

Low Temp Test procedure for EVs

ACEA TF EV proposal (update)

**New version – discussed in SG EV call on December 11th
Including feedback/comments from SG EV members**

Test Procedure (BEV)

General

- In case of an PEV, the application of a fixed factor should be allowed which increases energy consumption and decreases range.
[Factor still need to be determined]
- PEV's don't have criteria emission which need to be checked during the test, so no need to perform a physical test on the dyno.
- Test only for the purpose to derive customer information values
- If manufacturer does not want to apply the fixed factor, as this need to be a conservative one, manufacturer shall perform a test according to the procedure described for PEV low Temp Testing in WLTP

Feedback from SG EV web-audio 26.11.:

- More time and data are required
- To be discussed in a second step

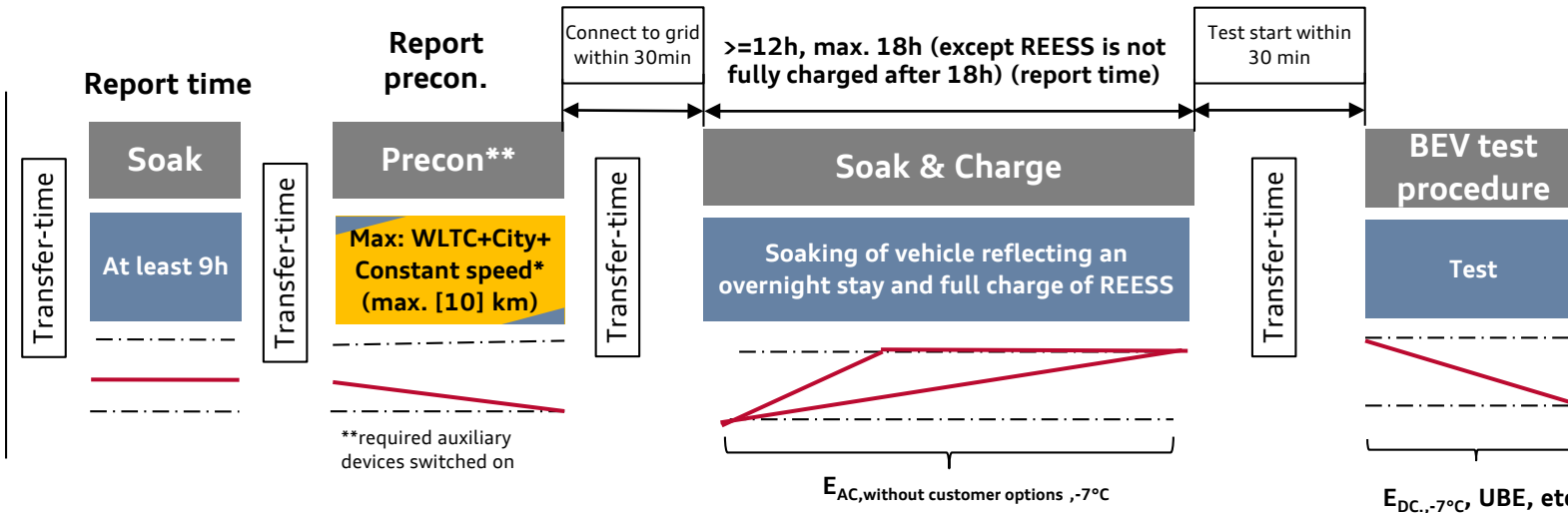
Test Procedure (PEV) – Shortened Test Procedure or Consecutive Cycle Procedure

Proposal for -7°C Procedure – mandatory: Base procedure with no customer based initiated action

[Vehicle Soak at 23°C or less until onboard REESS temperature target reached], SoC set to a level which allows to drive maximum WLTC+City+constant speed* (max. [10] km), lower SoC level is possible

Road load adjust.

