

***General Rule:** Check the general rule before reading this game rule. Please be aware that the general rules apply equally to all events during the competition.

***Attention:** Please be aware that this is a provisional version of the rules, there may be some changes. Especially, since the size and weight of the testing material are still on progress, there may be new updates.

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|----------------------|----------------------|--------------|------------------|
| Energy Saving | League | Construction | Participation |
| | Junior/ Challenge | On Site | 1 Person 1 Robot |

1. Game Description

Energy Saving is a game that aims the robot to finish the course as fast as possible using solar energy. Only solar energy and condenser is allowed as a power, and since diverse courses (curved, straight, slope courses) are asked to be driven, understandings of structure of robot and physical knowledge is needed.

2. Robot

2-1. Type of robot No restriction

2-2. Construction (on-site) The robot should be built on-site by the participant. However, controller module of robot, wire joint connected with solar panel, wire joint connected with condenser, and condenser module can be made in advance.

2-2-1. Size of robot No restriction on size of width, length, and height. However, robot bigger than the guide wall of the playfield is not allowed, if they cannot run the playfield due to its size.

2-2-2. Power of robot Robots should work only with a solar power supplied by the artificial sunlight (halogen light) and condenser provided in playfield A. Additional independent power except power using artificial sunlight and condenser are not allowed.

2-2-2-1. Size of solar panel Maximum of 150mm x 150mm

2-2-2-2. Condenser Condenser under 2F is allowed.

(Using more than one condensers under 2F in total is allowed.

i.e. 2 condensers of 1F, 20 condensers of 10mF)

2-2-3. Operation No limitation

2-3. Programming and controlling Robot must be programmed to move automatically, and no extra controlling is allowed except when starting.

2-4. Connector and low power motor

2-4-1. Connector (Participant must prepare their own) The robot must be connected with the assigned connector (arm shaped) at the power supplying line to the condenser. If not, **participating is not allowed** since electric discharge may not be handled or identified.

Assigned connector: SMH250 2.50mm pitch connector housing 2pin (arm shaped)

2-4-2. Electric discharge system (Low power motor) (Prepared by IROC) Small DC geared motor N20 type [SZH-GNP095]



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2-5. Disconnection between motor horn and wheel Wheel and tire doesn't need to be disconnected, and they are not supposed to be connected in advance.

3. Competition site

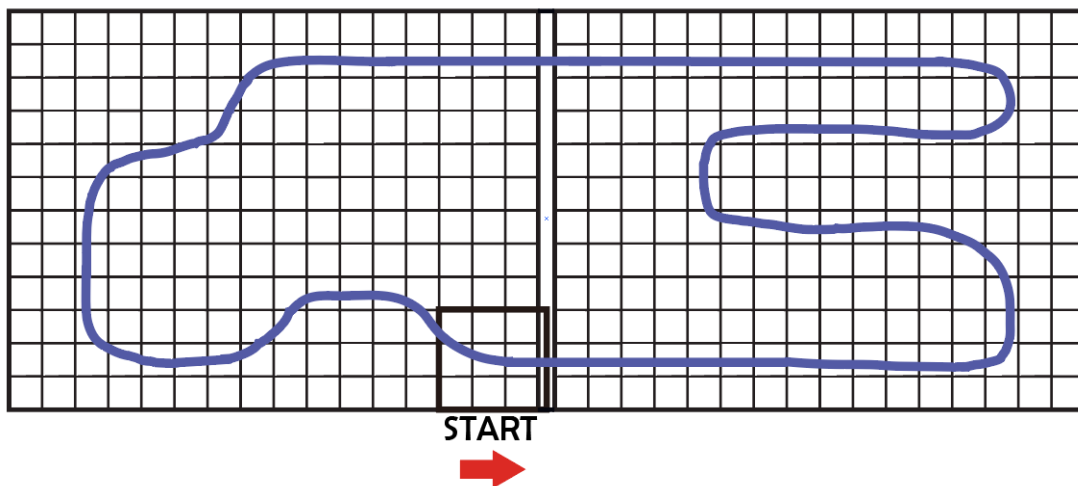
3-1. Official competition site Playfield approved by International Robot Olympiad Committee.

3-2. Size and composition Two playfields A and B in size of 160cm X 120 cm ($\pm 10\%$) is connected to each other.

3-2-1. Connection of bridge Two playfields may be connected with the bridge with 25cm (error $\pm 10\%$) in width with straight or curved shape, or may be connected directly. The bridge will be fixed on a playfield using sheet and tape.

