



XPRIZE
CARBON
REMOVAL



MUSK FOUNDATION

1 COMPETITION GUIDELINES

2 XPRIZE Carbon Removal is governed by these **Competition Guidelines**. The Competition
3 Guidelines summarize the high-level requirements and rules of the competition.

4 XPRIZE may revise these Guidelines at any time during the course of the competition to
5 provide additional information or to improve the quality of the competition. Unanticipated
6 issues that arise may require modifications to these Guidelines. XPRIZE reserves the right to
7 revise these Guidelines as it, in its sole discretion, deems necessary. All registered teams will
8 be notified of revisions in a timely manner.

9 For further details concerning the operation of the competition, such as exact dates and
10 locations of events, specific technical thresholds for performance testing, and operational
11 information, please refer to the **Rules and Regulations, Competitor Agreement**, and other
12 documents that will be forthcoming throughout the course of the competition.

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35 Overview

36 Climate science is clear that in order to avoid the worst effects of climate change we need to
37 dramatically reduce carbon dioxide (CO₂) emissions as aggressively as possible, now. It has
38 also become clear that net zero is not enough. We also need negative emissions: innovation
39 that goes beyond limiting CO₂ emissions, but actually removes and sequesters CO₂ that is
40 already in the air and oceans. In particular, the world's leading climate scientists estimate that
41 humanity must remove 10 gigatonnes of carbon dioxide per year by 2050 in order to reach the
42 Paris Agreement goal of limiting the Earth's temperature rise to no more than 1.5°C of pre-
43 industrial levels, or even 2°C. If humanity continues on a business-as-usual path, the global
44 average temperature could increase 6°C by the year 2100. One prize will not "solve" climate
45 change. But it can radically increase the level of innovation, demonstration, investment, and
46 rigor of a variety of carbon removal solutions in a way that accelerates the rate of scale-up and
47 deployment of the best solutions.

48 XPRIZE Carbon Removal is a four-year global competition that challenges innovators from
49 anywhere to create and demonstrate solutions that accomplish CO₂ removal ("carbon
50 removal") -- pulling CO₂ directly from the atmosphere or the oceans and locking it away in a
51 durable and sustainable way that can scale massively to gigatonne levels. We have entered a
52 key decade of climate action. In order to reach the long-term goal of 10 Gt/y by 2050, XPRIZE
53 Carbon Removal aims to incentivize solutions whose combined capacity at scale can reach 2.5
54 Gt/y by 2030. There are a range of scientific estimates for carbon removal targets, each of
55 which depend on a different set of assumptions about how quickly we can reduce our current
56 CO₂ emissions. Scientific debate about the right target will likely continue and evolve in time,
57 but one thing is clear: humanity will need gigatonne scale carbon removal, and we are nowhere
58 near there today. The field needs a nonlinear intervention to get there.

59 ***To win the prize teams must demonstrate carbon removal at the kt/y scale, model costs***
60 ***at the Mt/y scale, and make a case for a sustainable path to Gt/y scale. The team with***
61 ***the most scalable and lowest-cost carbon removal technology will win.***

62 ***Any carbon negative solution is eligible, whether related to air, oceans, land, or rocks, or***
63 ***any other method that can durably and reliably remove and sequester CO₂.***

64 Impact Goal

65 XPRIZE Carbon Removal will challenge innovators to demonstrate the viability of durable, low-
66 cost, scalable, and sustainable carbon removal solutions. Humanity needs a portfolio of
67 solutions that can reach a combined installed capacity of 2.5 billion tonnes (gigatonnes) of CO₂
68 removal **per year** by 2030 in order to be on track to meet the IPCC goal of at least 10
69 gigatonnes **per year** by 2050¹. The competition is designed to help put humanity on track to
70 meet this goal.

71 Objectives of the Competition

- 72 1. Increase the global supply of cost-effective, durable carbon removal solutions
- 73 2. Prove the scientific / technical viability of a diversity of high-quality carbon removal
74 solutions that can be deployed and maintained sustainably, including both existing and
75 new solutions
- 76 3. Accelerate the scaling and equitable deployment of proven carbon removal solutions
- 77 4. Inspire the next generation of talent and innovators in carbon removal

¹ IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. V.P. Masson-Delmotte et al.

78 Prizes

79 **Grand Prizes (US\$80M Total)**

80 After 4 years, judges will select the winners:

- 81 • US\$50 million paid to the single Grand Prize Winner
- 82 • US\$30 million to be distributed among up to 3 runners up

83 **Milestone Prizes (US\$15M Total)**

84 After 1 year of competition the judges will review all submissions received by that time and
85 award up to 15 Milestone Prizes of US\$1 million each. At the discretion of the judges, these
86 awards may be granted on a conditional basis, subject to the team’s demonstrated
87 commitment to continuing to develop and advance their solutions and to compete for the
88 Grand Prize.

