R&D can be achieved to develop a new redox flow battery solution with this technology embedded. For solar panel manufacturers this could be a move to expand their market and to create a device to recharge redox flow batteries, allowing incorporation of these batteries into superior products.

Technology Summary

The present invention discloses a process for charging a redox flow battery directly from sunlight, through chemical conversion. It also relates to a solar rechargeable redox flow cell and its operation. This process can be described as the use of photoelectrodes which absorb sunlight and upgrade electrolytes to their charged electrochemical form. This technology will materialize in a device for charging the redox flow battery directly from sunlight.

Development Phase

The technology readiness level (TRL) of the technology is 3 (experimental proof-of-concept). The technology is co-owned between Aarhus University and University of Porto.

The inventors

Anders Bentien, Associate Prof.
Adélio Mendes, Full Prof.
Luísa Andrade, Assistant Researcher

Contact Information

Conny Lund Tegtmeier
TTO Manager Aarhus University
+45 40 17 97 49
clt@au.dk

Seeking

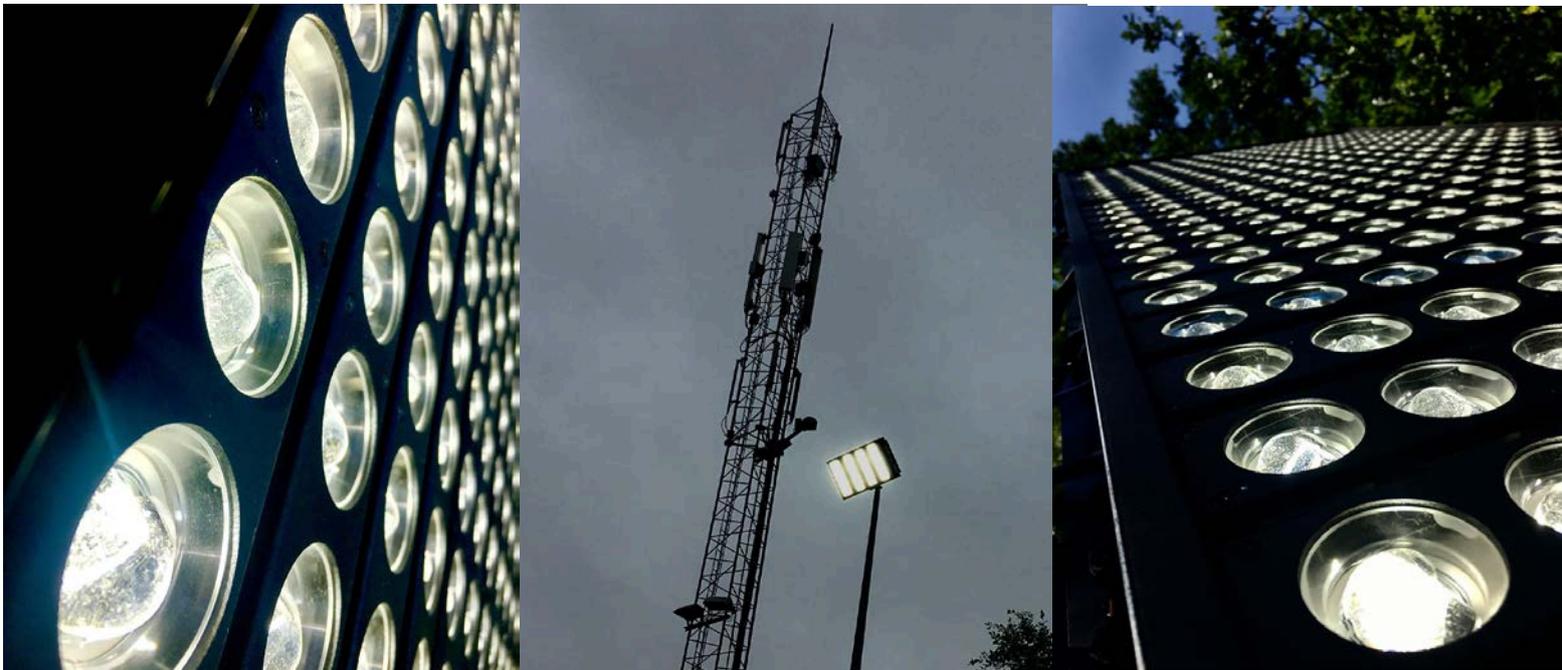
- Product development (R&D) collaboration
- Licensing agreement

European patent granted, n. 3105811, granted in 2018. USA patent in request n. 15/117,634, filed in 2016.



