

*[[1]](#footnote-2)*

**QUANTITATIVE SAMPLE DATA COMMERCIALIZATION ESTIMATE INPUT TEMPLATE**

CABLE Prize, Stage 2

## Project Name [Enter your team’s name]

## Tagline: [Your mission or idea as a single catchy sentence]

APRIL 2022

**Purpose:** This checklist and template are designed to ensure CABLE competitors provide comprehensive and comparable commercialization forecasts and sample data to enable the Prize Administrator and Expert Reviewers to make fair comparisons among competitors for Stage 2 of the contest and to prepare them for Stage 3, which will ask for a much more detailed commercialization plan and forecasts. The CABLE Prize Administrator will use the data provided in this template by competitors to calculate metrics for the scorecard in Appendix D available in the official [CABLE Prize Rules Document](https://americanmadechallenges.org/challenges/cable/docs/rules/CABLE_Prize_Official_Rules.pdf).

**Instructions:** Competitors are required to use this template for their responses. Responses in Appendix C should all be quantitative; any narrative descriptions of numbers provided should be included in the Technical Narrative.

**Checklist**Please ensure you have provided inputs for each of the sections in this template:

Section 1:

[ ]  Commercialization application statements (1A, 1B, 1C)

Section 2:

[ ]  Table 14, materials data

[ ]  Table 15, energy data

[ ]  Table 16, nonmaterial/nonenergy costs

Section 3:

[ ]  Selection of goal metric input questions (questions 1–7, as applicable)

[ ]  Table 17, material density

[ ]  Sample preparation data

[ ]  Superconductor critical current at 65 Kelvin

Competitors should complete all required questions and tables using the Appendix C template provided. Competitors may augment Appendix C with additional spreadsheets to show their work and calculations if needed. Please note that all qualitative information and analysis related to the data in Appendix C should be included in the Technical Narrative only.

Section 1: Commercialization/Application Statements

**Instructions**: A competitor’s summary commercialization statement assumes that unlike the sample preparation costs documented in Section 2, their net costs (which determine their likely commercialization success) will benefit from economies of scale, learning by doing, and other process innovations at the industrial scale that the competitor reaches when they begin their first 10 years of commercialization.

**Competitors should complete the following statements (1A, 1B, and 1C):**

**Statement 1A:** (COMPANY NAME HERE) estimates that during the first 10 years of commercialization of (MATERIAL NAME HERE), cumulative sales revenues would be $\_\_\_\_\_\_\_\_ and cumulative licensing revenues would be $\_\_\_\_\_\_\_\_.

**Statement 1B:** (COMPANY NAME HERE) estimates that after the first 10 years of commercialization of (MATERIAL NAME HERE), annual materials production would be \_\_\_\_\_\_\_kilograms (kg).

**Statement 1C:** (MATERIAL NAME HERE) is intended for application in the following categories (check all that apply):

[ ]  High-conductivity, high-strength, moderate-cost applications such as motor windings

[ ]  Moderate-conductivity, moderate-cost, low-weight, high-strength applications such as overhead power lines

[ ]  Ultra-high-conductivity, ultra-low-weight applications such as electric aviation

[ ]  High-corrosion-resistance, high-conductivity, moderate-cost applications such as undersea or underground power lines

[ ]  Highest conductivity applications where cost is not a factor such as premium electronics

[ ]  OTHER (provide example applications and properties that are maximized, moderate, or not a factor).

Section 2: Sample Preparation Data

**Instructions:** Competitors should complete the three tables below and include any and all assumptions and calculations and/or references, supporting data, and literature. These can include schematics, drawings, or sketches.

Table 14. Materials Data: Template for Type and Amount of Material for Sample Preparation

|  |  |  |  |
| --- | --- | --- | --- |
| Material | Element | Amount (Grams) | Notes: (e.g. If element Is Carbon, Indicate Nano-Allotrope (e.g. Graphene, CNT etc.) |
| A: Primary material: |  |  | (Appendix A must be used for primary material) |
| B: Secondary material (if applicable):  |  |  |  |
| C: Other materials (if applicable-- add rows (for D, E, F, etc. if needed) |  |  |  |
| TOTAL | Formula or Nickname |  |  |

Table 15. Energy Data

|  |  |
| --- | --- |
| Description | Input |
| Electricity source (grid or type of on-site generation or % of each) |  |
| Total electricity used (kilowatt-hours [kWh]) |  |
| Other energy used (British Thermal Units [BTU]) (add rows if necessary) |  |

For comparison purposes, the Prize Administrator will use the same material cost data (e.g., $15/kg for electrolytic copper (including cost for materials and manufacturing), $13/kg for aluminum, and energy cost data (e.g., $0.10/kWh) to compare and contrast the Commercialization Plans of different competitors on an equivalent basis.

