Challenge Regulations
for the
iLumen European Solar Challenge 2016

26.08.2016, Release version 1.2

This document should be read in conjunction with the technical regulations.

Subject to modifications.

1 Introduction

The European Solar Challenge presents itself in the year 2016 with a totally new concept. In the past the Events have been smaller. This year a lot will change as the ESC will take place on the former Formula-1 race circuit Zolder in Belgium. Surrounded by the cleanweek, a great framework event concerning the topic of electro-mobility.

The challenge for the Teams during this event is focused on the strategy development to successfully perform a long run solely with the energy of the sun. It's a "brain" Sport!

This document provides the details of the challenge regulations in order to ensure a smooth and fair procedure of the different challenges. If you have any questions or concerns about these regulations, please do not hesitate to contact us. In this case Laurenz Holthoff (laurenz.holthoff@europeansolarchallenge.eu) will be the contact person.

We are looking forward to welcoming you at the event and we are hoping for an exciting, fair and entertaining event.

The Event Organizers

2 General Information

Race Circuit Zolder

Address:

vzw Terlamen
Terlamen 30
3550 Heusden-Zolder

Phone: +32 11 85 88 88
www.circuit-zolder.be

Track Data

Location	Heusden-Zolder, Belgium
Length	4.011 km (2.492 mi)
Turns	10

For detailed site plan see appendix A.

2.1. Flag Signals

Flag	FIA-sanctioned championships	Location	Use
	Start of race / Restart / End of hazard / Safe racing conditions / Pit lane open	Whole course	Waving flag
	Local caution / Full-course caution (if displayed with "SC" sign Safety Car on course)	Whole course	Waving flag / if necessary shown with „SC“ sign
	Debris, Fluid, or Oil on track	Whole course	Hold still
	Session stopped	Whole course	Waving flag
	Slow vehicle on track	Whole course	Waving flag
	Faster car approaching — during races / Lapped cars should give way to faster cars	Whole course	Waving flag
	Session finished / Winner	Race organizers only	Waving flag

Only for the ESC relevant flag signals are listed.
Non-compliance of the flag signals will lead to time penalties which will be assigned by the race control.

3 Race Organization

3.1. Race Commission

Every team has to provide one team member for the race commission. As follows the race commission will consist of one team member of each participating team and one person from the race control of the organizers.

The race commission makes decisions by majority.

A person of the race control will organize and lead the race commission, however this person does not participate in the votes.

All race commissioners have to be available on Friday the 23th of Sept. 2016 from 9h00 to 11h00 for a first meeting. Not providing a team member to this meeting will result in the immediate disqualification of the team.

The task of the race commission is to clarify discrepancies regarding the regulations. Furthermore, the race commission takes decisions concerning unpredictable influences respecting the race e.g. the termination because of heavy rain.

Each team is allowed to call a meeting of the race commission once during the event. Every further summoning will cost the team 500 €. Exception: The race commission can be summoned as soon as more than 50% of the teams have the same objection.

3.2. Race Control

The race control consists of three persons decided upon by the event organizers.

The task of the race control is the surveillance and controlling of the race event. All communication channels during the event end up at the race control. The race control decides about the release of the race circuit, status of the flags, time penalties and the safety car inclusions.

If discrepancies exist the teams can contest time penalties through the race control. The objection will cost the team another time penalty. One again, the issue will be examined together. If the race control decides in favor of the team the time penalty will be adjusted or withdrawn.

The race control can always summon the race commission.

3.3. Lineup and Raffle

After the scrutineering the raffle will follow. The start-numbers of the teams that have passed the scrutineering will be placed in the draw pot and will be drawn by the Fairy of Fortune.

The order of the start-numbers corresponds with those of the line-up for each challenge.

3.4. Safety Equipment

The teams have to provide the following equipment:

First-aid-box, ABC fire extinguisher (10 kg or more), reflective vests for all team members, battery datasheet, battery safety container and a safety method to extinguish a battery fire.

The battery safety container and first-aid-box have to be ready to use in the pit lane. Each team member, who is on the pit lane or on the race track has to wear a reflective vest.

3.5. Support Vehicles

Without an allowance from the race control no support vehicle is allowed on the race track.

3.6. Safety Vehicles

Safety vehicles will be driven by the official event organizers of the ESC or by employees of the race track themselves (ambulance).