89 ***Teams that do not receive or do not compete for US\$1 million Milestone Prizes are still***
90 ***eligible to compete for the Grand Prizes.***

91 **Student Awards (US\$5M Total)**

92 XPRIZE will award up to US\$5M to student teams in the Fall of 2021. These awards may fund
93 participation in the XPRIZE Carbon Removal or the development of key supportive
94 technologies. The areas of focus for these awards are:

- 95 1. **College & University Carbon Removal Demonstrations (up to US\$3M)** : Awards of
96 up to US\$250,000 for carbon removal demonstrations to compete for the \$50M Grand
97 Prize.
- 98 2. **Measurement, Reporting, and Verification Technologies (up to US\$2M)**: Awards of
99 up to US\$100,000 for technology that may not directly remove CO2, but will enable
100 carbon removal. Priority will be given to proposals in the following areas:
 - 101 a. Technologies and methods which improve the precision, accuracy, and time
102 required for carbon measurement, especially in natural ecosystems.
 - 103 b. Methodologies and toolsets which improve the standards of assessment,
104 reporting, and accounting for Life Cycle Analyses (LCA), Cost Modelling, and
105 Techno-Economic Analyses (TEA) of carbon removal solutions.

106 For additional information, please refer to the [Student Award Guidelines](#).

107 Solution Scope

108 **Solutions In-Scope for the Prize**

109 Any carbon negative project is eligible to win prize money provided it removes CO₂ from the air
110 or oceans, and sequesters it in a durable way. Teams may compete in any of the major carbon
111 removal pathways listed below, or some combination of the pathways. This list of pathways is
112 not intended to be exhaustive:

- 113 ● **Air:** direct air capture (DAC) plus sequestration.
- 114 ● **Oceans:** algae, kelp, plankton, direct seawater removal, ocean alkalinity enhancement,
115 etc.
- 116 ● **Land:** Trees, agricultural solutions, soils, soil microbes and fungi, roots, grasslands,
117 large-scale outdoor natural ecosystem solutions, biochar, etc.
- 118 ● **Rocks:** Mineralization, enhanced weathering, mine tailings, subsurface geologic
119 sequestration combined with CO₂ removal from the air and/or the ocean, etc.

120 **Solutions Out of Scope for the Prize**

- 121 ● Pathways which result exclusively in short-term re-release of CO₂ without
122 sequestration, e.g. CO₂ to fuel. Solutions must demonstrate long-term, durable
123 sequestration of CO₂.
- 124 ● Utilization-only technologies that demonstrate conversion of CO₂ but not removal of
125 CO₂ from the air and/or the ocean.
- 126 ● Solutions that may capture CO₂ from the air and/or the ocean but cannot demonstrate
127 net negative emissions.
- 128 ● Solutions that remove CO₂ but are not net negative on a lifecycle basis, e.g. enhanced
129 oil recovery.
- 130 ● Solutions whose CO₂ benefits are only theoretical or cannot be directly measured with
131 adequate precision over the course of the competition.

132 **Novel Solutions vs. Solutions That Already Exist**

133 There is no restriction on existing solutions competing for the prize, provided they can meet all
134 the competition requirements. Similarly, there is no restriction on never-before-demonstrated
135 carbon removal solutions competing for the prize, provided they can meet all the competition
136 requirements.

137 **Demonstration Locations**

138 Teams may demonstrate their carbon removal solution at any location of their choosing
139 throughout the competition. Teams must be prepared to have XPRIZE visit their project site as
140 needed throughout the competition and in the final year of the competition to validate the
141 team's performance claims.

142 **Net-Negative CO2 Removal**

143 Solutions must demonstrate net-negative and durable CO2 removal to be considered in-scope.
144 It is the responsibility of teams to prove through their demonstrations and a life cycle analysis
145 that they meet this requirement. Negative emissions may be established on a net basis over
146 the lifetime of the demonstrated carbon removal project. In addition, teams must demonstrate
147 how the sequestered carbon will be maintained (on a net basis) for at least 100 years to ensure
148 that more carbon is removed than re-emitted. Finally, teams must demonstrate how they will
149 achieve net negative CO2 removal in the 1 Mt/yr and Gt/yr scenarios.

150 **Durable CO2 Removal**

151 The durability threshold for the competition is 100 years. This means that to be considered
152 removed, CO2 must be sequestered (on a net basis) over at least 100 years. A cradle-to-grave
153 life cycle analysis will be required to validate claims of 100 year durability in addition to net
154 negativity. In particular, establishing 100 year durability should be a function of inherent
155 verifiable and quantifiable durability of the CO2 removal solution (i.e. the stability of the
156 sequestered carbon) and any required repetition, long-term management, and/or monitoring
157 that may be required to ensure that removed CO2 remains sequestered on net through 100
158 years. For example, CO2 mineralized into rock may be known to be inherently stable (e.g.
159 geologic sequestration), but any monitoring and verification requirements during that 100 years
160 must still be explained and costed. Similarly, a standing forest may be known to have much
161 more dynamic CO2 flux over time and less inherent durability, so proposed methods of
162 ensuring long-term net sequestration through 100 years and any associated costs must be
163 explained in detail.

164

165 Eligibility

166 XPRIZE believes that solutions can come from anyone, anywhere: Scientists, engineers,
167 academics, entrepreneurs, and other innovators from all over the world are invited to form a
168 team and register to compete. To participate, a team is required to first create an account in
169 the [Prize Operations Platform \(POP\)](#) and pay a registration fee of \$250. POP is an online
170 platform through which teams will register for the competition, pay the registration fee, and
171 submit important documents throughout the competition. Teams are expected to maintain their
172 POP profiles throughout the competition, ensuring their profile is up to date with the most
173 recent team information. A Team may recruit and add additional team members at any time
174 throughout the Competition.