LED LigaLight

Cutting the Edge of Light Pollution



Cutting the Edge of Light Pollution

Existing stadium lamps cause significant light pollution outside the stadiums to the great annoyance of nearby neighbors and harm to the surrounding wildlife. LED LigaLight is cutting the edge of this light pollution by limiting the light to the stadium where it is needed – and nowhere else. The precisely controlled light is made possible by the use of a series of finely cut prisms designed specifically for stadiums. The prisms are powered by energy efficient LEDs and controlled by a built-in IOT solution.

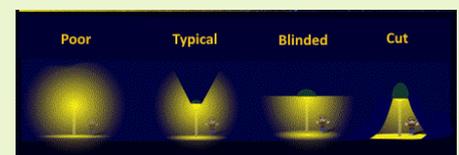
From Football to Tennis, Playgrounds, City-parks, Wildlife Protection, Logistics and Parking-areas.

The technology can easily be traversed from football stadiums into other outdoor sports areas like tennis courts, equestrian areas (horses) as well as golf courses, motorsports and ice hockey. Recreational areas like city-parks and playgrounds, old town squares and centers, camping parking lots and wildlife protection station could also benefit from a precise, pollution free illumination. Potential industrial applications include light for logistic terminals in harbors, airports and railroads as well as greenhouses, farming areas and food and beverage production or high-end electronics, where precise light solutions are needed.

A Cutting Edge Sustainable Technology

The technology has been developed in a joint EU project between DTU and the private startup company NorthLED. The core technology consists of 3 things in a combined and tested solution:

1. Precisely cut and concentrated illumination modules (Prisms and Lenses)
2. First grade electronic elements and components from world-class vendors
3. Intelligent, user-friendly IOT based operations and interoperability which can adapt to local
4. circumstances and conditions like e.g. the weather, the actual usage and system performance/efficiency.



Will You be Part of the Expansion?

LED LigaLight has successfully been installed in a football stadium in Roskilde, and two additional stadium projects have been won. The company now wants to accelerate the growth by inviting investors to participate in the expansion. The funding will be used for penetrating the stadium markets in Denmark & Northern Europe and to establish a viable business plan for the recreational and industrial markets.

The inventors

Henrik Chresten Petersen, DTU
Kenneth Saxskiold, NorthLED

Contact Information

Kenneth Saxskiold-Nørup
Partner
+45 30892427

Kenneth.saxskiold@northled.dk

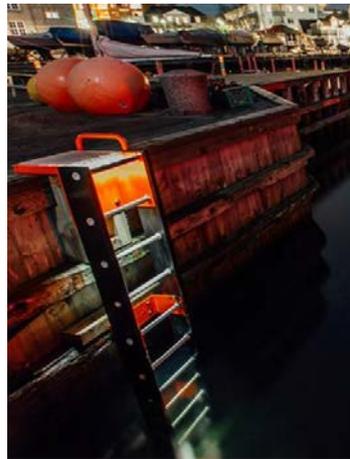
Seeking

- Funding/Investors
- Partner/Research Collaboration

FIREFLY

Nordic
FIREFLY

Converter electronics enabling high efficient solar powered lighting



Value Proposition/USP

The FIREFLY enables solar powering of your lighting system. It offers ultra high efficient energy conversion, superior reliability, long life-time and is plug-and-play.

Business Opportunity/Objective/Commercial Perspectives

The lighting business has undergone a technology transition to LED lighting. It has been a major challenge since the light source is fundamentally different from the earlier light sources used. Both the solar cells and the LED comes out of the electronics business, and fit perfectly together in a low voltage DC system. Delivering a plug-and-play ultra high efficiency converter system the FIREFLY makes almost any lighting system a solar powered lighting system.