Set point



Feedback from SG EV web-audio 11.12.:

- Requirement necessary that the level of SoC at the end of preconditioning shall be "same" than after test procedure
- Preconditioning at 23°C: Further evidence needs to be given that this has no impact on the test result
- Constant speed during precon needs to be linked to constant speed in test procedure
- Break-off-criterion for precon shall be defined
- **Base procedure is mandatory and shall always need to be performed; optional procedure on next slides is only there for having procedure to evaluated the benefit of specific functions on the range value which will increase than**
- Focus on mandatory procedure and not on additional procedure for the moment

23°C:

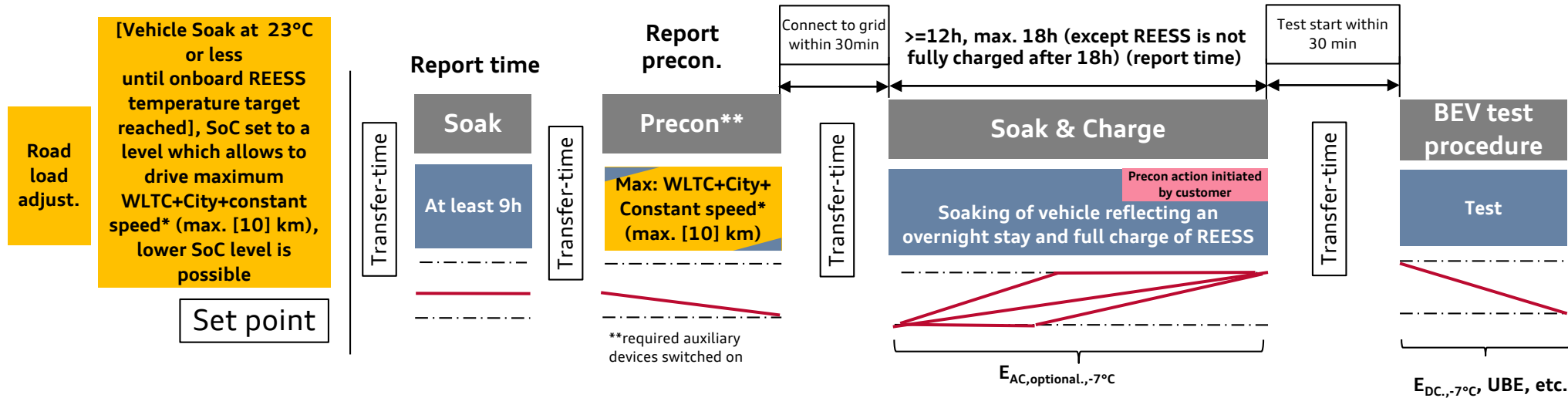
- Road load adjustment
- [Vehicle soak at 23°C or less until onboard REESS temperature target reached]
- SoC set to a level which allows to drive maximum WLTC+City+constant speed* (max. [10] km), lower SoC level is possible

-7°C:

- Soak of the vehicle for at least 9h; time of soak needs to be recorded
- SoC set at 23°C shall allow to drive "WLTC+City+Constant Speed* (with max. distance of [10] km)" maximum with required auxiliary devices switched on, less preconditioning shall be possible
- Preconditioning [can be] done at -7°C [but also 23°C (in case of 23°C: same proceeding like ATCT)]: Preconditioning drive of "WLTC+City+Constant Speed* (with max. distance of [10] km)" (to simulate a drive home) maximum (less shall be possible), required auxiliary devices switched on reflecting user behavior and taking into account cabin isolation & other technology; length of Constant speed segment shall reflect a defined max. distance → after preconditioning: REESS fully depleted
- Soaking and charging of vehicle (until REESS fully charged but for at least 12h, time needs to be recorded), measurement of recharged energy $E_{AC,without\ customer\ options,-7^{\circ}C}$ at -7°C
- Test procedure at -7°C with required auxiliary devices switched on
- To be discussed: required values to be calculated at -7°C

Test Procedure (PEV) – Shortened Test Procedure or Consecutive Cycle Procedure

Proposal for -7°C Procedure – optional: additional procedure to reflect customer based initiated action



Feedback from SG EV web-audio 11.12.:

- Requirement necessary that the level of SoC at the end of preconditioning shall be "same" than after test procedure
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- Constant speed during precon needs to be linked to constant speed in test procedure
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23°C:

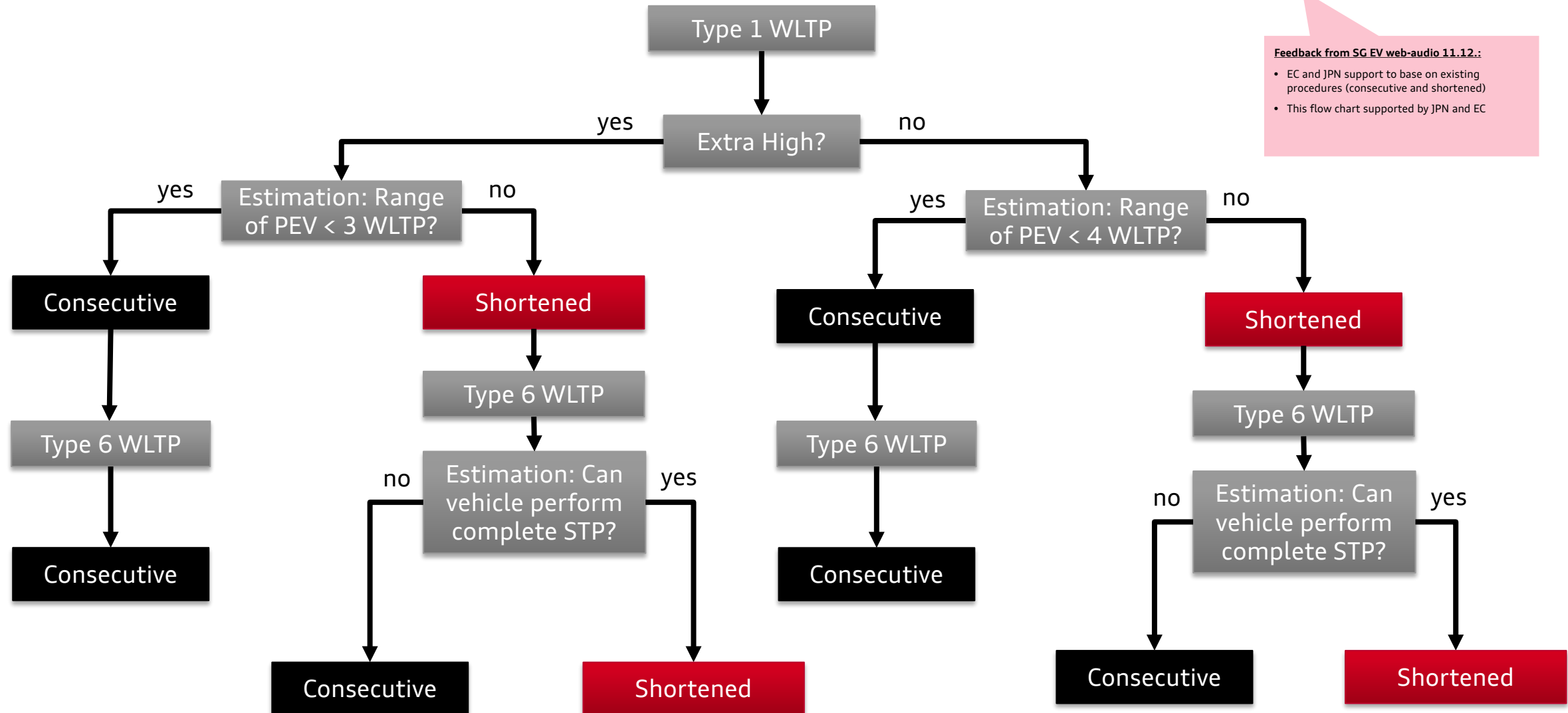
- Road load adjustment
- [Vehicle soak at 23°C or less until onboard REESS temperature target reached]
- SoC set to a level which allows to drive maximum WLTC+City+constant speed* (max. [10] km), lower SoC level is possible

-7°C (additional procedure for determining the effects of technologies like cabin preconditioning):

- Soak of the vehicle for at least 9h; time of soak needs to be recorded
- SoC set at 23°C shall allow to drive "WLTC+City+Constant Speed* (with max. distance of [10] km)" maximum with required auxiliary devices switched on; less shall be possible
- Preconditioning [can be] done at -7°C [but also 23°C (in case of 23°C: same proceeding like ATCT)]: Preconditioning drive of "WLTC+City+Constant Speed* (with max. distance of [10] km)" (to simulate a drive home) maximum (less shall be possible), required auxiliary devices switched on reflecting user behavior and taking into account cabin isolation & other technology; length of Constant speed segment shall reflect a defined max. distance → after preconditioning: REESS fully depleted
- Soaking and charging of vehicle (until REESS fully charged but for at least 12h, time needs to be recorded), measurement of recharged energy $E_{AC,optional,-7°C}$ at -7°C
- Test procedure at -7°C with required auxiliary devices switched on
- To be discussed: required values to be calculated at -7°C

Test Procedure (PEV) – Procedure determination

Procedure selection flow chart – option 1 (with existing procedures)



