HARMONIZATION OF STATION ACCEPTANCE PROCEDURES IN GERMANY WITH SAE AND ISO BY CLEAN ENERGY PARTNERSHIP (CEP)

Clean Energy Partnership
CEP

International Hydrogen Infrastructure Workshop, 11.-12.09.2018, Boston
Thomas Brachmann, Honda R&D Europe (Deutschland) GmbH

ORGANIGRAM

WORKING GROUP HRS // TT FUELLING PROTOCOL / 3RD PARTY

Clean Energy Partnership / TaskTeam fuelling protocol / 3rd Party

Members

Audi, BMW, Daimler, H2 MOBILITY, Honda, Hyundai, Toyota, Shell

Activities

- Evaluation of HRS test reports for approval
- Training 3rd Party
- Harmonization of CEP & ISO tests
- Standardized report template

Future activities

- HRS Certification outside Germany
- New refuelling protocols
- Training subcontractors
- New transport modes

The TaskTeam has set-up group workshops to define required HRS approval procedures

CEP HRS APPROACHES

WHERE WE ARE AND WHAT WE WANT

Main Questions	Activities	Status
Which test program should be used for testing in future?	• Defining a test according to CEP & ISO: Workshop 1&2 – Implementation of the tests as FAT or SAT? – Additional performance tests?	
How has the test to be evaluated?	• Sharpening the scope for interpretation of current SAE / ISO regulations. • What are minor and what are significant challenges for the acceptance?	
How should the test be documented?	• Creation of a reporting standard	
Who tests and evaluates?	• Enabling an independent 3rd party (ZSW) to evaluate the reports and test the HRS	
When should a test be repeated?	• When does an acceptance test (including periodic inspections) becomes necessary?	

CEP ACCEPTANCE TEST

HISTORY & OUTLOOK

2009

Definition of CEP refuelling protocol

- with questionnaire before release

2011

Every OEM tests the HRS before release

2012

Definition of the CEP acceptance tests before HRS release

- for each CEP station utilizing the SAE J2601
- tests are carried out with Opel Test Device

2015/16

ISO references CEP acceptance tests

2018

Harmonization of the CEP & ISO test procedures

- Definition of SAT- and FAT-tests
- Agreement on different interpretations of how to carry out the tests

2019

CEP acceptance test will be part of ISO document

2020

ISO tests will be part of AFID and have to be carried out EU wide before a HRS release

AFID: Alternative Fuel Infrastructure Directive

CEP ACCEPTANCE TEST

APPLICATIONS

The CEP test is standardized and necessary to get an approval for public refuelling

- 25 tests allowing to validate the HRS system/components and HRS performance
- Creation of a test report, evaluated by the car OEMs within the CEP

CEP ACCEPTANCE TEST PROCEDURE

Each CEP HRS utilizing the SAE J2601-2014 refuelling protocol

- has to successfully pass the safety function test procedure and
- should fulfil the station performance test procedure