3-2-2. Allowable range of error in the stadium The slope less than 2° ($\pm 10\%$) and a gap or bump less than 3mm ($\pm 10\%$) is allowable.

3-2-3. Prevention robot from falling There will be no special structure to prevent robot from falling.



<Example>

3-3. Playfield Covered with a white matte coated pet paper, and there may be an advertisement or a logo of the host.

3-3-1. Mission map Checkered map with 10cm interval is used, stick on the field with sheet and tape. Also, distance points will be written on the checkered patterns based on starting point to record score.

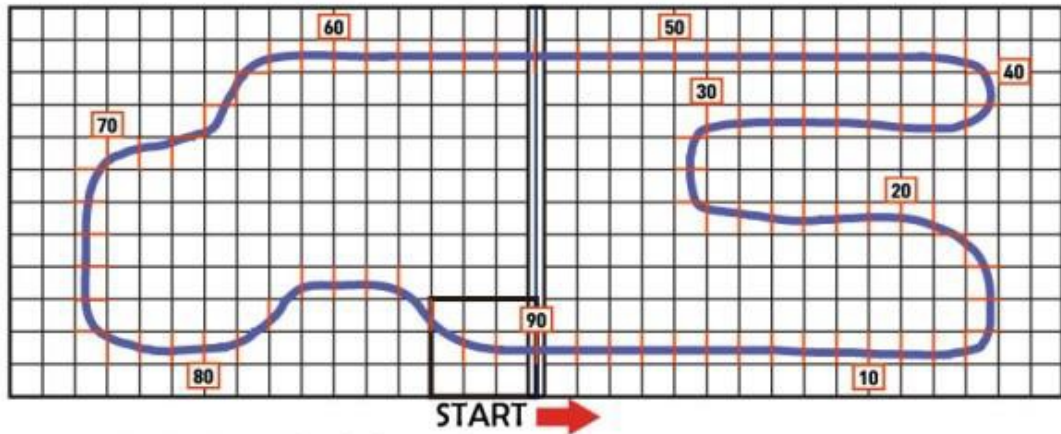


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2019 International Robot Olympiad Committee

Energy Saving



- Whenever a robot passes a red line, it will get 1 point.
(It is calculated after the start line, if a robot runs a lap, the point of start line will be scored as well.)
- If a robot touches the line a little anyway, the point will be scored.

▲ Do not bring this mission paper outside the challenge field until the end of every competition

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<Example>

3-3-2. Driving course Driving course is drawn in line, with a combination of straight and curved line.

3-3-3. Line Black line with 2cm in width (error $\pm 10\%$).

3-3-4. Starting line Starting line on the starting point is a black line with 2cm (error $\pm 10\%$) in width, connected with the driving course vertically or drawn in a broken line.

3-4. Artificial sunlight (halogen light): Artificial sunlight will be installed at area A as a source of light. There won't be any artificial sunlight in area B.

3-4-1. Allocation of halogen light Lamps are fixed standing on the side of the playfield or installed as a structure on the ceiling of the playfield.

3-4-2. Standard of halogen lamp At least 200wh and will be noticed on-site at the day.

3-4-3. Height of halogen lamp Installation height of halogen lamps is 25 cm (error $\pm 5\text{cm}$) above the floor of the playfield, and the pasturage of the light is vertical from the playfield.

4. Competition progress

4-1. Way of game process Game is processed by recording, and the chances are given twice. Rectifying time will be given between chances.

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4-2. Robot production and practicing time At least 30 minutes and maximum of 2 hours will be given for producing robot and practicing, and will be noticed on the day.

4-3. Assignment of playfield Depends on number of participants and level of difficulty.

4-4. Production and practicing Participant can practice on the playfield until production and practicing time noticed, but cannot before playfield assignment.

4-5. Production and end of practicing When time for production and practicing finishes, the participant must stop the robot and go back to their seat following staff and referee's instruction.

4-6. 1st trial 1st trial starts right after the production and practicing time (or after lunch).

4-6-1. Preparing competition All participants must bring their robots and wait in line following the instruction of staff and referee. The condenser used as a battery must be totally out of power. Thus, + and – pole of condenser must be shown to referee, or port to enable power outage must be added to facilitate power outage. Referee must discharge with low power motor right before the competition.

4-6-2. Stand by after competition All participants should not go back to their seat, but must wait in line after their trial until all participants finishes their trial.

4-7. Modification Time for modification will be given to all participant after 1st trial for robot modification and practicing. Modification time will be noticed on the day.

4-8. 2nd trial 2nd trial will be held right after the modification.

