

GenComm Micro H2 Hubs



DR BODO GROß

IZES

SOLAR



GENCOMM WP I2 SOLAR H₂ PRODUCTION AND REFUELLING STATION

GenComm Conference
Belfast, 31st May 2023

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AGENDA



➤ IZES gGmbH

➤ Hydrogen

➤ GenComm Work Package I2: Solar Powered Hydrogen Production and Refuelling Station

➤ Direct and Indirect Outcomes of GenComm

➤ Conclusion

IZES GGMBH: LOCATION



Source: https://www.interreg.de/INTERREG2021/DE/Foerderung/SechsProgrammaereue/Nordwesteuropa/nordwesteuropa_node.html

Ministerium für
Wirtschaft, Innovation,
Digitales und Energie
SAARLAND



Interreg 
North-West Europe
GenComm
European Regional Development Fund



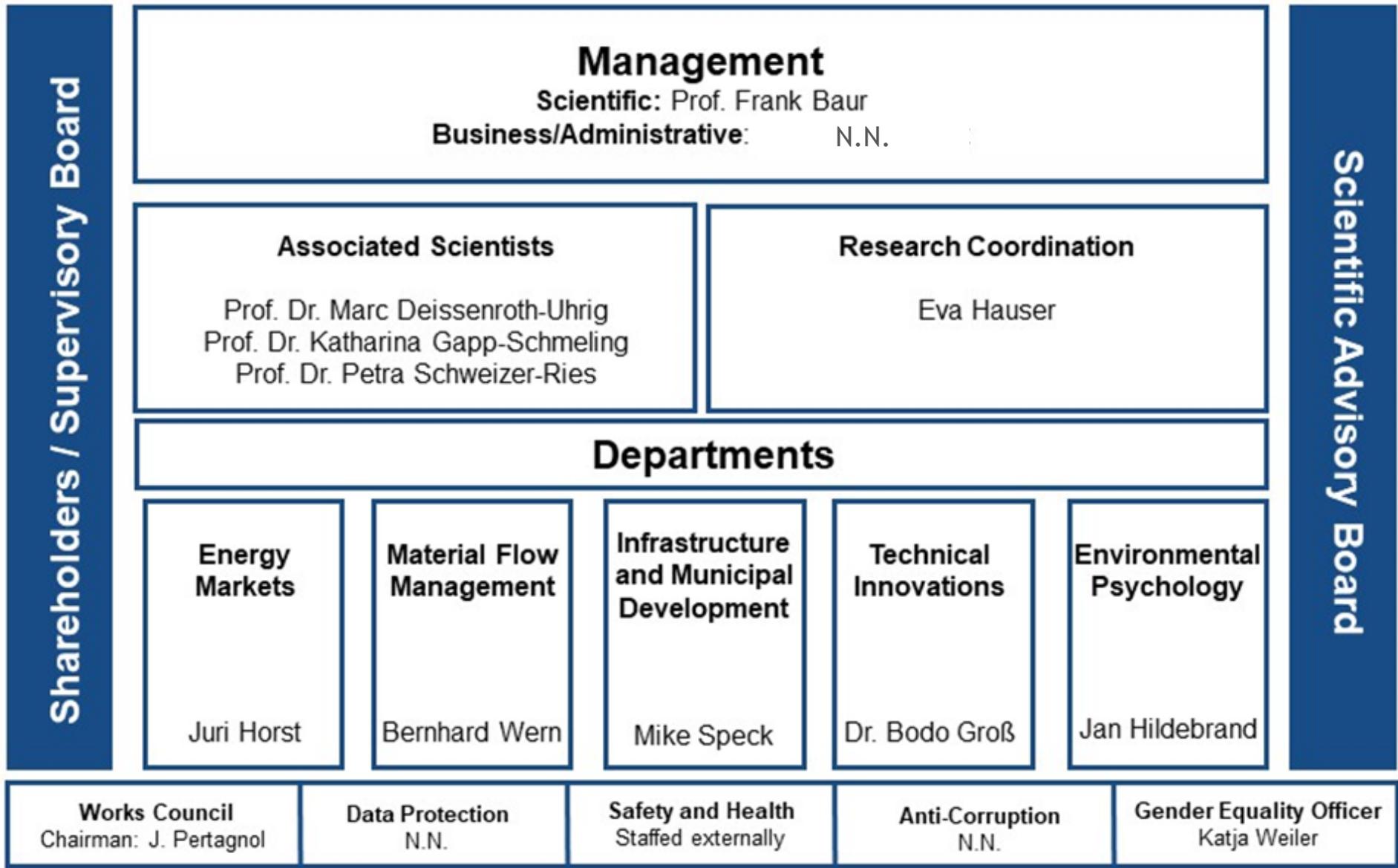
- IZES is located in Saarbrücken, the Capital of the Federal State Saarland
- Approx. 90 km from the city of Luxembourg