Test procedure validates

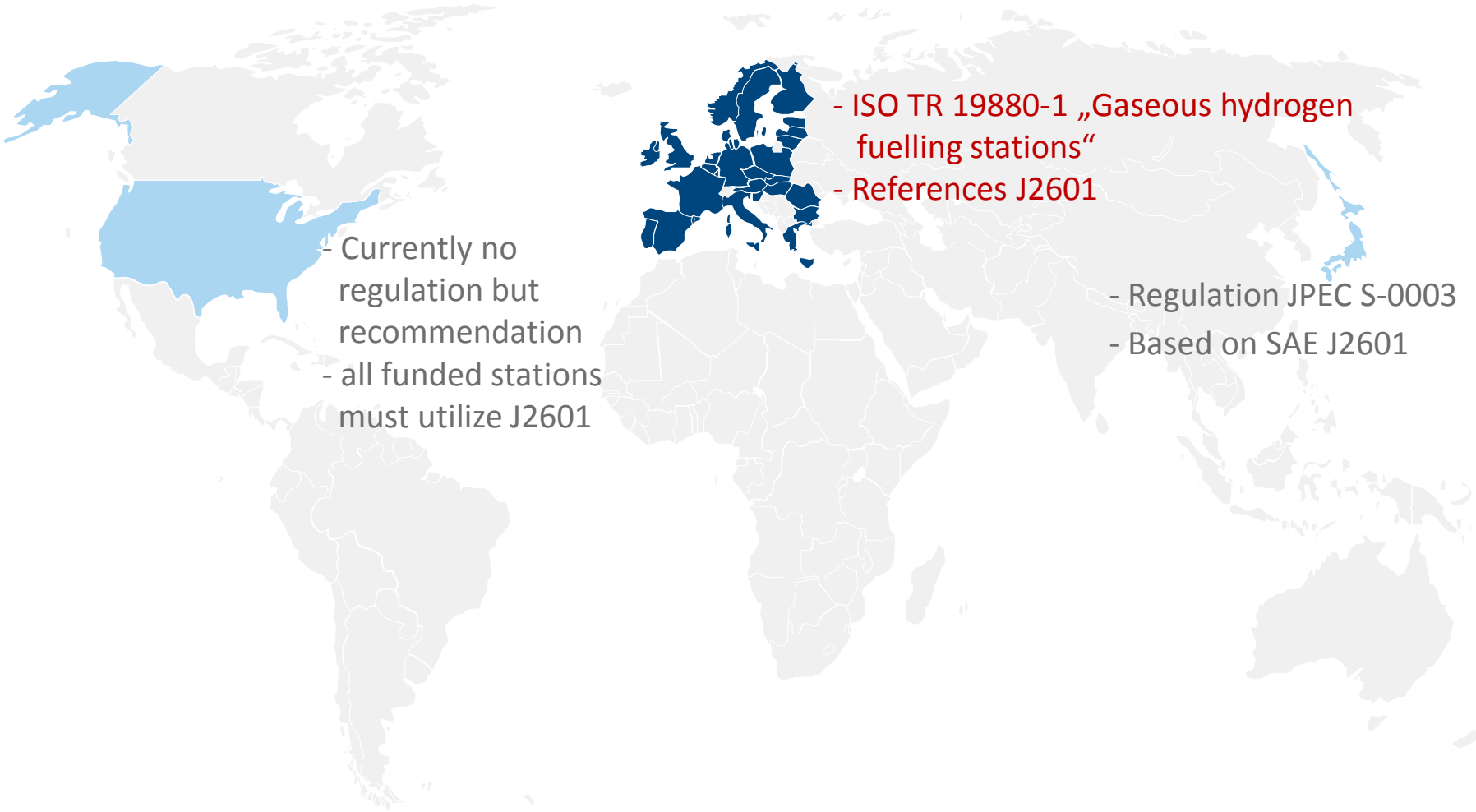
- Safety related functions
- Customer related performance

Test no.	realized b	function	IrDa	Preparation to be performed	Perform during main refueling part	Test outcome
1	FAT or HSTA	Ambient temperature (T_{amb})	NR	Influence T_{amb} measurement to < -40°C by manipulation of transmitter signal loop	not relevant	Main refueling part is not allowed to start
2	FAT or HSTA			Influence T_{amb} measurement to > 50°C by manipulation of transmitter signal loop		
3	FAT or HSTA	Vehicle tank starting pressure	NR	Refuel with < 0.5 MPa starting pressure by manipulation of transmitter signal loop	not relevant	Main refueling part is not allowed to start
4	FAT or HSTA			Refuel with >70 MPa starting pressure by manipulation of transmitter signal loop		
5	FAT or HSTA	Excess hydrogen flow	NR	Manipulation of transmitter signal loop. Additional hardware might be required for manipulation of signal without software change.	Influence hydrogen mass flow measurement to > 60g/s	Refueling must be aborted
6	HSTA	Absolute hydrogen delivery temperature	NR	not relevant	After a period of > 35 sek. influence hydrogen delivery temperature measurement under the lowest permitted temperature (e.g. <-40°C @T40 Stations)	Hydrogen delivery temperature has to be under the upper temperature limit within 30 s and then refueling must be aborted when leaving the fuel delivery temperature corridor.
7	FAT or HSTA	Hydrogen delivery pressure monitoring	No	Manually calculate expected APRR based on observed starting conditions	Influence hydrogen delivery pressure measurement above APRR Corridor	Refueling must be aborted. Compare the manual calculated APRR with the actual (ideal) APRR (Tolerance value to be evaluated).
8	FAT or HSTA				Influence hydrogen delivery pressure measurement below APRR corridor	
9	FAT or HSTA		Yes		Influence hydrogen delivery pressure measurement above APRR corridor	
10	FAT or HSTA				Influence hydrogen delivery pressure measurement below APRR corridor	

Current CEP base document characterizing the required tests

WHICH TEST PROGRAM SHOULD BE USED FOR TESTING IN FUTURE?