If a safety car is required it will drive on the „slow side“ of the race track. No driver may overtake another solar car on the track, including the safety car, until the safety car re-opens the track and returns to the pit lane. In this case and also when the yellow flag is up, overtaking is not allowed.

3.7. Radio Communication

The teams have to have a two-way channeled radio, which allows the communication between the pit lane and the solar car.

3.8. Pushing

It is not allowed to move the solar car manually (by pushing or pulling) after it has been placed on the starting position. Manual movement is only allowed in the pit lane.

In an emergency situation, technical failure or vehicle damage, the vehicle has to be removed from the race track immediately. In this case it is allowed to push, pull or lift the vehicle from the race track. If the challenge will be continued it is allowed to push, pull or lift the vehicle to the exact position where it was removed from the race track.

3.9. Damage and Vehicle Failure

Each solar car which breaks down on the track or encounters any mechanical or electrical problems has to be removed from the race track as soon as possible before a repair can take place (for details look into the safety concept).

It is prohibited for team members to enter the track until they get the OK from the marshals. All people have to follow the rule of wearing a reflective vest when on the race track at all times!

Each solar car has to carry a towrope within the vehicle at all times in order for the safety car to be able to tow off the vehicle from the track into the pit lane.

Every vehicle which is towed off the race track has to be inspected again before re-entering the race track.

Stopping on the race track for any reason will cause time penalties.

3.10. Charging with external power supply

During the 24-hour race each team is allowed to charge their car from mains for two times. Each charging stop has to last at least one hour. The event organizers will provide a 3 Phase 16A CEE Power Outlet (IEC 60309) for each team.

Within the charging time it is not allowed to fix technical problems or to modify the car (exception: tire pressure).

3.11. Solar Charging

The teams are allowed to charge their batteries with solar power at any time. The alignment of the panels is only allowed in the declared charging area. The charging area will be announced during the event.

4 Safety

During the event, all battery parameters must be within the limits, specified by the manufacturer. The power supply has to meet the electrical safety guidelines of the team's home country.

During the 24h-race each team has to inform the race commission hourly about the following values of their traction battery:

- Highest cell temperature
- Minimum single cell voltage
- Maximum single cell voltage

Safety requirements for the charging device to recharge the traction battery:

- A residual current device (RCD) must be used
- The charger output must be electrically isolated from the input
- The charger must be stopped charging automatically when the energy storage system is fully charged
- The battery monitoring system must be in operating status while charging
- The charger output must be either permanently wired to the solarcar high voltage system or connected to the energy storage system using an appropriate connector

The battery officer is responsible for all listed points.

4.1. Static Scrutineering

Qualification must be achieved in road ready configuration. Vehicles which are unable to present at the designated time or are not ready to start may fail to qualify.

Each team must provide appropriate tools and personnel to facilitate the inspection of structural components.

One group of checks will be made with the solar panel in place and another group of checks will be made with the solar panel removed.

Checks with the panel in place:

- Signage
- Solar EV size
- Solar collector type and size
- Vision (all Solar EV drivers required)
- Lights, indicators, horn
- Possibility to toe the car

Checks without solar panel:

- Mechanical systems (seats, tires, brakes, steering)
- Electrical systems
- Energy storage system
- Roadworthiness.

The official mass of each solar car driver as weighed at scrutineering with helmet and driving clothes shall be 80 kg.

If the mass of a driver is less than 80 kg ballast will be added to make up the difference.

Ballast will be provided by the organizer.

No credit will be given if a driver or passenger weighs more than 80 kg.

During the scrutineering the entrant must provide two printed copies of a diagram (plan view, front of the Solar EV at the top) which clearly shows how emergency isolation can be activated. One copy will be placed in the observers' log book; the other will held by the organizer.

The entrant must provide a datasheet of the battery cells.

4.2. Time Keeping

Each solarcar has to carry a data logging and tracking device (transponder) provided by the organizer. The mounting point must be outside the solarcar with a maximum distance to the ground of 600 millimeter [mm] without any material in between the transponder and the ground.

The tracker can be mounted with cable ties. Maximum dimensions of the transponder will be length = 150 mm, width = 100 mm, height = 50 mm.

The transponder will be tested during a free practice time on the track.