IZES GGMBH

- Founded in 1999 as non-profit research organisation
- Shareholders: Federal State Saarland (~70%), several regional utilities, the University of Saarland and the University of Applied Science Saarbrücken
- Interdisciplinary team with educational background in engineering, law, economics, forestry, social and natural sciences
- 80 employees, including the administrative department as well as bachelor, master and PhD students



ORGANISATION CHART OF THE IZES GGMBH



AGENDA

Quelle: Mats Karlsson

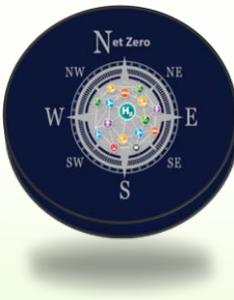
➤ IZES gGmbH

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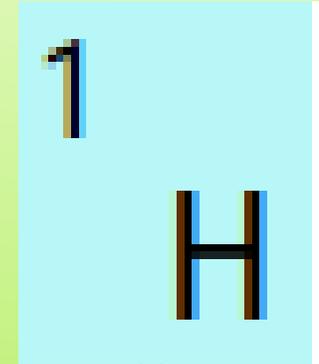
HYDROGEN – WHO ARE YOU?



1 H																	2 He																														
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne																														
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar																														
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr																														
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe																														
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn																														
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og																														
<table border="1"> <tr> <td>57 La</td> <td>58 Ce</td> <td>59 Pr</td> <td>60 Nd</td> <td>61 Pm</td> <td>62 Sm</td> <td>63 Eu</td> <td>64 Gd</td> <td>65 Tb</td> <td>66 Dy</td> <td>67 Ho</td> <td>68 Er</td> <td>69 Tm</td> <td>70 Yb</td> <td>71 Lu</td> </tr> <tr> <td>89 Ac</td> <td>90 Th</td> <td>91 Pa</td> <td>92 U</td> <td>93 Np</td> <td>94 Pu</td> <td>95 Am</td> <td>96 Cm</td> <td>97 Bk</td> <td>98 Cf</td> <td>99 Es</td> <td>100 Fm</td> <td>101 Md</td> <td>102 No</td> <td>103 Lr</td> </tr> </table>																		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu																																	
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr																																	

- Alkalimetalle
- Erdalkalimetalle
- Übergangsmetalle
- Metalle
- Nichtmetalle
- Halbmetalle
- Künstliche
- Edelgase
- Lanthanoide
- Actinoide