CEP & ISO: ONE PROTOCOL TO TEST THEM ALL



- Currently no regulation but recommendation
- all funded stations must utilize J2601

- ISO TR 19880-1 „Gaseous hydrogen fuelling stations“
- References J2601

- Regulation JPEC S-0003
- Based on SAE J2601

Current CEP approval tests:

- acceptance test_SAEJ2601-2010 (8 Tests – old projects only)
- acceptance test_SAEJ2601-2014 (25 Test)

ISO 19880-1 approval tests:

- SAT* Option 1 (7 Tests)
- SAT* Option 2 (9 Tests - Japan)
- FAT* & SAT* Matrix (33 Tests)

*Site Acceptance Tests (SAT),
Factory Acceptance Tests (FAT)

DEFINING A TEST ACCORDING TO CEP & ISO

SHARPENING THE SCOPE FOR INTERPRETATION OF CURRENT SAE / ISO REGULATIONS

Tests																															
ISO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
CEP				22	1	2	3	4		5	p	11			15		p					p	p	p	16	17	p	21	22		p	13	p
FAT	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
SAT	X				X	X	X	X	X		X		X	X	X	X	X	X	X	X				X	X	X		X		X	X	X	X

Comparison ISO 19880-1 + CEP

- **Only in CEP or ISO**
- **Partly in CEP or ISO**
- **In CEP and ISO**

CEP & ISO harmonization to be finished shortly

Plan: to be replaced by ISO 19880-1 FAT and SAT tables

- Annex I : Table C.2 - FAT and SAT Matrix
- Test procedure based on Chapter 12: SAT Option 1 Table
- Consistency between former tests and ISO tests to converge