Technology Description/Technology Summary

The FIREFLY builds on a 3-port converter architecture highly reducing the BOM, cost, size and volume. It has ultra high efficiency in all energy conversion steps and is very versatile enabling integration in almost any lighting product.

Development Phase/Current State

A number of prototypes have been performing flawlessly in several customers products for more than 1 year nationally and internationally. It is now undergoing CE/FCC/UL tests.

The team

Jørgen Kejlberg DTU AIS
Rasmus Overgaard Ploug DTU Elektro
Sune Thorsteinsson DTU Fotonik
Peter B. Poulsen DTU Fotonik

Contact Information

Jørgen Kejlberg
Anker Engeldunds Vej 1, Building 101
2800 Kgs Lyngby
Mail: joke@dtu.dk
Phone: +45 2465 1546

Seeking

- Funding/Investors
- Partner/Research Collaboration

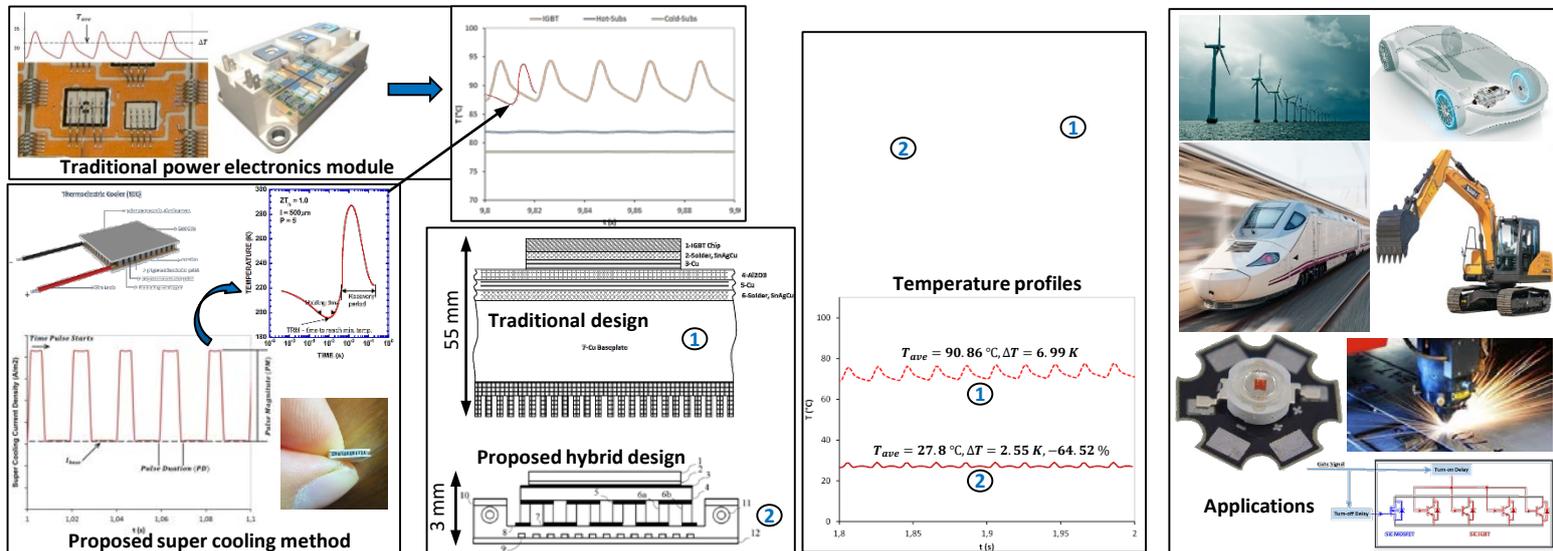
Intellectual property rights

DTU Pat. Number 95727/WO2016170184/2015-04-23

The IPR is covering an extremely efficient and BOM-reducing way of converting energy from solar to battery and from battery to LED lighting.



Smart & compact supercooling of power electronics with reduced amplitude temperature variations



Value Proposition/USP

- This invention proposes a super cooling method for **significant reduction** of both **average** temperature and temperature **oscillation** in power electronics devices. In comparison with traditional power electronics, the super cooling device is able to reduce the **temperature oscillation of the power electronic chip by 70 %** while the **average temperature is kept at ambient environment** temperature.
- The present invention provides a method of **minimizing thermal stress** of a semiconductor chip or **enhancing current density** through an existing power electronic module.