**Hydrogen is the
No. 1!**



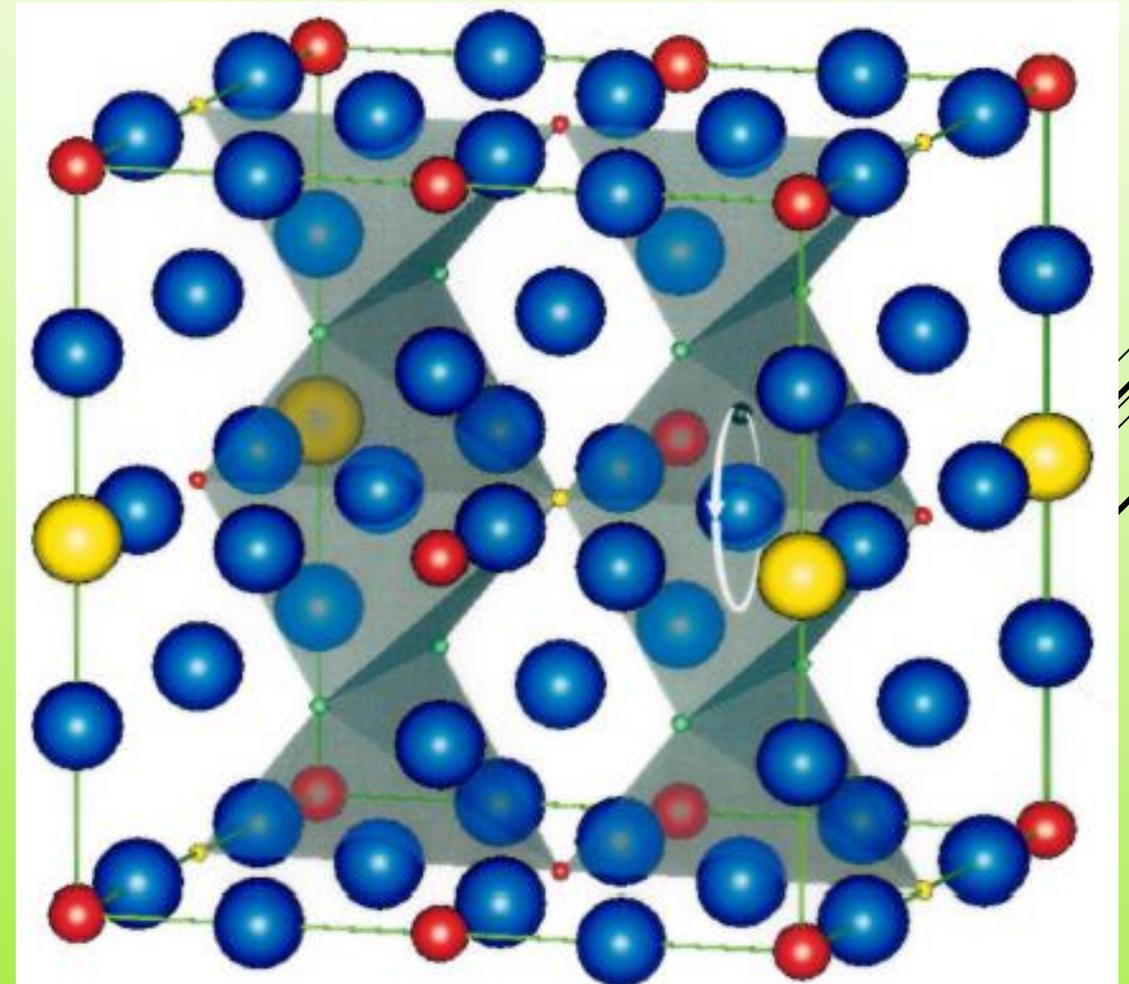
Source: <https://www.spektrum.de/periodensystem/wasserstoff/615188>

HYDROGEN & FUEL CELL TECHNOLOGY RESEARCH AROUND THIRTY YEARS AGO



One major area of research was in the field of Proton Conducting Ceramics

- The Perovskite (ABX_3) family seemed to be a good candidate
- Barium Calcium Niobate ($BaCa_{0,82}Nb_{0,18}O_{8,73}$ or BCN18) was handled as one of the most promising new membrane material for solid oxide fuel cells (SOFC)
- Why? The operating temperature of a SOFC using BCN18 is $300^{\circ}C$ lower than using doped zirconia.



HYDROGEN AND FUEL CELL EUPHORIA AROUND TWENTY YEARS AGO



imagine Strom aus Gas ... Wärme aus Gas ... Heißwasser aus Gas ... Kälte aus Gas ... Licht aus Gas ...

RWE

HEIMKRAFTWERK
produziert Strom, Warmwasser, Wärme

BRENNSTOFFZELLE

1888 Gründung des RWE
1902 Umstellung auf Wasserkraft
1920 Erwerb des Kraftwerks in Euskirchen
1950 Erste große öffentliche Stromerzeugung
1960 Erste öffentliche Stromerzeugung
2000 Übernahme der Energieerzeugung

RWE
One Group. Multi Utilities.

Strom. Naturgas. Wasser. Entsorgung. Services.