Test Procedure (OVC-HEV)

General

- Slide 7/8: independent CD-Test
- Slide 9: independent CS-Test

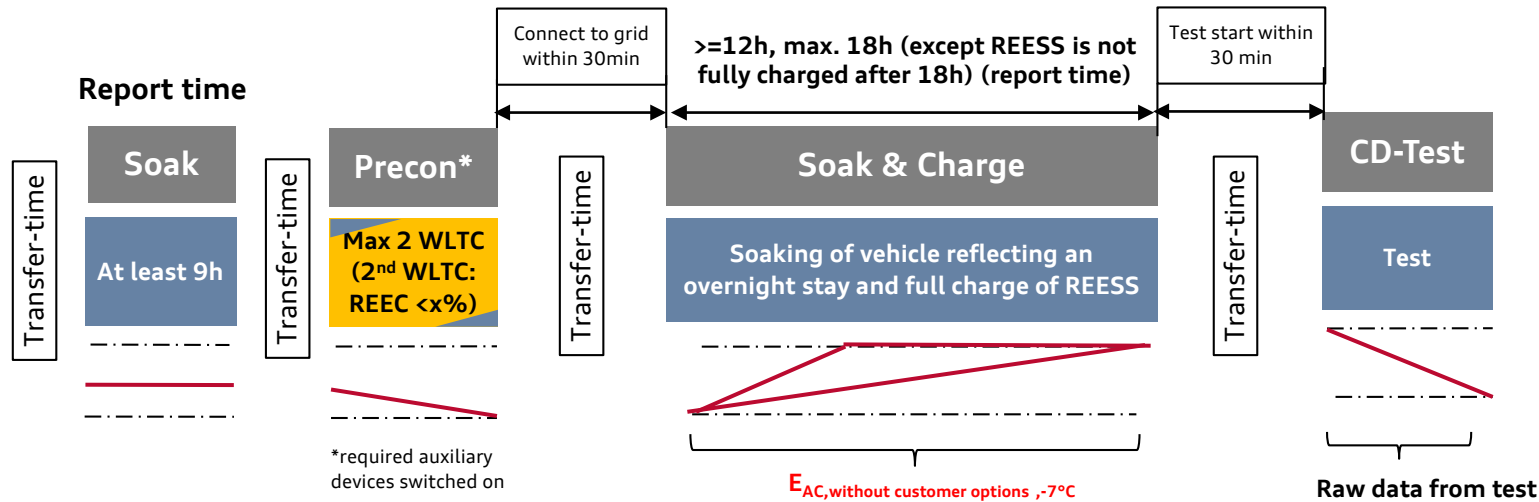
Test Procedure (OVC-HEV) – Charge Depleting Test

Proposal for -7°C Procedure – mandatory: Base procedure with no customer based preconditioning action

Road load adjust.

[Vehicle Soak at 23°C or less until onboard REESS temperature target reached,] SoC set to a level which allows to reach REEC < x% in the max. 2nd WLTC

Set point



Feedback from SG EV web-audio 11.12.:

- Requirement necessary that the level of SoC at the end of preconditioning shall be "same" than after test procedure
- Preconditioning at 23°C: Further evidence needs to be given that this has no impact on the test result
- Base procedure is mandatory and shall always need to be performed; optional procedure on next slides is only there for having procedure to evaluated the benefit of specific functions on the range value which will increase than
- Focus on mandatory procedure and not on additional procedure for the moment

23°C:

- Road load adjustment
- [Vehicle soak at 23°C or less until onboard REESS temperature target reached]
- SoC set to a level which allows to reach REEC < x% in the max. 2nd WLTC

-7°C:

- Soak of the vehicle for at least 9h; time of soak needs to be recorded
- SoC set at 23°C shall allow to reach REEC after maximum the 2nd WLTC (with required auxiliary devices switched on)
- Preconditioning [can be] done at -7°C [but also 23°C (in case of 23°C: same proceeding like ATCT)]: Preconditioning drive of max. 2 WLTC (to simulate a drive home) (second WLTC: REEC < x%), required auxiliary devices switched on reflecting user behavior and taking into account cabin isolation & other technologies
- Soaking and charging of vehicle (until fully charged but for at least 12h, time needs to be recorded); measurement of recharged energy $E_{AC,without\ customer\ options,-7°C}$ at -7°C
- Test procedure at -7°C with required auxiliary devices switched on
- To be discussed: required values to be calculated at -7°C