175 Because XPRIZE is a US-based nonprofit organization, in order to be eligible to receive prize
176 money a Team must not include any individual or entity organized or with primary residence in
177 Cuba, Iran, North Korea, Sudan, Syria, [Crimea Region of Ukraine](#) or where otherwise prohibited
178 by law.

179 (See [Sanctions Programs and Country Information | US Department of the Treasury](#)).

180 Interested Teams and individuals are encouraged to collaborate and share skills. A team may
181 recruit additional experts and can add new members to their team at any time throughout the
182 competition. Teams may also merge with other teams during the competition. Teams must
183 notify XPRIZE of a merger before it takes place. In the case of mergers, teams must register
184 under one legal entity and assign one team leader. Additional details regarding team mergers
185 are provided in the Competitor Agreement.

186 Throughout the registration period, XPRIZE will host a series of webinars and other
187 programming for all Registered Teams. XPRIZE webinars will allow teams to get to know each
188 other and also to receive important competition updates. Participation in these programs, while
189 not mandatory, is strongly encouraged.

190 While global in focus, the competition will be conducted in English. All teams must be prepared
191 to communicate with XPRIZE and make their submissions in English.

192 Competition Calendar

193 The competition takes place in two phases over 4 years. All dates are provided for planning
194 purposes only and are subject to change until confirmed by XPRIZE.
195

PHASE ONE: PROOF OF CONCEPT (YEAR 1, 2021-2022)

- Team Registration Opens April 22, 2021
- Prize Guideline Public Comment Period April 22 - May 13, 2021
- Final Guideline Publication June 21, 2021
- Student Award Submission Deadline October 1, 2021
- Student Award Judging October 2021
- \$5M Student Awards Announced November 2021
- Milestone Registration Deadline December 1, 2021
- Milestone Submission Deadline February 1, 2022
- Milestone Judging February - March 2022
- \$15M Milestone Prizes Announced April 22, 2022

PHASE TWO: FULL DEMONSTRATION (YEARS 2-4, 2022-2025)

- Ongoing Team Solution Development April 2022 - February 2024
- Grand Prize Registration Deadline December 1, 2023
- Finalist Site Visit Application Deadline February 1, 2024
- Finalist Judging and Selection February - March 2024
- Announce Finalists April 22, 2024
- Finalist Measurement & Verification Site Visits May 2025 - January 2025
- Final Team Submission Deadline February 1, 2025
- Final Judging February - March 2025
- \$80M Grand Prizes Announced April 22, 2025

196 **Team Registration**

197 Interested teams are required to register for the competition in the [Prize Operations Platform](#)
198 [\(POP\)](#) and share a brief overview of their carbon removal concept with the community.

199 Registration for the prize will remain open through December 1, 2023. To be eligible for a
200 Milestone Prizes, teams must register by December 1, 2021.

201 ***Teams who do not win a Milestone Prize are eligible to compete for the Grand Prizes.***
202 ***Teams may still register to compete in Phase 2 of the competition even if they do not***
203 ***compete in Phase 1. Student Teams are eligible to compete in Phase 1 and Phase 2 in***
204 ***addition to the Student Award competition.***

205 **Student Awards (Year 1)**

206 XPRIZE will award up to \$5M to student teams in the Fall of 2021. These awards may fund
207 participation in the XPRIZE Carbon Removal, as well as the development of key supportive
208 technologies. Applications for student awards will be due on October 1, 2021, with first awards
209 to be announced in November 2021.

210 **Phase 1 - Proof of Concept (Year 2):**

211 To be eligible to win a Milestone Prize, teams are required to submit a proposal for their carbon
212 removal solution and participation in the prize, including data and evidence of progress to date,
213 cost modelling, and pathway to achieving full scale. Submissions are due on February 1, 2022.
214 See “Evaluation Criteria” for more details.

215 **Phase 2 - Full Demonstration (Years 2-4):**

216 To be eligible to win a Grand Prize, teams must demonstrate their entire carbon removal
217 solution end-to-end in the final year of competition. Demonstrations must qualify for a site visit,
218 during which XPRIZE will verify each Finalist team’s performance. Teams must apply for a site
219 visit by the Finalist Submission Deadline (Feb 1, 2024) by submitting data and evidence of their
220 carbon removal solution’s ongoing operations, a cost model, and evidence that the
221 competition’s sustainable scalability criteria are met. Twenty (20) teams will be granted site
222 visits, which will be conducted between May 2024 - January 2025. Qualifying for a site visit
223 signifies a team as a XPRIZE Carbon Removal Finalist.

224 **Phase 2 -- Winner Selection (Year 4)**

225 In February 2025, Finalists will have an opportunity to submit a final data set and updated cost
226 model to XPRIZE judges before being considered for the Grand Prizes. The Grand Prize
227 Winners will be announced on Earth Day, April 22, 2025.