4-8-1. Preparing competition All participants must bring their robots and wait in line following the instruction of staff and referee. The condenser used as a battery must be out of power. Thus, + and – pole of condenser must be shown to referee, or port to enable power outage must be added to facilitate power outage. Referee must discharge with low power motor right before the competition.

4-8-2. Stand by All participant must go back to their seat after their trial.

5. Competition progress

5-1. Performing the mission

5-1-1. Driving at area A After referee's signal, participant should turn on its switch, and after that, touching robot is not allowed. If participant pushes the robot physically or turn on its switch again, they will be disqualified. Then the robot must convert or charge light energy to electric energy independently to move and the robot must start moving within 40 seconds.

5-1-2. Driving at area B Robots must use only the accumulated energy in the condenser from area A to drive the courses.

5-2. Acquiring score Score will be acquired at the point where robot stopped.



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5-3. Start Start by referee's start sign. Referee starts the timer at the moment when starting.

5-3-1. Discharge of condenser Before starting match, participants should discharge their condenser. Referee will check whether it stopped or not before starting the game using low-power motor. (Specifications of the motor will be noticed afterwards.)

5-4. Arrival Referee stops the timer when robot stops. (If robot moves in 10 counts or while 10 counts, the timer starts again.)

5-5. Limited time The total competition time is maximum of 2 minutes including area A.

5-6. Mission open Missions such as shape of playfield and bridge, driving course, and location of halogen light will be noticed on the site before the competition starts as a mission paper.

5-7. Finish of competition

5-7-1. Area A: Excess in time limit for charging If a participant exceeds the time limit for 40 seconds at area A, the participant will be disqualified.

5-7-2. Area B: Robot stop If robot doesn't move after entering area B, referee gives 10 counts from the moment the robot stopped. If the robot doesn't move again while counting, and the points when robot stops will be accepted as the record.

5-7-3. Record Score and time of moved distance till the limited time will be acknowledged as the record. If the moved distance is equal to each other, time takes the priority.

5-7-4. Lineout If the robot doesn't touches the robot at all, the game finishes, and the record till the declaration of end of competition will be acknowledged.

5-7-5. TKO (Technical Knock Out) If moving ordinarily is impossible, referee may declare TKO conforming to robot stop without 10 counts. The best score among scores till the declaration of TKO will be acknowledged. (i.e. when moving around the same places repetitively, when blocked by a structure or obstacle and not moving, when moving out of the playfield (falling from the playfield), when robot flips, etc.)

5-8. Disqualification Participants will be disqualified and the game ends if violating rules or disturbing the competition progress gets spotted by referee or staff, and the record doesn't get recognized.

5-8-1. Robot touch If the participant touches robot without acceptance of referee or staff, robot touch will be declared, and will be disqualified for the trial.

5-8-2. Robot modification while competition Adding, removing, exchanging or modifying component of the robot during the competition is not allowed, and if holding extra components, tool, or battery while waiting in order to modify the robot, the trial will be disqualified.

5-8-3. Defaulting assigned playfield If playing or practicing at the playfield other than the assigned field, the participant will be disqualified.

5-8-4. Battery usage detected If using ordinary battery, not a condenser, gets caught, the participant will be disqualified.



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5-9. Rematch When accident such as blackout or trouble in timer happens, rematch may occur by a decision of referee.

5-10. Decision of referee Referee has authorization to control all situations and participants at all times during the competition. Judgement of the competition is referee's own authorization and referee has the authorization for final judgement.

6. Competition record

6-1. Recording items Points per spot at the course and time record

6-2. Points per spot at the course After referee's declaration of finish of the game, the point of the spot where the robot stopped will be accepted. The highest point among the spots that wheel touches will be accepted. If gone through whole turn, total points in the mission map will be recorded.

i.e.) If the total point of whole turn is 90, and the robot has gone through whole turn and additional 10 red lines = 100 points (refer to the mission map on 3-3-1)

6-3. Time record Time counted at the timer when the robot stopped will be acknowledged as the time record. (If robot falls or TKO occurs, the time record till the occurrence will be acknowledge.)

6-4. Final record Better record among 1st and 2nd trial will be considered as the final record.

6-5. Priority of record If tied when arriving at the same grid, comparison between time record will be held to choose the rankings.

6-5-1. Priority on trial If tied on the same trial, record of another trial should be compared to choose the rankings.

6-5-2. Priority when record Better record among 1st trial and 2nd trial will be considered as the final record, but when tied, the participant with better score on the 1st trial takes priority.