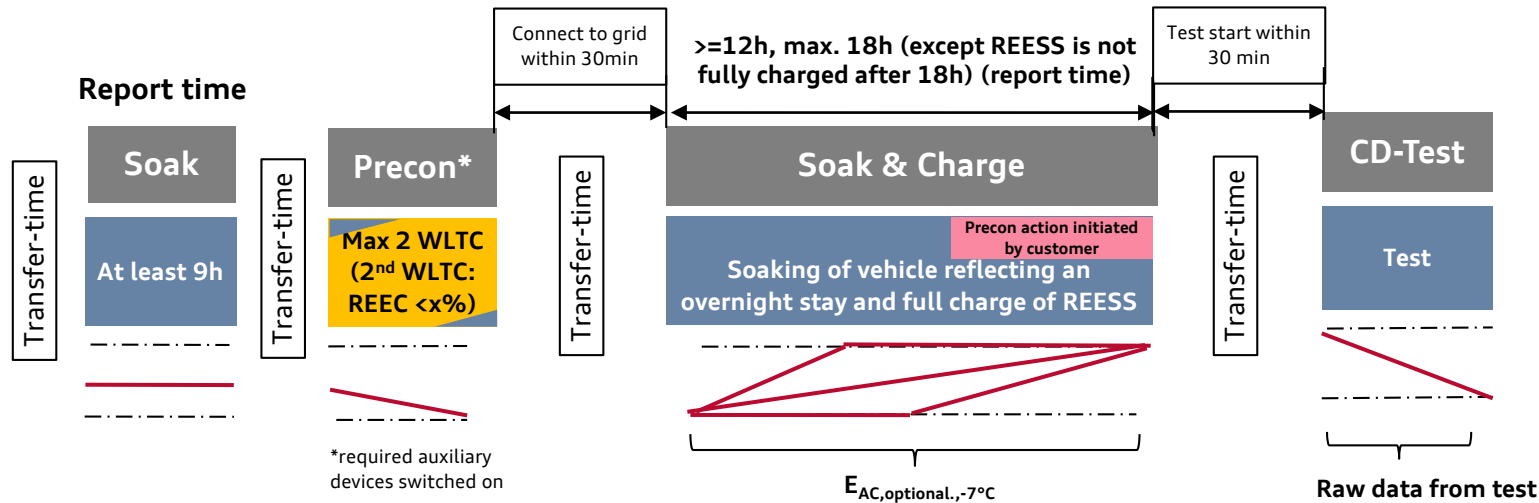
Test Procedure (OVC-HEV) – Charge Depleting Test

Proposal for -7°C Procedure – optional: additional procedure to reflect customer based preconditioning action

Road load adjust.

[Vehicle Soak at 23°C or less until onboard REESS temperature target reached,] SoC set to a level which allows to reach REEC < x% in the max. 2nd WLTC

Set point



Feedback from SG EV web-audio 11.12.:

- Requirement necessary that the level of SoC at the end of preconditioning shall be "same" than after test procedure
- Preconditioning at 23°C: Further evidence needs to be given that this has no impact on the test result
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23°C:

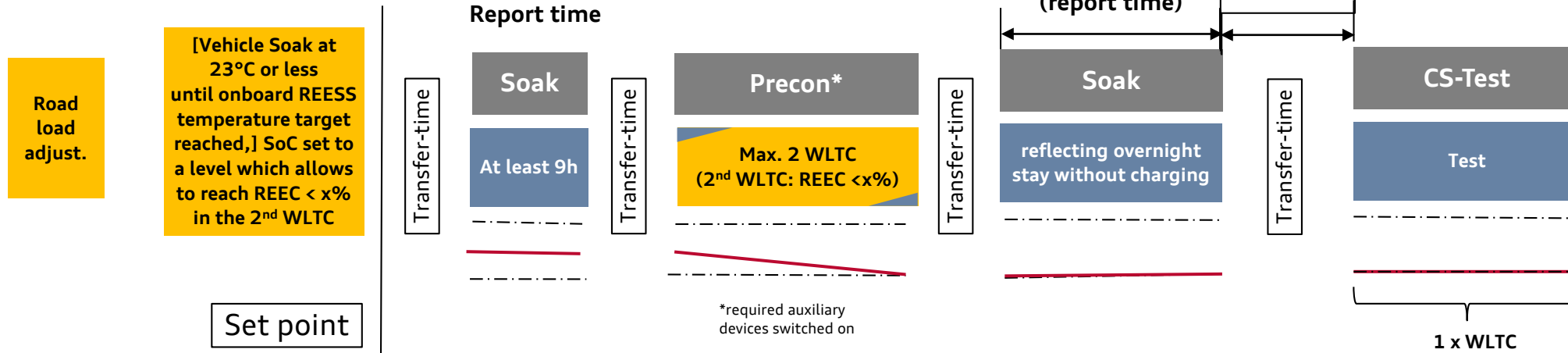
- Road load adjustment
- [Vehicle soak at 23°C or less until onboard REESS temperature target reached]
- SoC set to a level which allows to reach REEC < x% in the max. 2nd WLTC