228 **How to Compete: Submission Requirements**

229 To be considered for a Milestone Prize in Phase 1 and Grand Prizes in Phase 2 the
 230 competition, teams are required to show three things:

231

	COMPETITION REQUIREMENTS	TARGET SCALE
Demonstrate a working CDR solution	In Phase 1: Provide evidence, including 3rd party verification, of successful operation of the key enabling component or technology of a carbon removal solution.	Any
	Submit a technical proposal for the fully operational (1000 tonne/year) carbon removal project the team will demonstrate for Phase 2.	
	In Phase 2: Provide evidence, including 3rd party verification, of a complete fully operational carbon removal project.	1000 tonnes/year
Calculate Cost at Full Scale	Phase 1 & 2: Calculate the fully considered cost per tonne at 1 Mt/yscale.	1 megatonne/year
Make a Case for Massive and Sustainable Scalability	Phase 1 & 2: Provide evidence that the solution is sustainable today, can achieve gigatonne scale in future, and can remain sustainable at gigatonne scale.	1 gigatonne/year

232 **Details on the specific expectations and definitions for each requirement are outlined in**
 233 **“Evaluation Criteria”.**

234 ***NOTE: Submission templates and additional submission guidance will be released in***
 235 ***advance of each submission deadline (October 1, 2021; February 1, 2022; December 1,***
 236 ***2023).***

237 How to Win: Evaluation Criteria

238 ***To win, the prize teams must demonstrate CO2 removal at the kt/y scale, model costs at***
 239 ***the Mt/y scale, and present a plan to reach Gt/y scale.***

240 Teams will be judged based on their **Fully Considered Cost**, their **Operational performance**,
 241 and against the **Sustainable Scalability** requirements. Teams who meet or exceed the
 242 ambitious Operational and Sustainability requirements will be ranked by their “Fully Considered
 243 Cost” of CO2 removal. The teams with the lowest cost - after meeting or exceeding the
 244 Operational and Sustainable Scaling requirements will win. In the event of a tie, or where a
 245 winner cannot be selected due to uncertainties in the cost model, judges will use the
 246 Operational and Sustainable Scaling requirements, and in particular the scale demonstrated
 247 during the competition, in their final selection of winners. Teams that can best control and
 248 reduce uncertainties in their measurements and calculations will have a competitive advantage.

249 1. Calculation of Fully Considered Cost

250

COST CALCULATION	DESCRIPTION
Full Cost of CO2 removal	<p>Costs must be modeled at a hypothetical project scale of 1Mt/y (average net CO2 removal capacity). The calculation must include all costs over the life of the project on a levelized basis. Costs must include:</p> <ol style="list-style-type: none"> 1. Materials (feedstocks, other raw materials) 2. Transport (movement of matter and energy) 3. Processing (opex & energy costs) 4. Longitudinal management (durability/storage -- per year maintenance costs) <p>Teams must provide cost estimates that are reasonably accurate and precise, and presented in such a way that the major cost factors can be broken out and analyzed for error, uncertainty, and sensitivity.</p> <p>XPRIZE will publish standardized costs for use in cost calculations (i.e. cost of land (by region, by type)), labor (person-hours, skill level), energy (electricity, heat), discount rate, etc.</p>

Cost of Risk and Externalities

Any significant liabilities and risk factors beyond the expected technical project costs must be identified and quantified wherever possible.

Since the precision of these factors is expected to be lower than the cost calculation presented above, it will be considered separately by the judges and at their discretion, including the extent to which the team has holistically evaluated the potential sources of risks and external impacts of their proposed activities.

Revenue & Value

Any factors which may offset the cost of Carbon Removal can be specified, including the sale of valuable goods (ie CO₂ derived products or valuable co-products, provided the resulting end-use does not re-emit the captured carbon) and any tangible & measurable environmental co-benefits (eg improved biodiversity, improved crop yields, improved fisheries, ecosystem services, etc.). Teams may not count the value of social benefits derived from slowing climate change for this exercise. Teams may not count government or philanthropic subsidies as revenue.

The judges will consider claims of revenue and value creation at their discretion.

252 **2. Operational Requirements**

253

OPERATIONAL REQUIREMENT	PHASE 1 (MILESTONE REQUIREMENTS)	PHASE 2 (GRAND PRIZE REQUIREMENTS)
Demonstration Requirements	Submit a technical proposal detailing the intended ‘Phase 2’ demonstration, highlighting any work completed to date. Teams will be assessed on the quality and credibility of this proposal.	Operate a full carbon removal project (or projects) at a combined scale of 1000 tonnes of CO ₂ removed per year. Demonstrations must include: <ol style="list-style-type: none"> 1. Removal of CO₂ from air or ocean 2. All steps in the carbon removal process 3. Durable sequestration of CO₂, including any required monitoring & management of the CO₂ store.
	Operate the key component of the carbon removal solution. Demonstrate the team’s ability to field a successful demonstration in Phase 2.	Remove 1000 cumulative tons of CO ₂ in the final year of competition. Teams must be prepared to sustain operations during the demonstration period to accommodate XPRIZE verification.
3rd party Verification	Performance of the demonstration must be verified by a qualified 3rd party of the team’s choosing.	Performance of the demonstration must be verified by a qualified 3rd party of XPRIZE’s choosing.
Confidence in the solution’s efficacy	Teams must show how they intend to measure their net CO ₂ flux and sequestration durability with adequate precision.	Teams must demonstrate their solution’s performance with adequate precision, meeting or exceeding current best practices.