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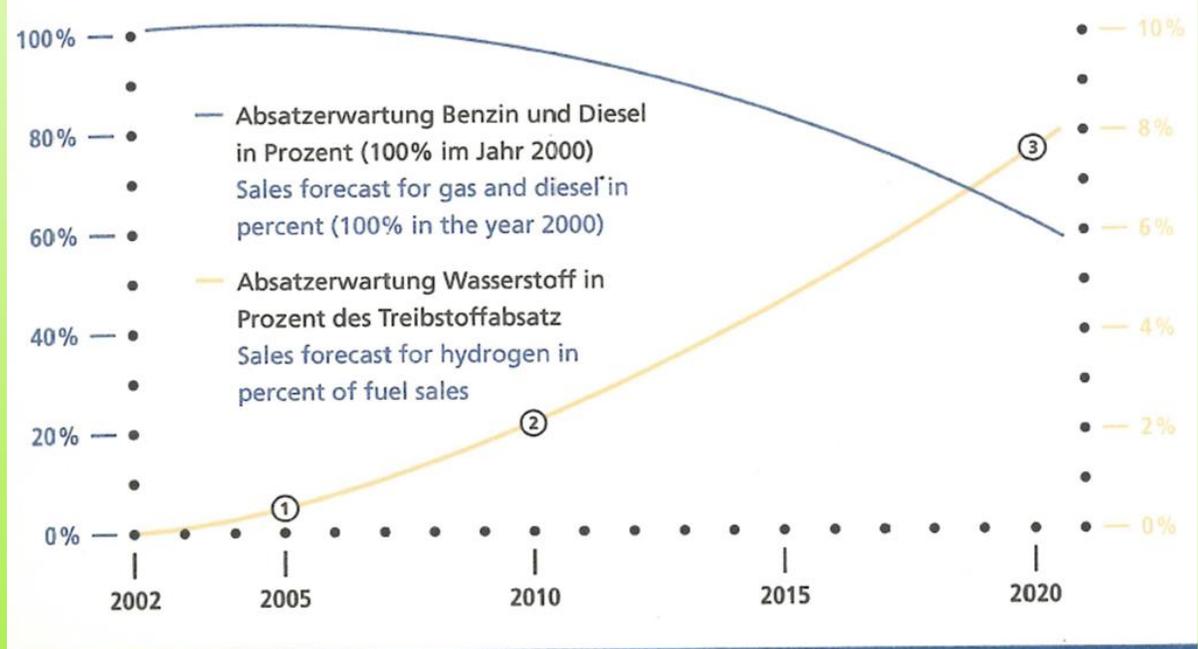
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HYDROGEN (TECHNOLOGY)-HYPE TWENTY YEARS AGO AND AT PRESENT



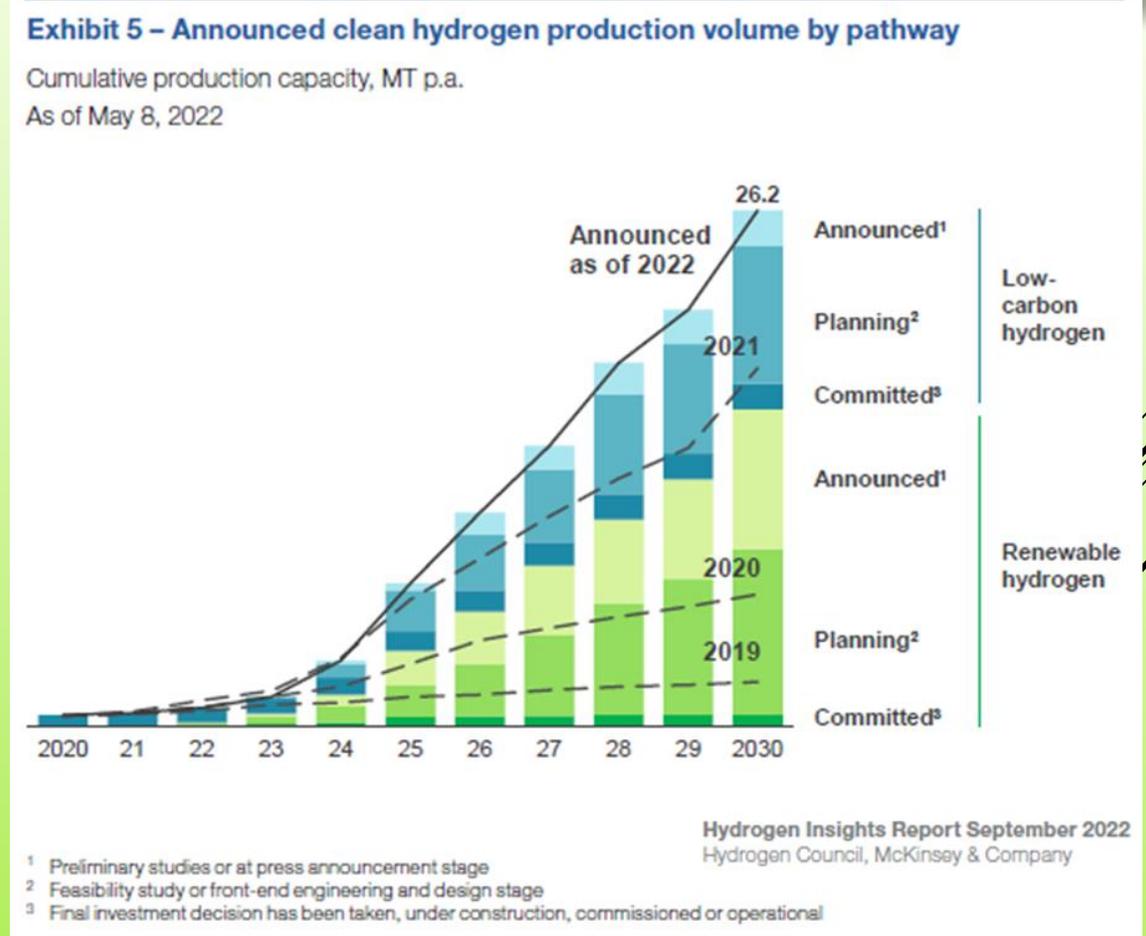
- ① Wasserstoffabsatz für ca. 500 Busse
Hydrogen sales for appr. 500 buses
- ② Wasserstoffabsatz 2,5% des Kraftstoffbedarfs
entsprechend der Verkehrswirtschaftlichen
Energierstrategie
Hydrogen sales 2,5% of fuel sales according
to the transportation energy strategy