4.3. Team Members

Each Team has to consists of at least:

- Team Manager
- Translator if the team manager is not proficient in English
- At least three solar car drivers
- Battery Officer

4.4. Entry Fee

The entry fee will be 2000 € per solarcar. There will be no refund.

4.5. Driver and Stint Organization

Each Team has to provide at least three drivers. Each driver has to perform at least one stint. It is not allowed to drive two stints in a row. Each driver is allowed to drive a solarcar for two hours continuously. Charging times will not be included in this time.

Laps which have been started after the two hours will not be counted.

5 Penalties

Any team failing to comply with these regulations during scrutineering, the qualifier or the challenge will be penalized. Penalties range from official warnings to disqualification from the event.

5.1. Penalty Times

All penalty times listed are suggested minimums. Driving conduct may double with each subsequent infraction. Mathematical penalties will normally be the same for each infraction. If the Inspectors believe that teams are deliberately violating traffic or driving regulations for strategic advantage, they may impose more penalties up to and including potential disqualification.

5.2. Protests

The race commission has the possibility to protest against the penalties (see 3.1).

5.3. Conduct

Penalties including disqualification from the event may be imposed for improper conduct or the use of alcohol or illegal substances. Improper conduct may include but is not limited to improper language,

unsportsmanlike conduct, unsafe behavior or cheating. Teams are responsible for the conduct of all persons associated with the team, whether or not they are officially registered.

5.4. Reduce Lap Penalties

Speeding: Any solar car found to be speeding will be penalized. Speeding penalties may be assessed based on the following factors: (1) velocity over posted speed limits, (2) length of time of speeding infraction. The speed of either the solar car itself or the trailer vehicle may be used in determining a speeding infraction.

Traffic Violations: Any solar car committing a traffic violation may be penalized, up to disqualification. Any solar car driver who commits three (3) traffic violations (including speeding) over the course of the challenge may be individually disqualified from the event.

Pushing: A one lap penalty for every team who pushes a solar car along the track. (Except in an emergency).

Improper Ballast: A five lap penalty may be assessed each time a team operates their solar car with ballast that does not match the solarcar driver.

Unauthorized Drivers: Any solar car that drives with an unauthorized driver will be required to return to the pit lane and drive with an authorized driver. Unauthorized driving will not be counted.

Disturbing Official Battery Seals: Solarcar batteries will be marked with an official seal. Disturbing these seals in a manner that prevents proper identification by an observer may be penalized as though all of the battery modules affected had been replaced as in Reg. 4.4.8.

Replacement of Batteries: Decisions to exchange all or part of a battery must be communicated formally to the teams' observer. The penalty will be computed as follows:

One Lap penalty for each single physical cell.

Exceeding Size Specifications: Oversized solar arrays will be penalized one lap per excessed centimeters in each dimension beyond the allowed size specification.

Restriction on Overtaking: On the track there are three dangerous curves. The restriction on overtaking will be marked with red tire stacks (will be published in the team meeting). Dangerous overtaking in these curves will be panelized with a penalty of three laps.

Shortcut curves on the green areas beside the track will be penalized with one lap penalty.

6 The Challenges

The race event entails four different challenges which are distributed over three days. Through the participation in each of the four different challenges the teams can achieve a score which will be weighted according to the figure below (Figure 1).

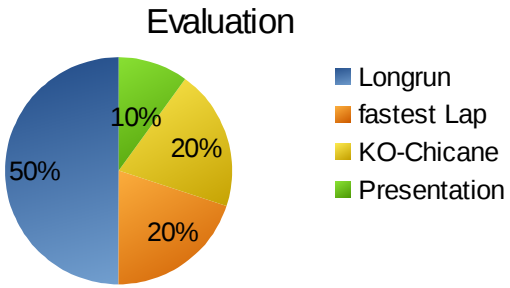

Figure 1: Evaluation

1. The scoring for the different challenges is divided as follows:

	First Challenge Fastest Lap	Second Challenge 24-hour Race	Third Challenge Presentation	Fourth Challenge K.O. - Chicane
1st	20	50	10	20
2nd	15	40	8	15
3rd	10	30	6	10
4th	5	20	4	5
5th	-	10	2	-

Table 1: Overview of the scoring for each challenge

6.1. Fastest Lap

The fastest lap will take place during the 24-hour race.