-7°C (optional procedure for determining the effects of technologies like cabin preconditioning):

- Soak of the vehicle for at least 9h; time of soak needs to be recorded
- SoC set at 23°C shall allow to reach REEC after maximum the 2nd WLTC (with required auxiliary devices switched on)
- Preconditioning [can be] done at -7°C [but also 23°C (in case of 23°C: same proceeding like ATCT)]: Preconditioning drive of max. 2 WLTC (to simulate a drive home) (second WLTC: REEC < x%), required auxiliary devices switched on reflecting user behavior and taking into account cabin isolation & other technologies
- Soaking and charging of vehicle (until fully charged but for at least 12h, time needs to be recorded); measurement of recharged energy $E_{AC,optional,-7^{\circ}C}$ at -7°C
- Test procedure at -7°C with required auxiliary devices switched on
- To be discussed: required values to be calculated at -7°C

Test Procedure (OVC-HEV) – Charge Sustaining Test

Proposal for -7°C Procedure



Feedback from SG EV web-audio 11.12.:

- Requirement necessary that the level of SoC at the end of preconditioning shall be "same" than after test procedure
- Preconditioning at 23°C: Further evidence needs to be given that this has no impact on the test result

23°C:

- Road load adjustment
- [Vehicle soak at 23°C or less until onboard REESS temperature target reached]
- SoC set according to OEM to a level to reach REEC < x% after maximum the 2nd WLTC

-7°C:

- Soak of the vehicle for at least 9h; time of soak needs to be recorded
- SoC set at 23°C shall allow to drive a maximum of 2 WLTC with predominant mode in CD on with required auxiliary devices switched on
- Preconditioning [can be] done at -7°C [but also 23°C (in case of 23°C: same proceeding like ATCT)]: Preconditioning drive of 2 WLTC, 2nd driven WLTC shall fulfil REEC x% (to simulate a drive home and coming home in CS condition and forgetting to plug in the car), required auxiliary devices switched on;
- Soaking of vehicle (for at least 12h and a maximum of 18h, time needs to be recorded); soaking of vehicle reflects an overnight stay without charging
- Test procedure at -7°C with required auxiliary devices switched on

Proposal Procedures

Background of application of base procedure and additional procedure

NEW

Base procedure

- Mandatory only for the worst case of Low Temp Family (as Worst Case ratio can cover all vehicles of the Low Temp Family)
- Optional for all other vehicles in the Low Temp Family
- No customer initiated preconditioning actions shall be reflected in this procedure, only what the vehicle does by itself

To be discussed: value set

- Possible: Each vehicle will get a separate set of Low Temp Values
Value set based on the type 1 test result of the referred vehicle and the determined representative low temp ratio

Additional procedure (not considered at current stage)

- Additional procedure is optional
- Additional procedure for reflecting effects of customer initiated actions like cabin preconditioning on test results of base procedure
- Additional procedure can only be performed in addition to the base procedure, not stand alone for a vehicle