Business Opportunity/Objective/Commercial Perspectives

- The proposed technology moves the high temperature zone from the semiconductor to the heat sink, by immediate response to current variations, giving much reduced cooling system footprint as well as wider operational window of power electronics.
- The micro-structured heat sink together with thin film cooling elements open a new window for hybrid power electronics modules, operating as independent power electronic systems, and enhances system design flexibility by creating independent island-like modules.
- This technology is most suitable for high temperature applications, so that the chip is able to operate close to the coolant fluid temperature (e.g. oil) and low temperature semiconductors (Si) can be used instead of high temperature semiconductors (SiC).
- Since the temperature oscillation of the semiconductor and its solder layer drops, the thermal stress reduces and life time of the power electronic modules enhances significantly. This technology can be utilized in high density power electronics industries, such as wind turbine, electric car, train, digging machine, light emitting diodes, laser, etc.

Technology Description/Technology Summary

- The method comprises the steps of establishing a periodic super cooling pulse matched with device modular frequency by a thermoelectric cooling device thermally connected to the semiconductor chip.
- The super cooling period partly overlaps the temperature increasing period, and the recovery period of the cooling period partly overlaps the temperature decreasing period, in the semiconductor chip, thereby peak shaving at both high and low temperatures.
- The super cooling current, imposed into the thermoelectric cooler, includes optimal values of base current, pulse magnitude, pulsing period, and time when the pulse is enforced

Development Phase/Current State

Significant amount of simulations, both in fundamental level and 3D calculation environment, are considered. Proof of concept has been achieved in an initial design prototype, and the simulations show good agreement with the experimental validation. The manufacturing process of efficient super and smart cooling technology is documented.

The inventors

Alireza Rezaniakolaei alr@et.aau.dk
 Lasse A. Rosendahl lar@et.aau.dk
 Meysam Karimirad mek@et.aau.dk
 Ali A. Enkeshafi aae@alpcon.dk

Contact Information

Lars Halkjær
 TTO Manager
 +45 9940 7343
lah@adm.aau.dk

Seeking

- Funding/Investors
- Licensee
- Partner/Research Collaboration
- IPR Sale

Patent Pending

Green Diesel and Chemicals from Biomass Waste

A one-step process without catalyst or hydrogen

35% of all plant biomass is lignin

95% of lignin is burned as low value fuel

A third of plant biomass is underutilized

Demand

low sulfur fuels



Supply

low sulfur lignin



Value Proposition/USP

- Bio-refining: Improve revenue (valorize large waste stream) and increase independence on tax incentives and subsidies
- Fossil refining: Increase addressable market (transition to sustainable fuels) while utilize existing equipment

Business Opportunity/Objective/Commercial Perspectives

- Demand for **200 million ton p.a.** low sulfur marine diesel in 2020 (~100 billion USD).
- Large ship engines can burn more crude fuels (a simple process to yield bio-crude is sufficient)
- A blend solution (bio-crude and fossil diesel) can penetrate 10% of low sulfur marine diesel market (~10 billion USD)

Technology Description/Technology Summary

- We have developed a novel and simple process in which biomass waste (lignin) is “cooked” in ethanol thereby converting it to a bio-crude in one step.
- No catalyst or hydrogen needed
- The bio-crude likely satisfies marine fuel standards as is or can be upgraded to high value chemicals

Development Phase/Current State

- Batch experiments conducted (1-10 ml oil per day)
- Next step is more industrially relevant continuous setup (100 ml oil per day) (novel reactor designed)
- The project has previously received DTU PoC funding (2017), Climate KIC funding (Nordic Ideation Day, 2017), and the technology was shortlisted as a finalist at Royal Society of Chemistry’s Emerging Technologies Competition (2017)

The inventors

Joachim B. Nielsen (DTU)* jobni@kt.dtu.dk
Anker D. Jensen (DTU) aj@kt.dtu.dk
Anders Jensen (KU)