Important 2 know

“CEP hydrogen fuelling validation test protocol“ will be part of ISO appendix

- **incl. harmonization of ISO & CEP tests**

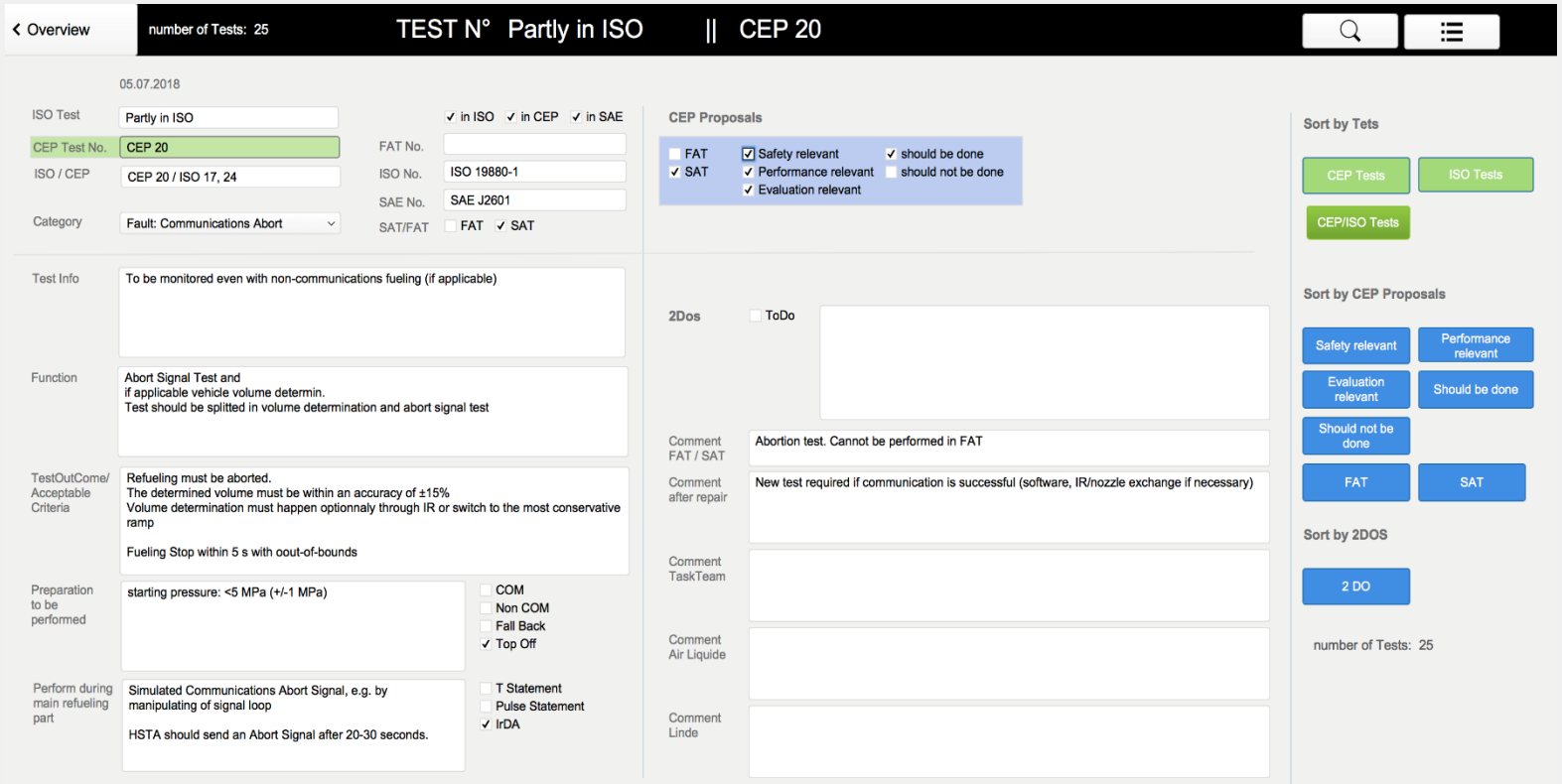
Synopsis of ISO and CEP Tests

DEFINING A TEST ACCORDING TO CEP & ISO

SHARPENING THE SCOPE FOR INTERPRETATION OF CURRENT SAE / ISO REGULATIONS

Development of a database within the CEP to comment on ISO & CEP tests

Audi · BMW · Daimler · H2 Mobility · Honda · Hyundai · Shell · Toyota · Air Liquide · Linde



Each HRS report is available in CEP HRS approval data base/bank

THE PROCESS FOR HRS APPROVAL TODAY & FUTURE

Procedure	Description	Responsibility
1. declaration	The HRS supplier declares the SAE conformity of the system.	HRS-Supplier
2. testing	The HRS is tested by a qualified independent 3rd party on behalf of the HRS operator/supplier in accordance with the CEP acceptance program. The results are documented in detail in an acceptance report.	HRS-Supplier / 3rd Party
3. evaluation	The acceptance report and declaration of conformity are checked and confirmed by a qualified independent 3rd party on behalf of the plant operator/supplier. This should preferably take place within the framework of HRS testing by the ZÜS.	3rd Party / ZÜS
4. control	The acceptance report will be submitted to the OEMs. The OEMs evaluate the report and discuss the results with the HRS supplier.	OEMs
5. approval	Explicit approval of the acceptance reports by the OEMs.	OEMs

HANDOVER TESTING TO AN INDEPENDENT 3RD PARTY

	Who is conducting the test?	Who is creating the acceptance test report?	Who assess the acceptance test report?	Who gives the HRS approval?
Past	HRS-Supplier	HRS-Supplier	OEMs	OEMs
Today	HRS-Supplier + independent 3rd party	HRS-Supplier + independent 3rd party	OEMs	OEMs
Target: 2nd step	HRS-Supplier + independent 3rd party • Retest of selected inspection points or • Perform all site acceptance tests	independent 3rd party • 3rd party has to create an acceptence test report for at least 2 stations of every manufacturer	OEMs + independent 3rd party • 3rd party has to assess an acceptence test report for at least 2 stations of every manufacturer	OEMs
Target for 2018/2019	independent 3rd party	Independent 3rd party	independent 3rd party	OEMs

DEFINE REPORT TEMPLATE FOR ACCEPTANCE TEST

Main Questions

How should the test be documented?

Activities

- Creation of a reporting standard
- Who bears the costs of the examination?
- When does an acceptance (including periodic inspections) become necessary?