254 3. Sustainable Scalability

255

SUSTAINABLE SCALABILITY REQUIREMENT	DESCRIPTION
Scale Demonstrated during Competition	Teams must report cumulative net tonnes of CO2 removed during the competition.
Scalable to Gigatonne scale	Teams must convince judges of the credibility of their plan to achieve gigatonne scale removal, including the estimated time horizon for achieving gigatonne scale given demonstrated scale to date, and detailed accounting of any key limiting factors.
Durable CO2 Sequestration	Teams must demonstrate, and include in their cost calculations, a credible plan to maintain their CO2 stores for at least 100 years, taking into consideration all existing best practices relating to measurement reporting and verification.
Net Negative Performance	Teams must demonstrate using a Lifecycle Analysis that their solution results in net CO2 removal (“negative emissions”) on a lifecycle basis annually, and that net negative performance can be sustained as the solution scales to 1 Mt/y and 1 Gt/y.
Environmental Sustainability	Teams must explicitly address energy, land, water, and other natural resource needs, benefits, positive or negative impacts on biodiversity and other ecosystem services, and constraints of their solutions.
Social Licence & Environmental Justice	Teams must discuss their plan for achieving broad social licence and acceptance, equity, and environmental justice that will allow the solution to achieving low-cost and gigatonne scale. Teams must address the social and policy implications of their carbon removal demonstration as it reaches the Mt/y and Gt/y scale, including impact on local communities.

256 Roles and Responsibilities

257 **Competing Teams**

- 258 1. **Good Standing:** Teams must register their intent to compete on the XPRIZE Prize
259 Operations Portal (POP), sign the Competitor’s Agreement, and pay the registration fee
260 ahead of the deadline in order to be eligible for an award. Each team must specify a
261 legal entity (ie individual or corporation). After being named a winner by the judges
262 XPRIZE will pay the award to the specified legal entity.
- 263 2. **Fundraising:** All costs of competing in the XPRIZE Carbon Removal are the
264 responsibility of the competing team.
- 265 3. **Safe and Ethical Behavior:** Teams are responsible for maintaining the health and
266 safety of their teams and the environment over the course of their participation in the
267 prize. Teams must comply with all laws and regulations which apply to their
268 participation in the prize. XPRIZE reserves the right to expel teams who do not uphold
269 reasonable standards of safety and ethics.

270 **Advisory Board**

- 271 1. **Selection of Advisors:** XPRIZE and its Partners and Sponsors will collaborate to
272 appoint a panel of subject matter experts, and big-picture thought leaders to serve as
273 the Advisory Board for the competition. The Advisory Board will remain in place
274 throughout the competition to advise XPRIZE regarding the scientific, economic, social,
275 and other elements of the competition.
- 276 2. **Independence:** The Advisory Board will be independent of XPRIZE, Sponsors, and all
277 teams and team members. No Advisor, nor any member of the Advisor’s immediate
278 family, shall participate, nor have any financial or other material interest, in XPRIZE, the
279 Sponsor(s), and/or any team or team member. All members of the Advisory Board shall
280 promptly disclose to XPRIZE any such current, former, or expected future conflict of
281 interest with XPRIZE, the Title Sponsor, or any team or team member.
- 282 3. **Role of Advisory Board:** The duties and responsibilities of the Advisory Board may
283 include, but not be limited to: (i) assisting with the establishment of qualifications for
284 prospective Judges; (ii) recommending members of the Judging Panel; (iii) assisting
285 with development of testing protocols and judging criteria; (iv) and providing input
286 toward the development of these Competition Guidelines.

287 **Judging Panel**

- 288 1. **Selection Of Judges:** The Judging Panel (as defined in the Competitor Agreement) will
289 be composed of highly-qualified subject matter experts from a diversity of fields and
290 professional backgrounds, selected and vetted by XPRIZE, Sponsors, and the
291 competition Advisory Board.
- 292 2. **Independence:** The Judging Panel will be independent of XPRIZE, the Title Sponsor,
293 any other prize sponsors, and all teams and team members. No Judge, nor any
294 member of Judge’s immediate family, shall participate, nor have any financial or other
295 material interest, in XPRIZE, the sponsor(s), and/or any team or team member. All
296 members of the Judging Panel shall promptly disclose to XPRIZE any such current,
297 former, or expected future conflict of interest with XPRIZE, the sponsor, and/or any
298 team or team member.
- 299 3. **Role Of Judging Panel:** The duties and responsibilities of the Judging Panel will
300 include, but not be limited to: (i) evaluating teams’ compliance with the Competitor
301 Agreement as they relate to prize operations, these Competition Guidelines, and the
302 Rules and Regulations for the purposes of the competition; and (ii) the awarding of
303 points and selection of teams that will proceed to each subsequent round of the
304 competition.

305 **Grounds For Judging Panel Decisions**

306 Official decisions made by the Judging Panel will be approved by a majority of the Judges that
307 vote on each such decision after careful and impartial consideration of the testing protocols,
308 procedures, guidelines, rules, regulations, criteria, results, and scores set forth in the
309 Competitor Agreement, these Competition Guidelines, Rules and Regulations, and all other
310 applicable exhibits to the Competitor Agreement. If any vote of the Judges results in a tie, then
311 the Judging Panel shall determine, in its sole and absolute discretion, the mechanism to settle
312 the tie. Similarly, if one or more teams are tied at any stage during the competition, the Judging
313 Panel shall have the sole and absolute discretion to settle the tie.