Contact Information

Hans Christian Holländer
AIS Business Development
+45 93 51 13 73
hcho@dtu.dk

Seeking

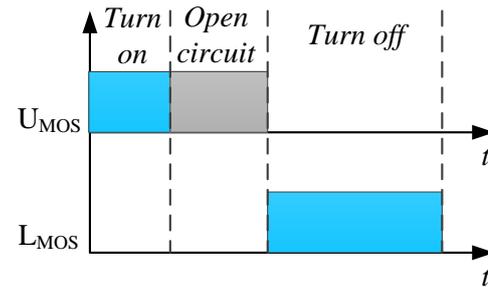
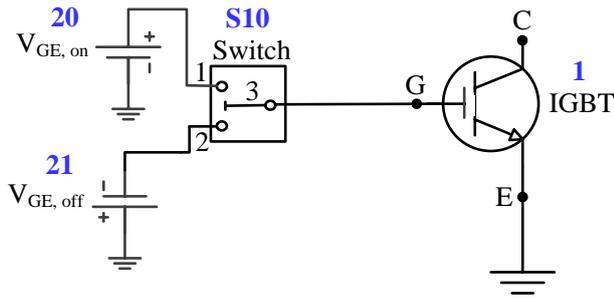
- Funding/Investors
- Partner/Research Collaboration
- IPR Sale/licensee

“Diesel-soluble lignin oils and methods of their production”, **WO2016113280 (A1)**, published 21 July 2016 (priority data: **EP3045513 (A1)**, 13 January 2015)



Gate Driver with Three-State Output

- A robust control to eliminate high-frequency oscillations



Value Proposition/USP

This invention presents a 3-state gate driver for voltage-controlled power devices with three output states: 1) turn-on state, 2) turn-off state and 3) open-circuit state. This gate driver implements a robust control method, which immediately eliminates high-frequency oscillations in power electronics, when changing the gate driver state from turn-on, to open-circuit state. Thereby securing smooth operation of your power electronics, including the capability to survive abnormal events, increasing reliability and availability of power electronics.

Business Opportunity/Objective/Commercial Perspectives

The invention is applicable to various voltage-controlled power devices (i.e., IGBT, MOSFET) and its implementation is basically for free. The required changes compared to traditional gate drivers can be implemented in one step as part of existing production processes, using basic circuit elements such as a capacitor, a variable resistor and a comparator. The invention is suited for power applications where a high robustness during short-circuit is important. In addition, the concept may be relevant in Gate Drive Design, providing the benefit that you can run tests on new ideas for voltage-controlled power devices without running the risk of destroying the device, thereby enabling an easier and more structured way to understand why errors detected occurred, and eliminate these in updated designs.

Technology Description/Technology Summary

Main characteristics of the developed technology:

- The gate circuit can be decoupled from the voltage-control device, eliminating ringing effects
- Robust short-circuit operation
- Overall increased reliability performance
- Noise disturbances propagating through the gate circuit cannot interfere with the device operation
- More controllability of paralleled power modules
- The method can be applied during the normal operation of the device
- Cheap solution and ease of implementation
- Possibility to increase the switching speed since ringing/oscillations will be mitigated
- The method can be implemented in combination to whatever short-circuit protection circuit

Development Phase/Current State

At present, simulations have been performed, showing that high-frequency oscillations are eliminated immediately, when the gate driver is set to open circuit. A proof of concept solution will be developed to further validate the concept.