Open Items

- quality of the reports has strongly improved, but reporting format is still not comparable
- report template was prepared and approved
- data quality, temporal resolution, measurement uncertainties, calibration certificates of the sensors: required for 3rd party?
- HRS data details to become accessible through technology provider


Air Liquide

N° Chrono D13560-NT-010(0)_SAE-J 2601 Safety and performances
Tesla
N° Affaire Wendlingen H2M
N° Client
Page : 1/55

HYDROGEN REFUELLING STATION
SAE J2601 Safety and Performances tests

BLUE HYDROGEN
Clean energy solutions

AIR LIQUIDE
Advanced Technologies
2 rue de Clémencière
F – 38360 SASSENAGE
☎ + 33 (0)4 76 43 62 11 or / ou + 33 (0)4 76 43 62 27 - Fax : + 33 (0)4 76 43 62 71

Measurments & records		Distribution (*Diffusion*):
Yacine BRAIK *Corentin AIRIAU*		Date : October 11th 2017 Version : (0)
Approbation Damien SALLAIS/Sylvain PAYARD/Christophe MICHEL *Industrial Solutions Europe* ☎ + 33 (0)6 12 78 11 87		

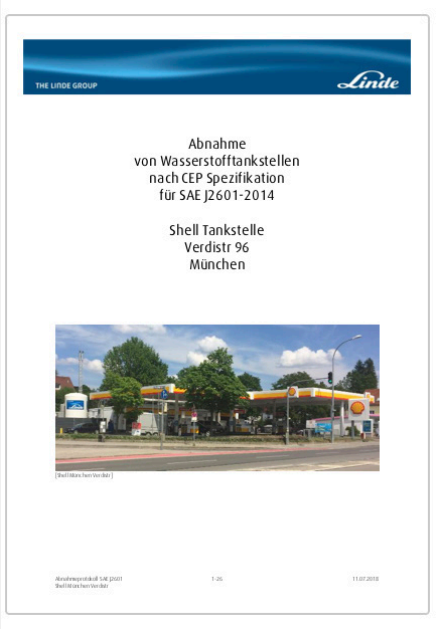
●BUSINESS CONFIDENTIAL INFORMATION

HOW SHOULD THE TEST BE DOCUMENTED?

CREATION OF A REPORTING STANDARD

Activities

Creation of a reporting template “CEP hydrogen fuelling validation test protocol“
Template will be part of ISO appendix (incl. harmonization of ISO & CEP tests)


THE LINDE GROUP

Abnahme
von Wasserstofftankstellen
nach CEP Spezifikation
für SAE J2601-2014

Shell Tankstelle
Verdistr 96
München


Air Liquide

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SAE J2601 Safety and Performances tests

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AIR LIQUIDE
Advanced Technologies
2 rue de Clémencière
F – 38360 SASSENAGE

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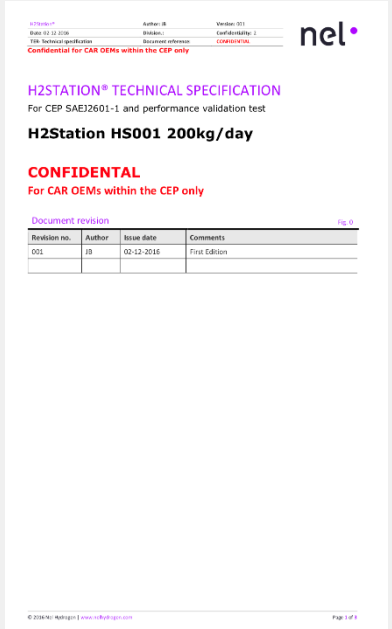
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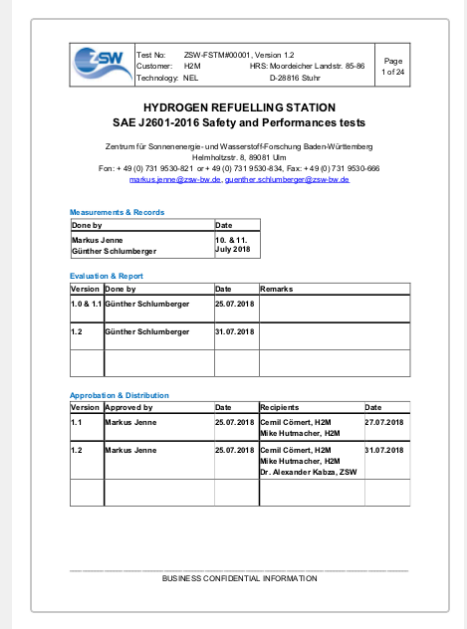
H2STATION® TECHNICAL SPECIFICATION
For CEP SAEJ2601-1 and performance validation test