Each team has to communicate their intention to do the fastest lap to the race control. After recognition of the race control each team is allowed to perform two run-throughs. Only the fastest lap prevails.

The team with the fastest lap wins the challenge.

6.2. 24-hour Race

The 24 hour race takes place from Saturday the 24th of Sep 2016 13h00 to 25th of Sep 2016 13h00.

The race consists of 22 hours driving time and two times of at least one hour of charging (see 3.10).

The race starts with a Le-Mans-Start (see).

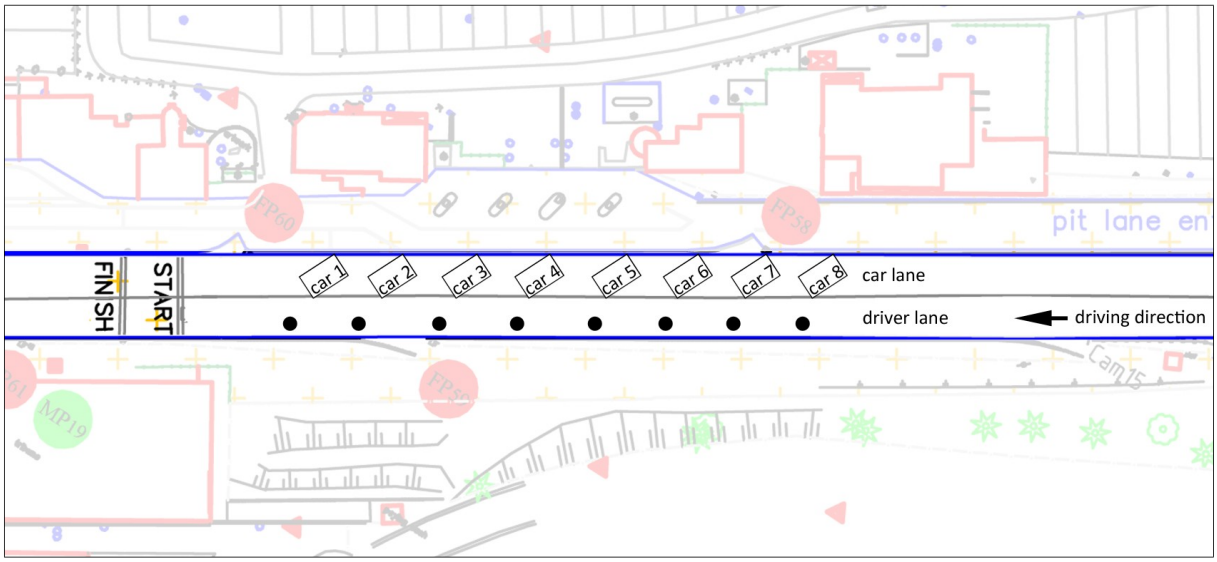

Figure 2: Le-Mans line-up

For the lineup the teams are allowed to drive backwards through the pit lane. The lineup will be guided by the observers (for starting position see chapter 3.3).

Driving without properly fitted safety belt will be penalized.

Each team has the possibility to assign one team member to help the driver enter the solarcar during the start.

The lineup has to be completed by all teams 12h50 on Saturday.

Teams which arrive not in time must start from the pit lane and will be penalized.

Depending on the challenge strategy all teams can decide when their solar car exits and enters the race track during the given race time (for details see chapter 3.10 and 3.11).

Within the given challenge time technical problems can be fixed (tire change etc.). All changes have to comply with the iESC regulations.

6.3. Presentation

Each team has to give a 10 minute technical presentation about a particular exception or a technical innovation of the vehicle (please present an example of the particular exception or the technical innovation)

The presentation has to be held in English.

The teams can decide themselves how many people will be involved in the presentation.

The order of the presentation will be related to the raffle of the lineup (see 3.3).

The presentations have to be handed in to the organizers as PDF file during the scrutineering. The organizers will make sure that a laptop and a video projector are in place (all handed in presentations will already be saved on the laptop).

The presentation laptop will have a preinstalled version of Adobe Acrobat X Pro and Microsoft PowerPoint 2010 which can be used. Other programs are not supported (if you want to use others please contact the organizer).

If the presentation will not be handed in until the deadline the presentation will not be regarded in the overall evaluation.