The inventors

Paula Diaz Reigosa pdr@et.aau.dk
 Francesco Iannuzzo fia@et.aau.dk

Contact Information

Lars Halkjær
 TTO Manager
 +45 99 40 71 89
lah@adm.aau.dk

Seeking

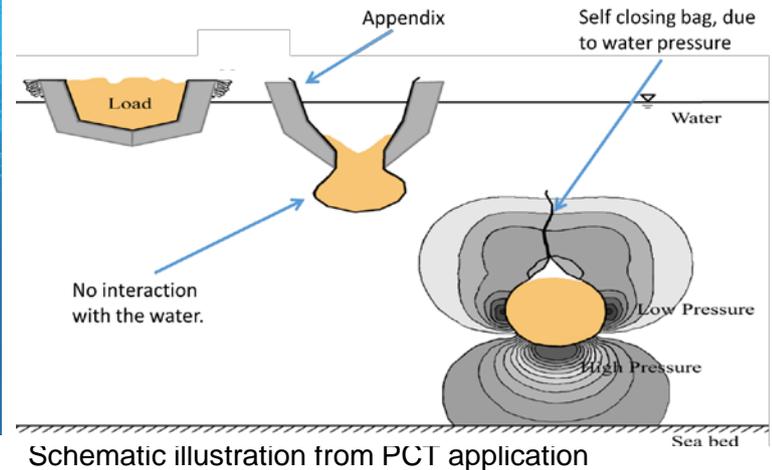
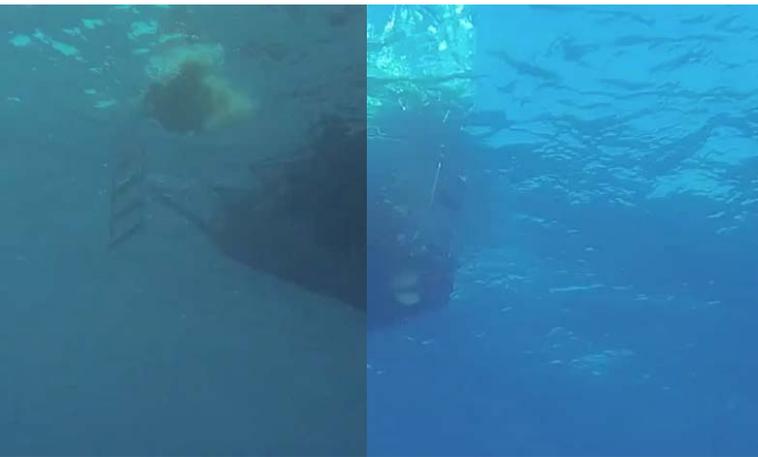
- Licensee
- IPR Sale
- Partner/Research Collaboration

Patent Pending

Energy and Environment

Reduction of the environmental impact from dredging operations

- and efficient, cheap and fast land reclamation



Conventional dredging solution

Patented dredging solution

Value Proposition/USP

The invention holds great potential because it:

- significantly **lowers the environmental** impact of dredging activities
- creates **faster** and more efficient **land reclamations** operations compared to existing solutions
- opens for useful and versatile usage of all types of marine materials in land reclamations
- **lowers the operation costs** and transportation time during maintenance dredging activities

Business Opportunity/Objective/Commercial Perspectives

Mitigating impacts of turbid plumes in the open sea from dumping of dredged spoils, is traditionally achieved by only dumping at predefined permitted sites, which are located sufficiently far "downstream" from sensitive receptors. Sites are typically in deeper waters with subdued currents, to ensure subsequent re-suspension events have a small probability of causing environmental impacts. When contaminated sediments are dumped in bags, these are manually laced-shut (stitched) before dumping.

Technology Description/Technology Summary

A shield bag with long attached sleeves has been shown to be effective in shielding the spoils from the water, after it is released by the split barge hopper. This ensures all the spoils quickly settles on the bottom, and avoid being mixed with the water. The bag automatically closes from the surrounding pressure, when released from the hopper. The benefits for dredging companies are:

- **Reduced transit time** to/from designated dumping grounds
- Reduce environmental impacts -> boost green profile
- Allows for **sediments to be used in land reclamation** operations effectively.

Development Phase/Current State

The solution has been tested at the DTU's basin for marine technology. Subsequent tests have been made successfully in the Mediterranean Sea, and full scale test are planned in Singapore harbor. As such the solution is conceptually proven and the next step is to test practical handling, i.e. placement on hopper, filling and dumping to the seabed in various weather and current conditions.