Table 16. Actual Sample Preparation Nonmaterial/Nonenergy Costs (Fraction of Capital and Operating Costs; for Equipment/Hardware Cost (Including Everything Above ~5%)

|  |  |  |  |
| --- | --- | --- | --- |
| Equipment/Hardware Costing (Process and Non-Process) | First Cost of Equipment | Expected Equipment Lifetime | Time (Fraction) Used for Sample Preparation |
| Equipment 1 |  |  |  |
| Equipment 2 |  |  |  |
| Equipment 3 |  |  |  |
| Equipment 4 |  |  |  |

Section 3: Goal Metric Inputs

**Instructions**: Unlike the other inputs in this template, these inputs are used for the testing-based scoring of the competition. A competitor should answer each applicable question as directed.

**All Contests:**

1. What class of conductor are you entering into the competition (select only one)?
	1. Metal non-superconductor—go to question (2)
	2. Nonmetal, non-superconductor—go to question (2)
	3. Superconductor—go to question (5-7).
2. What Table 1 Contest are you competing in:
	1. Competing only in Contest 1 (Beat Copper!)—you are done.
	2. Competing in Contest 2 (Beat Aluminum!)—go to question (3).
	3. Competing in Contest 3 (Beat a Conductor System!)—go to question (4).

**If competing in Contest 2: Beat Aluminum!**

1. What is your sample density \_\_\_\_\_\_\_\_kilograms per cubic meter (kg/m3)? (It is recommended you cross-check your density using densities in Table 17 and Equation (2) or equivalent.) After answering this question and filling in Table 17, you are done with this template.

**If competing in Contest 3: Beat a Conductor System!**

1. What is the:
	1. Baseline conductivity of your commercial system \_\_\_ megasiemens per meter (MS/m)
	2. Sample density \_\_\_\_\_\_\_\_kg/m3 (Please complete Table 17 below)
	3. Other properties (e.g., strength) that are key for this commercial system
	4. Commercial system’s current world market size \*\*B/[indicate data year]
	5. CAGR for your commercial system between 2025 and 2035 (to any year within this range

(Note: The information in Figure 2 is an example of how to answer 4a–d.)

**Instructions for Table 17 Question 3.3 and 3.4 (density check):** Please ensure that you fill in Table 17, the cells for A, B, C, etc. for the same elements you provided in Table 14 so that the Prize Administrator can calculate %A, %B, %C, etc. from the weights in Table 15 divided by the total weight in the last row of Table 14. To cross-check your sample density, the Prize Administrator will use Equation (C1)—rule of mixtures weighted mean—to calculate the density to be used for calculation of conductivity by density of your sample. The testing lab also will provide density and weight information.

Table 17. Weight Percentage and Density Data for Sample (To Be Used in Equation C.1)

|  |  |  |
| --- | --- | --- |
| Element (same as Table 14) | % a | Density |
| A: |  | Primary material must use density data from Appendix A |
| B: |  |  |
| C: |  |  |
| Sample density cross-check (to be calculated by the Prize Administrator)  |  |  |
| a Must be calculated from corresponding element row A, B, C weight divided by total sample weight (last row) in Table 14 |

**For superconductor submissions only:**

1. What is the manufacturing cost and weight for a 100-m-long, 10,000-A cable that delivers 50 megawatts (MW) of power at 65 K?
2. What are the inputs for room-temperature-equivalent conductivity (RTEC): Specifically, f = ratio of the 10-year-post-commercialization manufacturing cost of the superconductor in $ per kiloampere (kA) m versus that of copper = $50/kA m, and *T*c?
3. What is the value of RTEC (in MS/m)? (No need to fill in further data.)

Equations

$Sample density = (density A × \%A) + (density B × \%B) + (density C × \%C)$ (C.1)

**Section 3 (questions 3.5–3.7) Instructions:** For superconductors, in addition to filling out Table 14–Table 16, The requested values for *f*, *T*c need to be calculated for question 3.6 at the beginning of this section. Also, a competitor should calculate and fill in the RTEC value in question 3.7 using Equation C.2:

$RTEC = 72.55 + (26 × (1 - f)) – (ΔT / 11.1)$ (C.2)

where *f* is the manufacturing cost of the superconductor in $/kA m divided by that for copper ($50/kA m) and $ΔT=295.15-T\_{c}$, where *T*c is the superconductor’s critical temperature in K.

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