To be discussed: value set

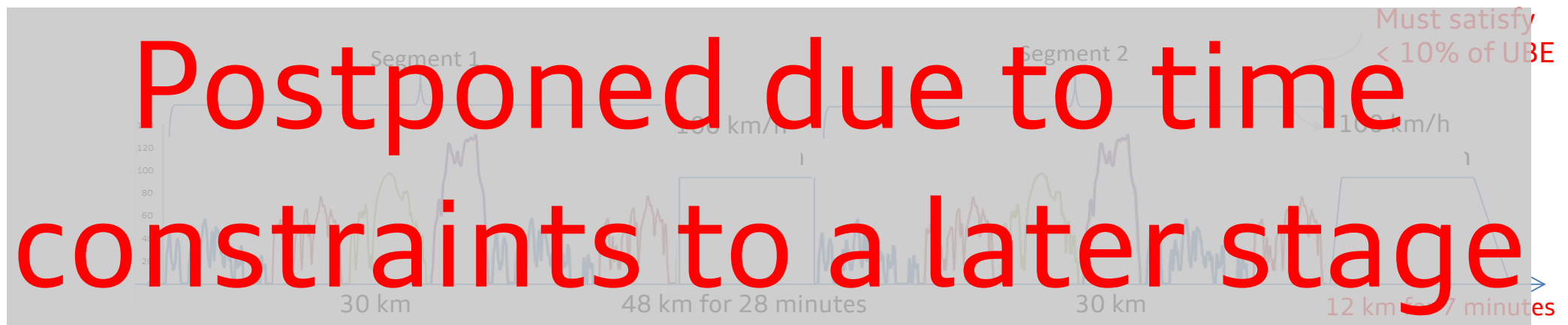
- Possible: For each vehicle tested with the additional procedure, the delta between the value set of this procedure and the base procedure shall be reported
- Delta shall quantify the benefit of the preconditioning action and can be shown to the customer

Postponed

Test Procedure (PEV) – Shortened Test Procedure at Low Temp

If 23°C STP is used for low temperature, what are the problems?

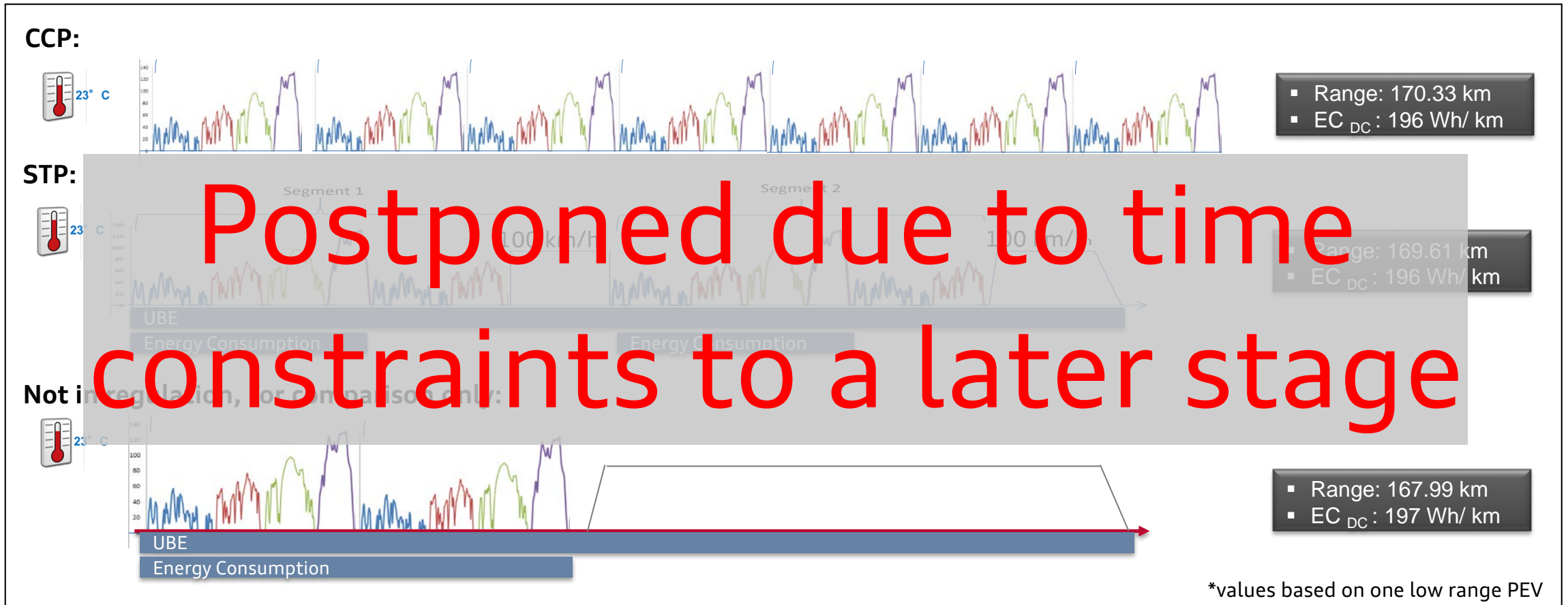
Exemple: 200 km WLTC range at 23°C => 120 km WLTC range at -7°C