314 **Decisions of Judging Panel are Final**

315 The Judging Panel shall have sole and absolute discretion: (i) to allocate duties among the
316 Judges; (ii) to determine the degree of accuracy and error rate that is acceptable to the
317 Judging Panel for all competition calculations, measurements, and results, where not specified
318 in the Rules and Regulations; (iii) to determine the methodology used by the Judging Panel to
319 render its decisions; (iv) to declare the winners of the competition; and (v) to award the prize
320 purses and other awards. Decisions of the Judging Panel shall be binding on XPRIZE, teams,
321 and each team member. XPRIZE and teams agree not to dispute any decision or ruling of the
322 Judging Panel, including decisions regarding the degree of accuracy or error rate of any
323 competition calculations, measurements, and results. Teams shall have no right to observe
324 other teams’ testing or evaluation, or to be informed of other teams’ calculations,
325 measurements, and results, unless such information is made publicly available by XPRIZE, or
326 by a team choosing to release their own data publicly.

327 APPENDIX A:
328 STUDENT COMPETITION GUIDELINES

329 The XPRIZE Carbon Removal is a four-year global competition inviting innovators and teams
330 from anywhere on the planet to create and demonstrate solutions that accomplish carbon
331 dioxide removal ("CDR") -- pull carbon dioxide directly from the atmosphere or oceans,
332 ultimately scaling massively to gigaton levels, locking away CO2 permanently in an
333 environmentally benign way.

334 Of the US\$100M prize purse, XPRIZE will award US\$5M to student teams in the Fall of 2020 as
335 part of the Carbon Removal Student Competition. The objectives of this award program are to:
336

- Increase participation of young people in carbon removal
- Fund early stage ideas from the next generation of carbon removal innovators
- Remove barriers to the competition for students that need funding for their

339 demonstration

340 The XPRIZE Carbon Removal Student Competition is governed by these Student Competition
341 Guidelines. The Competition Guidelines summarize the high-level requirements and rules of the
342 competition.

343 XPRIZE may revise these Student Competition Guidelines at any time during the course of the
344 competition to provide additional information or to improve the quality of the competition.
345 Unanticipated issues that arise may require modifications to these Student Competition
346 Guidelines. XPRIZE reserves the right to revise these Student Competition Guidelines as it, in
347 its sole discretion, deems necessary. All registered teams will be notified of revisions in a timely
348 manner.

349 These awards may fund participation in the XPRIZE Carbon Removal, as well as the
350 development of key supportive technologies.

351 Award Areas

- 352 1. **Student Carbon Removal Demonstrations:** Awards of up to US\$250,000 as seed
353 funding for student teams with carbon removal solutions intending to compete for the
354 XPRIZE Carbon Removal Grand Prizes. Student teams will need to make a compelling
355 case to the judges that they will be competitive applicants in the overall competition.
356 Student teams will be required to meet all demonstration requirements outlined in the
357 main competition guidelines.
- 358 2. **Measurement, Reporting, and Verification Technologies:** Awards of up to
359 US\$100,000 for technology that may not directly remove CO2, but will enable carbon
360 removal. XPRIZE invites proposals in the following areas:

- 361 a. Technologies and methods which improve the precision, accuracy, and time
362 required for carbon measurement, especially in natural ecosystems.
363 b. Methodologies and toolsets which improve the standards of assessment,
364 reporting, and accounting for Life Cycle Analyses (LCA), Cost Modelling, and
365 Techno-Economic Analyses (TEA) of carbon removal solutions.

366 Eligibility

367 To qualify as a student, applicants must:

- 368 ● Be enrolled in at least one course at an educational institution at the time of application,
369 or show proof of recent completion of the 2020-2021 academic year.
370 ● Not exceed 35 years of age at the time of application.

371 Student teams may be formed out of existing research groups, student clubs, or they may be
372 independently incorporated, provided they meet the eligibility criteria listed below.

373 Student Teams must:

- 374 ● Be composed of >50% students enrolled at an educational institution for the 2021-
375 2022 academic year or show proof of recent completion of the 2020-2021 academic
376 year.
377 ● Be led by a student who is enrolled for the 2021-2022 academic year.
378 ● Identify an academic advisor or business leader who will act as a formal mentor to the
379 team.
380 ● Provide a letter of support from their academic institution. This may come from faculty
381 or an administrator.
382 ● Identify the legal entity to which the award will be paid: This may be the student's
383 academic institution or a registered private organization. XPRIZE cannot award prize
384 money to individuals directly.
385 ● Example student teams could be research groups or extracurricular student groups.

386 Student Awards are made at the discretion of XPRIZE and the XPRIZE Carbon Removal
387 Student Award Judges. XPRIZE reserves the right to redistribute any unallocated funding
388 following review of the October 2021 applicants. This redistribution may come in the form of a
389 second future call for student applications or a redeployment of unallocated funds to the
390 XPRIZE Carbon Removal Milestone Awards, or any reasonable redeployment determined by
391 XPRIZE.

392 All submissions must be uploaded through the XPRIZE Carbon Removal Prize Operations
393 Portal (POP). Applications transmitted via postal mail, fax, and/or email will not be considered.
394 Applications are due October 1, 2021 at 11:59 PM (Pacific Standard Time).