The evaluation of the presentations will take place by an independent jury consisting of 5 specialists. The assessment criteria are:

- Innovativeness: 40%
- Overall impression of the presentation: 30%
- Quality of the slides: 20%
- Compliance of the time limit: 10%

6.4. K.O.-Chicane

The KO - Chicane will take place on Friday the 23th of Sep 2016 from 09h00 until 13h00.

Each team one after the other drives through a predefined segment of the race track including a chicane. The distance between the start and finish line will be approximately 300 meters.

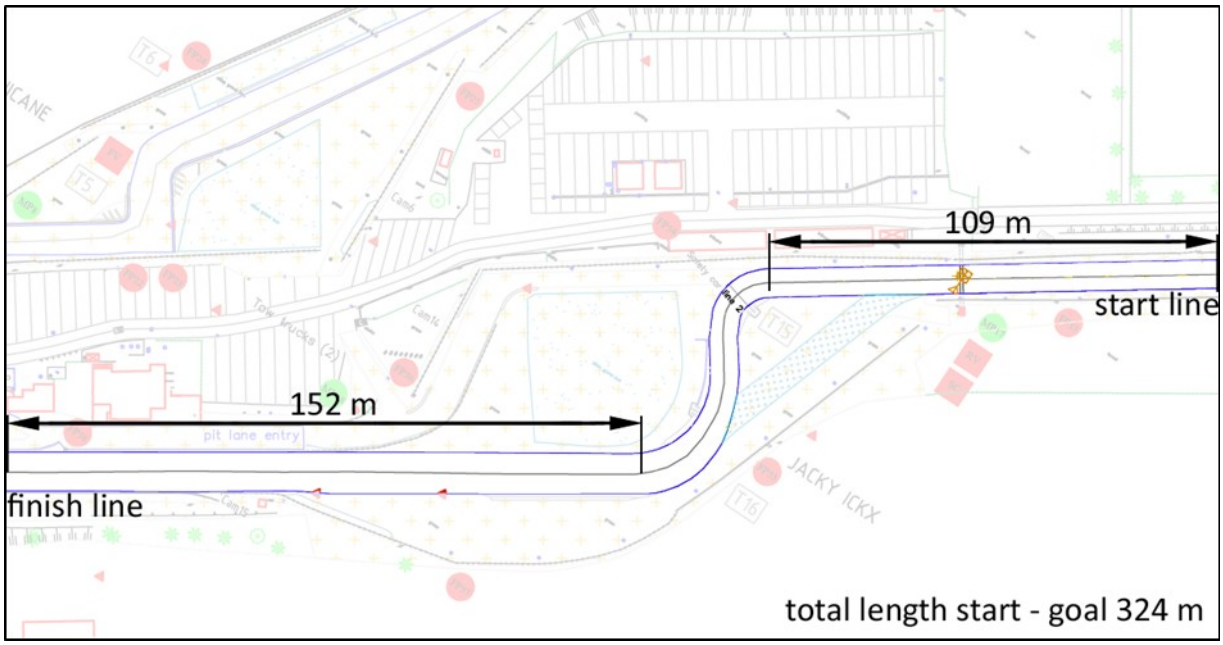

Figure 3: Overview of the chicane

The teams will drive backwards to the pit lane and turn at the medical center. The lineup will be executed in front of the gate (see Figure 3).

The time from start to finish will be measured and is crucial for the determination of the winner.

The event is composed of a qualifying and a K.O.-system.

The qualifying will take place within a timeframe of one hour. During this hour each team is allowed to perform up to three run-throughs depending on the number of participants.

Only the fastest time will be measured.

The best teams will qualify themselves for the K.O.-system.

After the qualifying there will be a short brake (up to 30 minutes). In this break the participants of the K.O.-system will be determined by a raffle.

There are different scenarios for the KO-system depending on the number of participating teams. The raffle and the competition will take place according to the respective scheme (see Appendix A and Appendix B).

Each duel consists of one run-through. The team with the faster time will go through to the next round.

When the two teams have to exact same time both teams have to race again.

The first four rankings will receive points (see Table 1).

6.5. Beat the Tesla

Regulations will be announced soon.