The Team

Jacob Hjelmager Jensen, *inventor*
Lasse Nørbye Døssing
Adam Hillestrøm
Jesper Holm Lundeman, *CEO*

Contact Information

Scandinavian Marine Technology ApS
Jesper Holm Lundeman, *CEO*
+45 53 29 24 46
Jhl@scandinavian-marine-tech.com

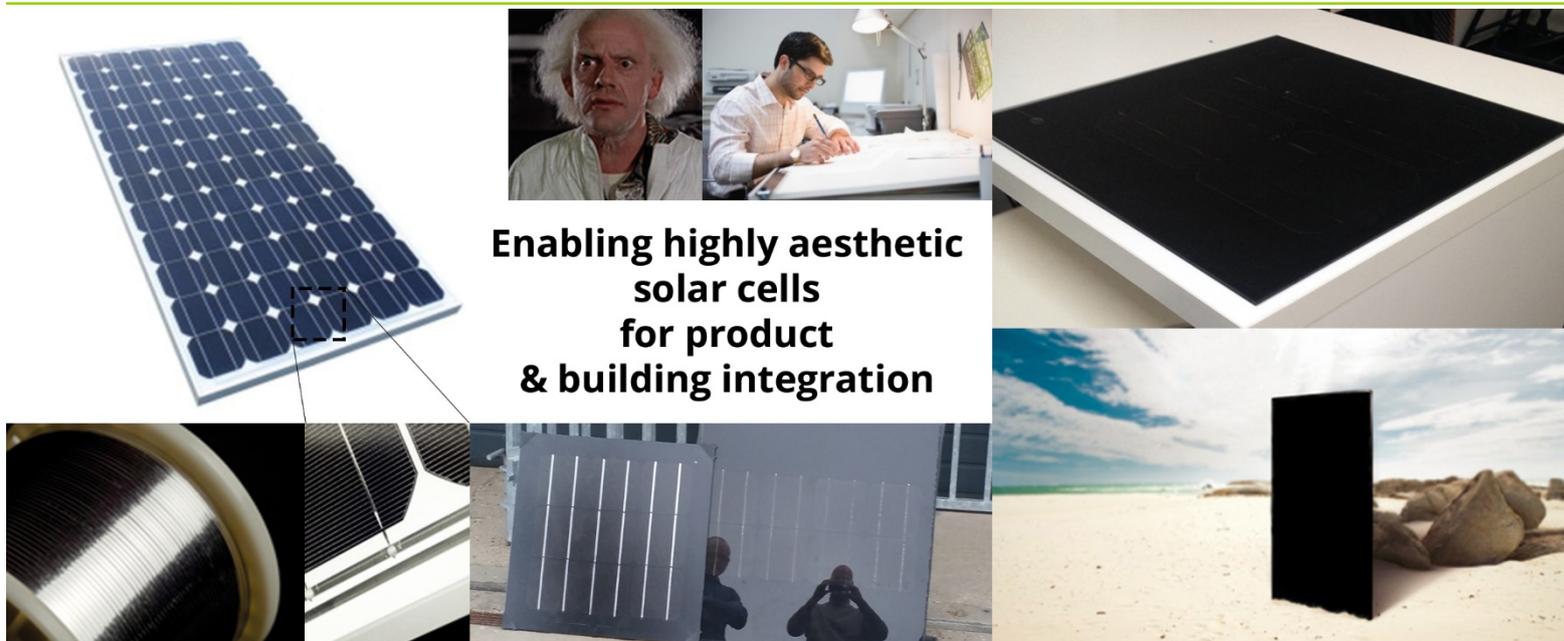
Seeking

- Funding/Investors
- Partner/Research Collaboration

The patent is currently in the national phase. The International application number is PCT/EP2016/066414

Black Solar Cell Strings

- Enabling aesthetic solar cells for products and building integration



Enabling highly aesthetic solar cells for product & building integration

Value Proposition

Ask the architects what their biggest resistance towards integrating solar cells into buildings is, and they will say it's the aesthetics. The future of the building skin is to provide services to the user and energy production is a very relevant service. This invention provides a solution to one of the major aesthetic obstacles – making the highly reflecting wires inside the solar panels beautiful.

Commercial Perspectives

- Dying of strings in solar panel production facilities or dying strings for solar panel manufacturers.
- Producing machinery for solar wire manufacturers.
- Realizing a machine platform environment for developing and selling machinery for the solar cell manufacturing business.

Technology Description

The purpose of the strings in the solar panel is to interconnect the solar cells in series to step up the voltage and carry the electrons out of the panel. A flat metal wire of tinned copper is used and it is manually or automatically soldered to the individual solar cells. The technology disclosed here is implementing an electrochemical dying process step that can be integrated in the standard process used today. The selective dying process makes it possible to keep the tinning where it should be soldered to the solar cells and the dyeing only where the string is exposed to the user.