395 **Please note that applications must be written in English only. Applications written in**
396 **languages other than English will not be considered for award.**

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- 397 **ALL SUBMISSIONS DUE OCTOBER 1, 2021**
- 398 **APPLICANTS AWARDED NOVEMBER 2021**

399 Student Carbon Removal Demonstrations

400 Individual awards up to \$250,000, total funding not to exceed US\$3 million

401 **Scope:** These grants will help finance participation in the XPRIZE Carbon Removal
402 competition. Applicants must register as a competing team and are subject to the rules &
403 regulations of the competition. Please refer to the XPRIZE Carbon Removal Competition
404 Guidelines for more details.

405 While we expect that proposals for these awards will involve some amount of prior work on
406 carbon removal technologies, **please note that we expect proposals for demonstrations**
407 **that may not yet exist and would be funded with the award money. An existing**
408 **demonstration is not a requirement of the student award proposals.**

409 Proposal Requirements:

410 1. **Applicant Biographies**

411 *Submissions should include a brief biography of each team member and the relevant*
412 *experience that would contribute to the success of the proposal.*

413 2. **Proof of Student Status**

414 *Applicants must provide some documentation proving their enrollment at an educational*
415 *institution for the 2021-2022 academic year.*

416 a. Upload one of the following:

- 417 i. a scanned copy of each team member's student identification card
418 demonstrating that you will be enrolled in the 2021-2022 academic year.
- 419 ii. a letter from your school's student affairs or admissions office confirming
420 your team member's standing as a student for the 2021-2022 academic
421 year.
- 422 iii. Other proof that you are enrolled in an academic program.

423 3. **Letter of Support**

424 *Applicants must obtain a letter of support from an academic advisor or administrator for*
425 *inclusion in the proposal.*

426 4. **Project Description**

427 *Brief narrative describing the project for which you are seeking funding.*

- 428 a. Describe how you intend to compete for the XPRIZE Carbon Removal
429 competition.
- 430 b. Describe your demonstration objective for the milestone round (Phase 1)
431 (optional)
 - 432 i. What will the Phase 1 demonstration entail?
 - 433 ii. Why is the Phase 1 demonstration important?
- 434 c. Describe your demonstration objective for the grand prize

- 435 i. What will the demonstration accomplish?
- 436 ii. Where will it be located?
- 437 iii. Why do you believe this concept is a strong contender for the XPRIZE
- 438 Carbon Removal?

5. Project Drawings & Supporting Files

- 440 a. Submit a Process Flow Diagram and corresponding Stream Table, or other
- 441 comparable diagrams, for the proposed XPRIZE Carbon Removal
- 442 demonstration.
- 443 b. Submit any additional engineering drawings, schematics, or renderings of your
- 444 project design (for both Phase 1 and Phase 2 of the competition as needed),
- 445 demonstrating how the process will remove CO₂ from the air or ocean and
- 446 sequester it durably.
- 447 c. Include any additional charts, diagrams, graphs, spreadsheets, etc. to support
- 448 the proposal.

6. Literature to Support Approach

449 *Submissions should point to relevant academic literature to support the underlying*

450 *premise of the proposal.*

- 451 a. Cite and summarize any key literature that supports the underlying premise of
- 452 your proposed demonstration.
- 453 b. If any experimental work has been conducted by the team to date, please
- 454 describe it here.
- 455

7. Project Plan including Timeline, Budget, and Key Milestones

456 *Describe the project timeline, milestone schedule, and budget for the duration of the*

457 *project proposal*

- 458 a. Submit a brief narrative describing the major milestones.
- 459 b. Submit a detailed project plan (gantt chart or similar), mapping the major
- 460 milestones onto a timeline.
- 461

8. Project Budget

462 *A full project budget must be included, showing how the XPRIZE funds will be used as*

463 *well as any other funding requirements*

- 464 a. What funds are you requesting from XPRIZE? (maximum US\$250,000)
- 465 b. Submit a budget narrative describing the major costs associated with the
- 466 project, justification of the requested amount and describe how the XPRIZE
- 467 funds would be used.
- 468 c. If additional funding beyond the XPRIZE award will be required (or if resources
- 469 have been secured already), describe them here, along with your fundraising
- 470 strategy.
- 471 d. Submit a detailed budget spreadsheet which breaks the proposed project into
- 472 subsections and phases (as needed), and shows the resources required for
- 473 each.
- 474

9. Ability to Execute

475 *Provide the judges confidence that your team is capable of executing the project*

476

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- 477 a. What projects has your team completed in the past which demonstrate your
478 team's ability to complete your proposed project?
479 b. What key skills does your team possess?
480 c. What mentors or supporting infrastructure does your team have access to
481 support your project?
482 d. How will the XPRIZE award guarantee the success of your project?

483 **Evaluation:** Expert, third-party judges from business, and government, and academia will
484 review proposals in October 2021. Judges will consider innovation, the ability to reach gigaton
485 scale, team resources and capabilities, and project plan feasibility when evaluating proposals.
486 Judges may reach out for further clarification or additional information if needed.