- 2nd constant speed cycle will be very difficult to perform
- Combining the 2 constant speed segments at the end can provide a good solution
- Might situations where STP can be performed at 23°C but is not possible to be performed at -7°C

Test Procedure (PEV) – Shortened Test Procedure at Low Temp

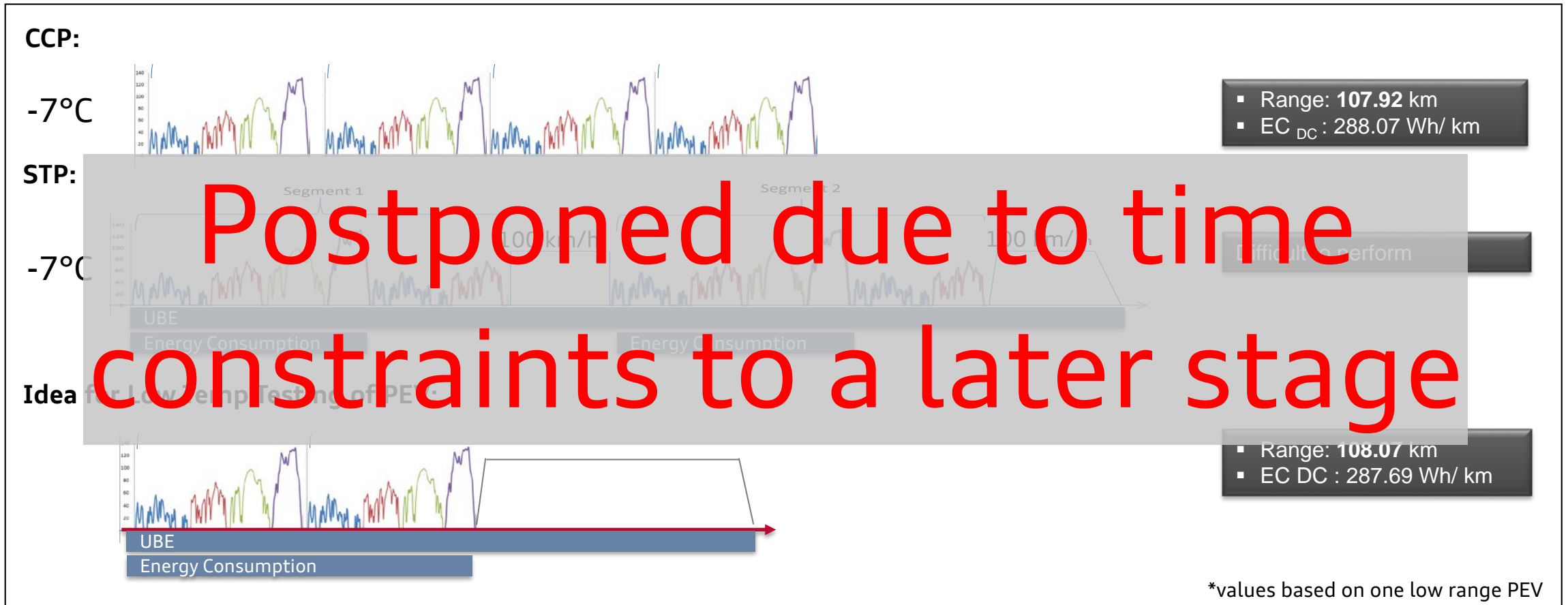
Possible solution for the problems to perform STP at Low Temp based on 23°C test result findings



- CCP and STP are providing the same test results, to avoid cherry picking regulation defined a threshold concept when which procedure shall be selected
- For comparison, an alternative set up of STP is provided above at the bottom of the box
- All procedure set ups provide the same test results which is important regarding the -7°C test procedure set up

Test Procedure (PEV) – Shortened Test Procedure at Low Temp

Possible solution for the problems to perform STP at Low Temp



- STP might be difficult to perform at -7°C (even if done at 23°C) due to the higher electric energy consumption
- To avoid the situation to run into problems, proposal is to drive the dynamic segments at the beginning and the constant speed segments in 1 piece at the end → UBE can be measured at -7°C

Test Procedure (PEV) – Procedure determination

Procedure selection flow chart – option 2 (with new procedure)