H2Station HS001 200kg/day

CONFIDENTAL
For CAR OEMs within the CEP only

Document revision

Revision no.	Author	Issue date	Comments
001	JB	02-12-2016	First Edition


ZSW

HYDROGEN REFUELLING STATION
SAE J2601-2016 Safety and Performances tests

Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg
Helmholtzstr. 8, 89081 Ulm

Measurements & Records

Done by	Date
Markus Jenne Günther Schlumberger	10. & 11. July 2018

Evaluation & Report

Version	Done by	Date	Remarks
1.0 & 1.1	Günther Schlumberger	25.07.2018	
1.2	Günther Schlumberger	31.07.2018	

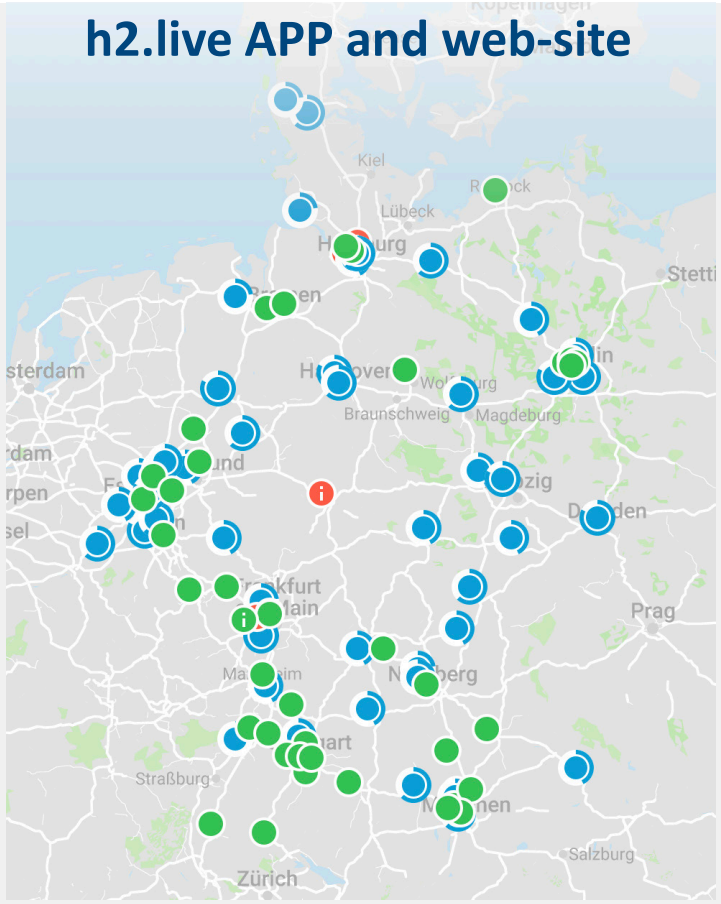
Approbation & Distribution

Version	Approved by	Date	Recipients	Date
1.1	Markus Jenne	25.07.2018	Cemil Cömert, H2M Mike Hutmacher, H2M	27.07.2018
1.2	Markus Jenne	25.07.2018	Cemil Cömert, H2M Mike Hutmacher, H2M Dr. Alexander Kabza, ZSW	31.07.2018

BUSINESS CONFIDENTIAL INFORMATION

Status

ACTIVITIES & CHALLENGES



Activities	Status
• Definition of a test according to CEP & ISO – Discussion with ISO	
• Training an independent 3rd party (ZSW) to perform the tests and create and evaluate the test reports	
• Creation of a reporting standard for a 3rd party and manufacturer	