487 **Conditions of Award:** Award payments will be made in two tranches. The first tranche will
488 deliver 50% of the award at the time of award in November 2021. The second tranche will
489 deliver the remaining 50% of the award following the completion of a predetermined project
490 milestone, to be decided by the selection committee. Teams must provide progress reports at
491 each milestone. Teams must also provide evidence of IP rights in the form of an MOU
492 countersigned by their university's technology transfer office or other suitable documentation.
493

494 Analytical and Measurement Tools

495 Awards up to \$1000,000, total funding not to exceed US\$2 million

496 **Scope:** These grants will finance development of carbon measurement innovations and novel
497 tool kits which directly benefit the carbon removal space. In particular, we are interested in:

- 498 1. Soil GHG monitoring & verification technology
499 2. Ocean GHG monitoring & verification technology
500 3. Life Cycle Analysis Tools
501 4. Techno-Economic Analysis Tools, and specifically methods and tools for estimating
502 cost at scale of early-stage carbon removal solutions.

503 We expect that proposals for these awards will involve prior work on carbon removal
504 measurement technologies and that these awards will fund further development of these tools.

505 **Submission Requirements:**

506 **Proposal Requirements:**

507 1. **Applicant Biographies**

508 *Submissions should include a brief biography of each team member and the relevant*
509 *experience that would contribute to the success of the proposal.*

510 2. **Proof of Student Status**

511 *Applicants must provide some documentation proving their enrollment at an educational*
512 *institution for the 2021-2022 academic year.*

513 a. Upload one of the following:

- 514 i. a scanned copy of each team member's student identification card
515 demonstrating that you will be enrolled in the 2021-2022 academic year.
516 ii. a letter from your school's student affairs or admissions office confirming
517 your team member's standing as a student for the 2021-2022 academic
518 year.
519 iii. Other proof that you are enrolled in an academic program.

520 3. **Letter of Support**

521 *Applicants must obtain a letter of support from an academic advisor or administrator for*
522 *inclusion in the proposal.*

523 4. **Project Description**

524 *Brief narrative describing the project for which you are seeking funding.*

- 525 a. Describe the technology you plan to advance with this award, and the final
526 deliverable you will develop.
527 b. Describe how the technology will advance the Carbon Dioxide Removal field.
528 c. Provide a justification for why this project should be considered a priority for
529 Carbon Removal.

- 530 **5. Project Drawings & Supporting Files**
- 531 a. Submit engineering drawings, schematics, or renderings of your project design
- 532 which demonstrate your proposed technology and its use.
- 533 b. Include any additional charts, diagrams, graphs, spreadsheets, etc. to support
- 534 the proposal.
- 535 **6. Literature to Support Approach**
- 536 *Submissions should point to relevant academic literature to support the underlying*
- 537 *premise of the proposal.*
- 538 a. Cite and summarize any key literature that supports the underlying premise of
- 539 your proposal, including any studies on the core technology, current state of the
- 540 art, or describing the need for your proposed technology.
- 541 b. If any experimental work or development has been conducted by the team to
- 542 date, please describe it here.
- 543 **7. Project Plan including Timeline, Budget, and Key Milestones**
- 544 *Describe the project timeline, milestone schedule, and budget for the duration of the*
- 545 *project proposal*
- 546 a. Submit a brief narrative describing the major milestones.
- 547 b. Submit a detailed project plan (gant chart or similar), mapping the major
- 548 milestones onto a timeline.
- 549 **8. Project Budget**
- 550 *A full project budget must be included, showing how the XPRIZE funds will be used as*
- 551 *well as any other funding requirements*
- 552 a. What funds are you requesting from XPRIZE? (maximum US\$100,000)
- 553 b. Submit a budget narrative describing the major costs associated with the
- 554 project, justification of the requested amount and describe how the XPRIZE
- 555 funds would be used.
- 556 c. If additional funding beyond the XPRIZE award will be required (or if resources
- 557 have been secured already), describe them here, along with your fundraising
- 558 strategy.
- 559 d. Submit a detailed budget spreadsheet which breaks the proposed project into
- 560 subsections and phases (as needed), and shows the resources required for
- 561 each.
- 562 **9. Ability to Execute**
- 563 *Provide the judges confidence that your team is capable of executing the project*
- 564 a. What projects has your team completed in the past which demonstrate your
- 565 team's ability to complete your proposed project?
- 566 b. What key skills does your team possess?
- 567 c. What mentors or supporting infrastructure does your team have access to
- 568 support your project?
- 569 d. How will the XPRIZE award guarantee the success of your project?

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570 **Evaluation:** Expert, third-party judges from academia, business, and government will review
571 proposals in October 2021. Judges will consider innovation, measurement approach, the
572 impact of improved ability to measure carbon removal and sequestration for a given pathway,
573 team resources and capabilities, and project plan feasibility when evaluating proposals. Judges
574 may reach out for further clarification or additional information if needed.

575 More detailed evaluation criteria will be provided following the selection of the Judging Panel.

576 **Conditions of Award:** Award payments will be made in two tranches. The first tranche will
577 deliver 50% of the award at the time of award in November 2021. The second tranche will
578 deliver the remaining 50% of the award following the completion of a predetermined project
579 milestone, may be linked to milestones, to be decided by the selection committee. Teams must
580 provide progress reports at each milestone. Teams must also provide evidence of IP rights in
581 the form of an MOU countersigned by their university's technology transfer office or other
582 suitable documentation.