7 Appendix

Appendix A


TERLAMENBOCHT
G. VILLENEUVE
BOLDERBERGBOCHT
MEDICAL CENTER
ZOUCHEN RINDT
GB-BRUG
JACKY IDEX
CHICANE
1STE LINKSE
L. BIANCHI
STERRENWACHT
KANAALBOCHT
LEGEND
Observation post
Fire post
Safety car
Recovery vehicle
Helipad
Fire vehicle
Medical vehicle
Extrication vehicle
Debris fence (second line of protection)
Spectator fence
Guardrail (first line of protection)
Tyre barrier with conveyor belt
Kerbs
Run off asphalt
Run off gravel
N
File name: FIA_belgium_zolder.dwg
Issued by: Circuit and Saftety departement
Scale: 1/2.000
Date: 07-05-2009
CIRCUIT ZOLDER
vzw TERLAMEN
Terlamen 30
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Fax: +32 11 85.88.95
FEDERATION INTERNATIONALE DE L'AUTOMOBILE (FIA)

Appendix B

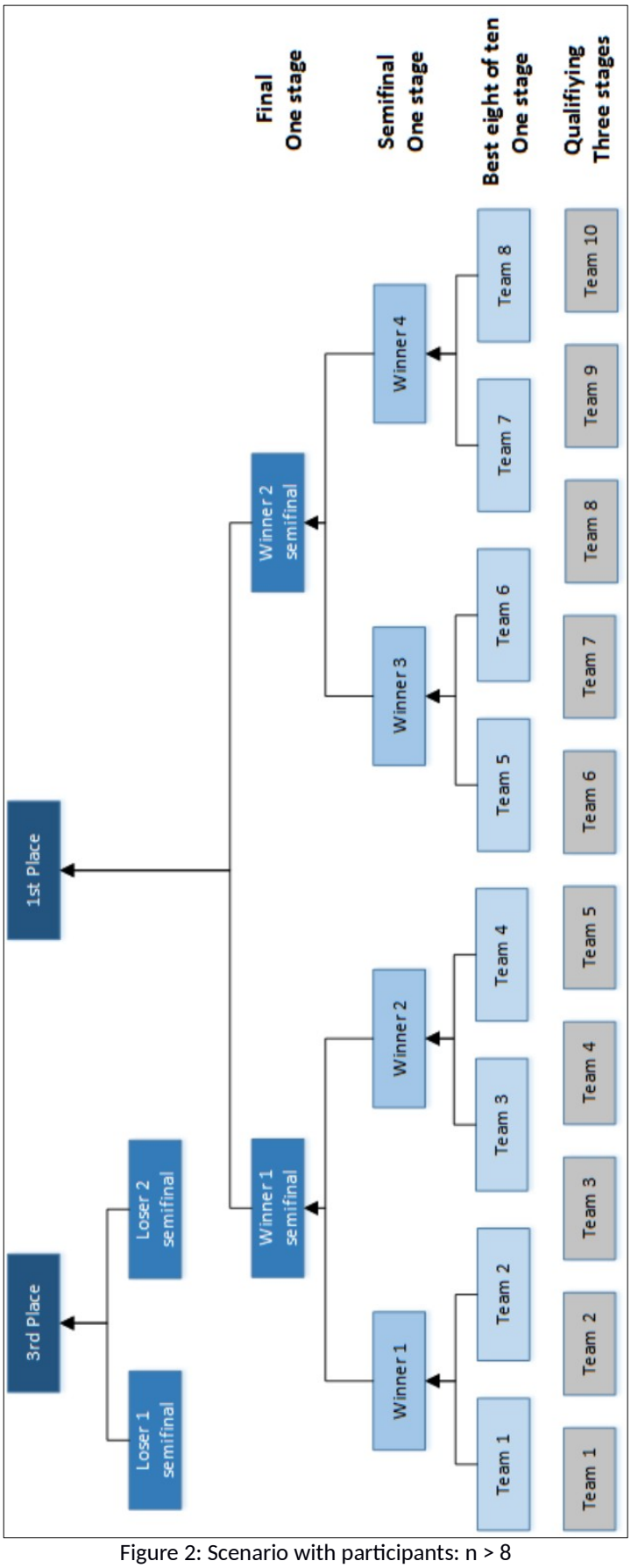

Figure 2: Scenario with participants: n > 8

Appendix C

Document Control

Release version 1.2

- 6.2 & 6.4: Schedule times amended
- 7: added Apprendix A-C