- ③ 20% des Kraftstoffbedarfs aus alternativen
Quellen (EU Ziel). Schätzungsweise 40%
werden davon durch Wasserstoff abgedeckt.
20% of fuel consumption from renewable
sources (EU-target). Estimated 40% of it will
be covered by hydrogen.



Absatzprognose für Treibstoff Sales Forecast for Fuel

Source: Broschüre Clean Fuel, Gesellschaft für Hochleistungselektrolyseure zur Wasserstoffherzeugung mbH (GWH)



AGENDA

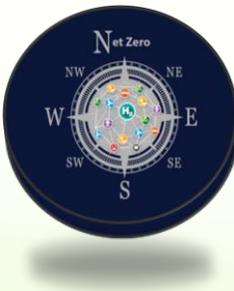
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GENCOMM WP I2

Work Package I2

- IZES was responsible for the construction of a solar powered hydrogen production and refuelling station

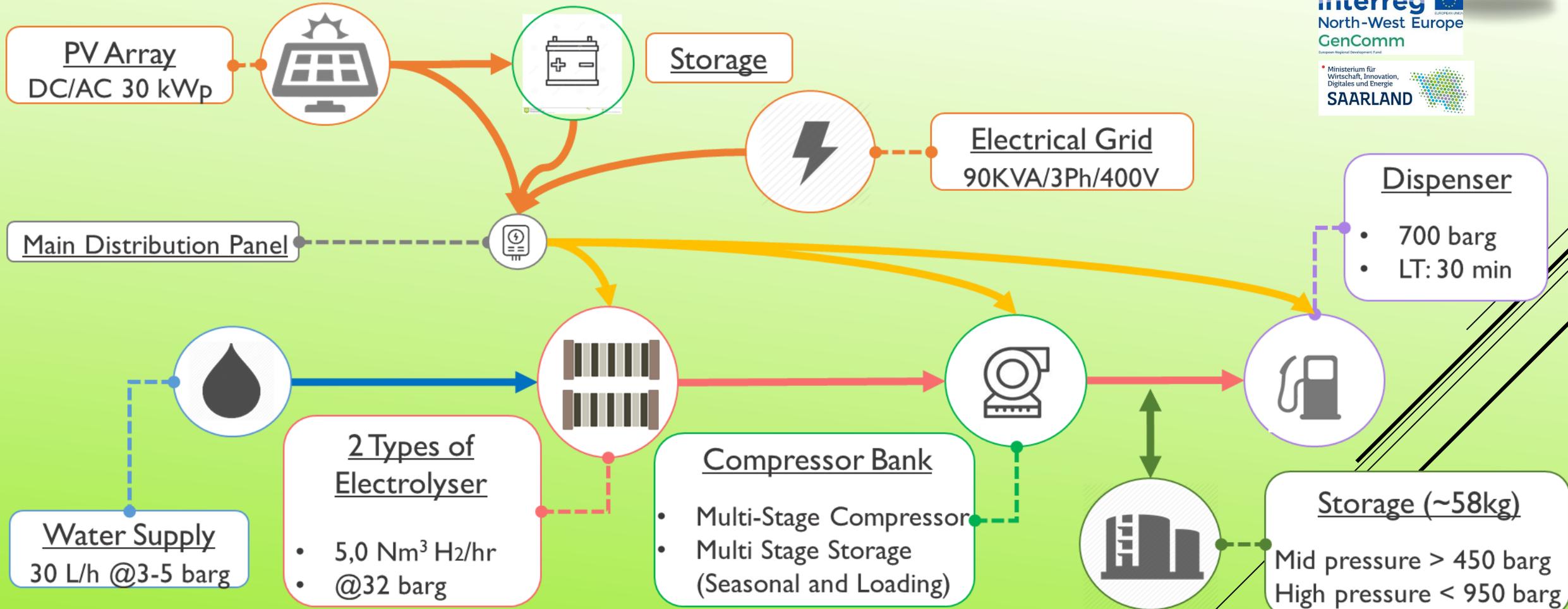
Why a Hydrogen Refuelling Station at IZES?