Current State of the invention

Several process formulations has been shown to be able to dye the strings black. An automated machine is being build for demonstrating that the dying can be done automatically. DTU Fotonik in Roskilde has an state-of-the-art automated stringer machine being used in the solar panel industry and the dyed strings should fit perfectly into the stringer machines operation. The dyed strings has shown to have sufficient electrical conductivity and accelerated testing of its compatibility to the chemistry inside a solar panel will be tested in autumn of 2018.

The inventors

Rasmus Davidsen rasda@nanotech.dtu.dk
Peter Behrendorff Poulsen ppou@fotonik.dtu.dk
Sune Thorsteinsson sunth@fotonik.dtu.dk
Beniamino Iandolo benian@nanotech.dtu.dk

Contact Information

Katrine Kamph Slott Maarlev
TTO Manager
+45 60 15 58 73
kksma@dtu.dk

Seeking

- Funding/Investors
- Licensee
- Partner/Research Collaboration
- IPR Sale

A patent application is in draft

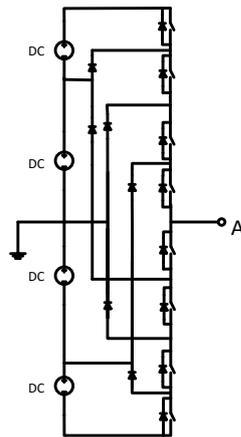


PN-Cell based Converters.

A new circuit is proposed and named PN-Cell

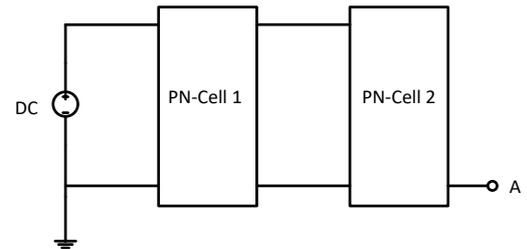
**Conventional
multilevel
converter**

5 Level:



**Proposed
multilevel
converter**

5 Level:



Value Proposition/USP

Simple serial connection of PN-Cells – Enabled by two fold functionality (i), (ii) of proposed PN-Cell:

- (i) transfer DC power energizing the next cell plus
- (ii) transfer AC power for the load

Only one DC source – removing need of complex voltage balancing

Standard multilevel PWM is used – simple to add new levels

Simplifying modular multilevel converter for motor drives and replacement of bulky grid transformers with light weight solid state converters.

Business Opportunity/Objective/Commercial Perspectives

Can replace existing 3-level converters with a simpler circuit and offer a solution for transformer less based DC to AC conversion providing a high voltage gain and high power conversion efficiency e.g. 6.5 kV DC to 33kV AC. Application area include motor drives and renewable systems interfacing to 33kV and 66kV grid. Proposed circuit is flexible and not limited to applications mentioned here.

Technology Description/Technology Summary

Conversion of electric voltage levels by solid state electronics has increased impact on our society and usage of low frequency passive transformers in voltage conversion are not always first choice. Solid state electronics offer a improved condition of the voltages for the load side and current on the grid side that can be optimized beyond passive transformer solutions. The application area of solid state electronics is limited by voltage range of used semiconductors, and at higher voltages the low frequency transformer is still the favorite, however new types of semiconductor materials as SiC and circuits as MMC open up for increased usage of solid states electronics. Here is introduced a compact modular multilevel converter cell able to convert lower levels of DC voltages into higher levels of both DC and AC voltages, offering a reduced weight and increased quality of system voltage and currents compared to transformer solutions.

Development Phase/Current State

Patent application filled. Circuit analysis and simulation done. Hardware demonstrator built. Application specific demonstrators needed.

The inventors

Stig Munk-Nielsen

smn@et.aau.dk

Contact Information

Lars Halkjær

TTO Manager

+45 99 40 71 89

lah@adm.aau.dk

Seeking

- Funding/Investors
- Licensee
- Partner/Research Collaboration
- IPR Sale

Patent Pending