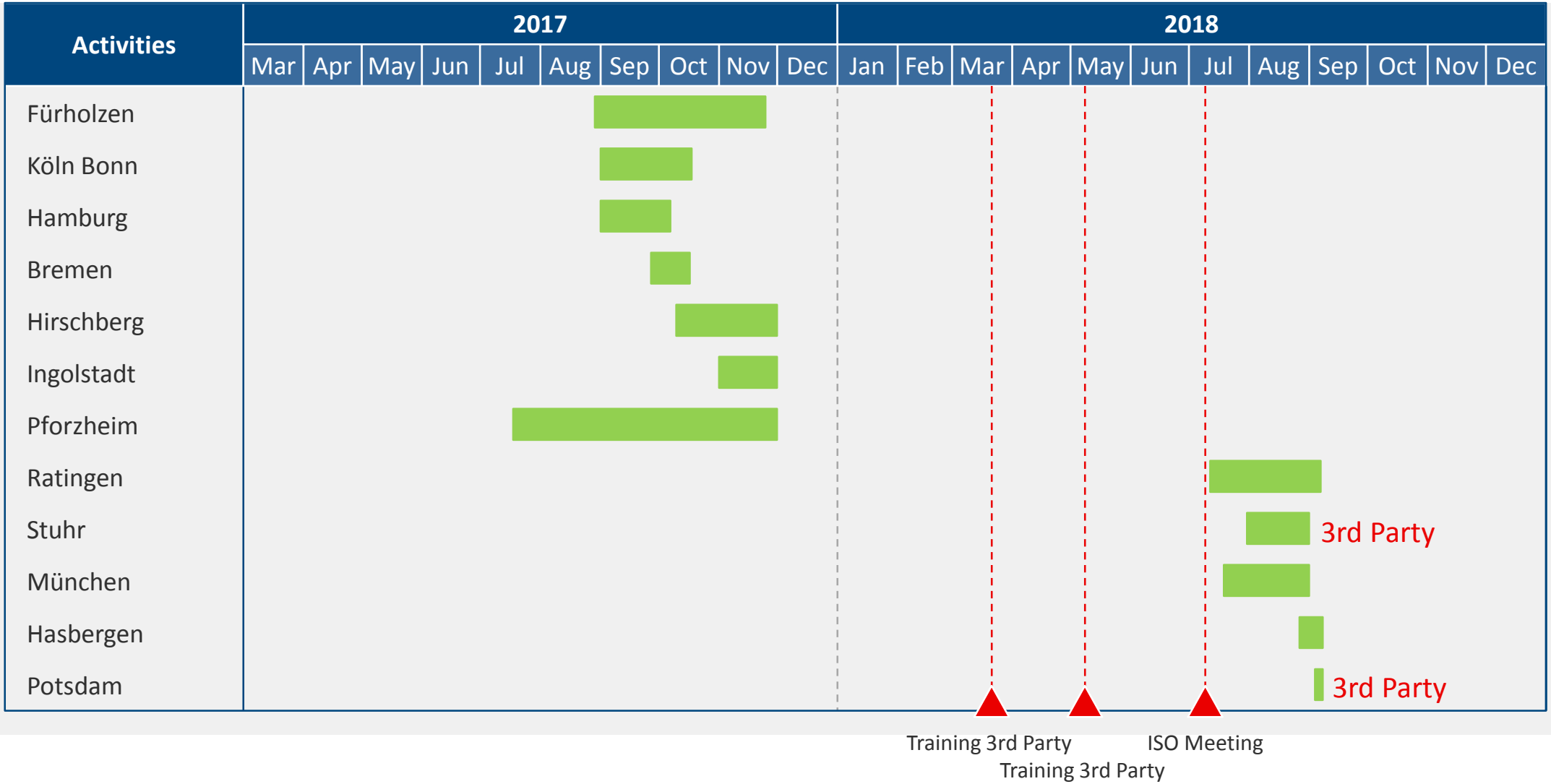
50 HRS approved (9/2018)

44 HRS in realization

For the timely opening of announced HRSs, the assessment time needed for OEMs averages to minimum 3 weeks including various iteration rounds in which OEMs demand safety & performance related clarifications from HRS technology providers

TRIAL PERIOD FOR 3RD PARTY QUALIFICATION

TIME FOR APPROVAL PROCESS & DISCUSSION



CHALLENGES AHEAD

REDUCTION OF OVERALL APPROVAL TIME & PROCESS SPREAD IN EU

- Adoption of harmonized test reports standards for a 3rd party and technology provider
- Reach a consistent HRS opening schedule with min. 3 weeks lead time for car OEM review of test reports
- Enhance quality of test reports to reduce iterations with OEMs for final approval
- Negotiation with EU countries to adopt the established HRS approval process

Car OEMs are committed to provide expertise to the approval process for best future test report quality

FUTURE ACTIVITIES

HRS certification in Europe

New refuelling protocols

Training subcontractors

MOVE IT WITH HYDROGEN

Thomas Brachmann
Chief Project Engineer
Honda R&D Europe
+49 698 9011 506
Thomas_Brachmann@de.hrdeu.com