- In 2014 IZES build a quasi-autarkic solar powered charging station for Battery Electric Vehicles.
- Fuel Cell Electric Vehicles could be seen as the next evolution step of Battery Electric Vehicles.



GENCOMM WP I2

Planned Design of the Solar Powered Hydrogen Refuelling Station



Source: IZES gGmbH

GENCOMM WP I2

Facts and Data of the Solar Operated Hydrogen Refuelling Station

- Location: Innovation Campus Saar, 66115 Saarbrücken, Altenkesseler Straße 17A1, Headquarter IZES gGmbH
- Energy supply: PV-Array with 30 kW peak power
- Containerised solution: two 20 feet container with a separated dispenser
- Hydrogen production: two different electrolyser (AEM and PEM) with a maximum H₂ production of 5 Nm³/h
- Hydrogen storage capacity: 58 kg at two different pressure levels 450/950 bar
- Gas quality: 5.0 or 99,999% or at least according to the fuel standard
- Suitable for 700 bar vehicles
- Maximum refuelling time is less than 30 min
- Operation as a non-public research station



GENCOMM PARTNER MEETING #03; DECEMBER 2017, SAARBRÜCKEN



Source: IZES gGmbH



Introduction and welcome message by State Secretary Jürgen Barke (now Saarland's Minister for Economics, Innovation, Digital and Energy)

GENCOMM WP I2: PV ARRAY WITH APPROX. 30 KWP



Source: IZES gGmbH



GENCOMM WP I2: HYDROGEN PRODUCTION AND REFUELLING STATION

Source: Mats Karlsson Fotografie & Medien



GENCOMM WP I2: HYDROGEN PRODUCTION AND REFUELLING STATION



Source: Mats Karlsson Fotografie & Medien



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SAARLAND



GENCOMM WP I2: MEETING #23; DECEMBER 2022, ST. INGBERT



Source: IZES gGmbH



Welcome and Introduction by State Secretary Elena Yorgova-Ramanauskas from Saarland's Ministry for Economics, Innovation, Digital and Energy

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GENCOMM WP I2: DIRECT OUTCOMES

Ministerium für
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Direct outcomes

- Installation of the solar powered H₂ production and refuelling station
- Installation of the 30 kWp PV system, which delivers the green electricity to operate the H₂ production and refuelling station (HRS)
- Future usage of the HRS as a unique training facility or as showcase for educational topics; e.g. the certified TÜV course "Specialists for Hydrogen Technologies"
- Establishing an excellent pan-European network in the field of hydrogen technologies → "The GenComm Family" and beyond!

GENCOMM WP I2: INDIRECT OUTCOMES



Indirect outcomes

- GenComm was the first hydrogen project at IZES after the initial hype at the beginning of the new millennium
- After the launch of GenComm in 2017, more than ten hydrogen related projects were started at IZES and several more are currently in the application phase
 - TransHyde
 - HALLIE
 - SH2AMROCK
 - KoNSTanZE

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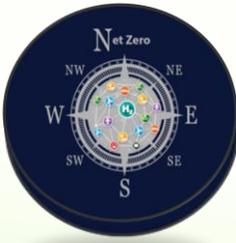
➤ Direct and Indirect Outcomes of GenComm

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CONCLUSION

Source: Clean Energy Partnership, CEP; Jörg Starr;
NOW Beiratstreffen June 13th, 2019



GenComm was a very successful project!

Hydrogen may not be **the** only No. 1 but in any case an important pillar on our way to decarbonise the European energy economy in a sustainable way!





Thank you for listening!

Dr. Bodo Groß

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