



Company Announcement, December 7<sup>th</sup>, 2017

## Shenghe Delivers Major Improvements to Kvanefjeld Metallurgical Performance

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### HIGHLIGHTS:

- Mineral concentrate grade increased to >23% REO with mineral recovery standards maintained; a 64% increase from concentrate grade of 14% used in Feasibility Study (2016)
  - Mineral concentrate grade optimisation drives substantial reduction in operating costs
  - Significant reduction in Capital Expenditure expected and staged development optionality
  - Commencement of investigations into direct mineral concentrate sales from Greenland
  - Test work ongoing, further technical and developmental improvements upcoming
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### Kvanefjeld Project: Optimisation Program

Greenland Minerals and Energy Ltd ('GMEL' or 'the Company') is pleased to update on the optimisation program that is progressing with leading rare earth company and major shareholder Shenghe Resources Holding Co Ltd (Shenghe). Shenghe have world class and proven technical expertise in all aspects of the rare earth value chain from mine to the production of high-purity oxides and metals.

The Kvanefjeld Project, 100% owned by GMEL, is underpinned by a JORC-code compliant resource of >1 billion tonnes, and an ore reserve estimate of 108 million tonnes to sustain an initial 37 year mine life. It is projected to be one of the largest producers globally of key magnet metals including neodymium, praseodymium, dysprosium and terbium, along with by-production of uranium and zinc.

In early 2017 a technical committee was established with representatives from both GMEL and Shenghe to oversee a test work program that aims to improve the metallurgical performance, simplify the processing route and related infrastructure, and improve the cost structure of the Kvanefjeld Project. Flotation beneficiation test work is being directed by Shenghe, and draws on the expertise of a number of Chinese technical institutes.

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## Improvements to Metallurgical Performance and Project Implications

Significant improvements to metallurgical performance have been achieved, with mineral concentrate grades of greater than 23% REO, at overall recoveries at 78%, a significant increase on previous test work that generated concentrates of 15% REO at 79% recovery.

Notably, the Kvanefjeld Feasibility Study uses a mineral concentrate grade of 14% REO; well below the grades achieved by the revised flotation process now under development.

This significant increase in mineral concentrate grade with a lower mass pull will result in substantial reductions in the size of equipment leading to lower capital and operating costs of the processing plant (atmospheric leach) circuit.

Importantly, the higher mineral concentrate grades allow for consideration of direct sales of mineral concentrates from the Kvanefjeld Project, as part of a phased development strategy to further reduce the initial development capital requirements. GMEL and Shenghe are investigating this strategy, and will engage with the required regulatory bodies associated with the export of Kvanefjeld mineral concentrate. In contrast to common RE ore minerals, the unique ore minerals from Kvanefjeld are treated with a simple atmospheric acid leach process without complex high-temperature stages, which equates to cost-competitive processing.

### GMEL Managing Director Dr John Mair commented:

*“The metallurgical improvements achieved by Shenghe to date are extremely significant, and set the scene for an exciting 2018 as we roll-out the integration of Shenghe’s leading rare earth technology and sector experience with the world’s most significant emerging rare earth project in Kvanefjeld.*

*The concentrator circuit is just one of a number of focus areas, but increases in the order of 60% in rare earth concentrate grade will have a profoundly positive impact on the efficiency and cost-structure of the Kvanefjeld Project.*

*Of further importance, a grade of approximately 23% REO opens the opportunity to investigate the direct sale of mineral concentrates, that would serve to facilitate a staged development strategy with a low initial capital outlay.*

*We will update the market as further results of the optimisation program are available.”*

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## **Background**

Test work programs to optimise the Kvanefjeld Project have been underway in both China and Australia in 2017. Shenghe has been guiding test work that aims to improve the flotation circuit to increase the mineral concentrate REO grade. Shenghe is very well connected with the Chinese rare earth technical community allowing them to assist with the placement of metallurgical test work with eminent technical institutes in China.

Test work programs that aim to optimise the refinery (leach) circuit are also progressing well, and the Company will look update the market in due course.

## **Positive Preliminary Results from Chinese Research Institutes**

The Institute of Multipurpose Utilisation of Mineral Resources – Chinese Academy of Geological Sciences (IMUMR) is based in Chengdu in Sichuan Province. They have developed flotation reagents and methods which have been successfully commercialised at Shenghe's operating mines. Test work with IMUMR commenced in May 2017 with very good progress achieved to date.

The IMUMR has tested a wide range of Chinese supplied flotation reagents on the Kvanefjeld ore. An optimum reagent scheme has been identified and has been subjected to further development. This new reagent scheme is lower cost than the Feasibility Study (2016) equivalents and is able to operate with simpler processing conditions. Importantly, the metallurgical performance is superior.

The development has advanced to the stage that continuous (locked cycle) test work has been completed. This test work mimics the conditions in the commercial operation at smaller scale. Recent test work has shown that a mineral concentrate grading 23.25% REO at a REO recovery of 78.03%, can readily be produced. These results are significantly superior to previous flotation test work performed by GMEL which achieved 15% REO at a recovery of 79% REO back in 2014. Significantly, the Kvanefjeld Feasibility Study (2016) factors a mineral concentrate grade of only 14% REO.

In addition to the IMUMR work program, other Chinese technical institutes are also conducting test work under Shenghe's guidance to ensure the best-possible outcome is achieved for the revised Kvanefjeld flotation process. Additional sample material has been deployed from GMEL's operations base in Narsaq, southern Greenland, to facilitate ongoing work in the Chinese laboratories. When the best possible process has been determined, Shenghe and GMEL will move directly into a pilot plant operation.

## **Increased Mineral Concentrate Grade and Development Optionality**

An increase in concentrate grade from 15% to >23% REO will significantly reduce the capital and operating costs of the refinery processing. Additional progress will be provided to the market as the results become available, with an update on Operating Costs expected in Q2, 2018.

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The higher mineral concentrate grade brings optionality to the Kvanefjeld development strategy. It will allow for the investigation of direct concentrate sales from Greenland, as the first step of a phased development strategy. This would further reduce the capital cost of the initial phase of project development, as a refinery would not be required as part of the first phase of operation, and would then be developed as a second phase. Investigations into the technical, economic and regulatory considerations of this scenario are being investigated by GMEL and Shenghe. Shenghe would look to establish a special purpose joint venture vehicle to purchase the mineral concentrates in a scenario that follows a number of industry precedents.

**-ENDS-**

Statement of Identified Mineral Resources, Kvanefjeld Project, Independently Prepared by SRK Consulting (February, 2015)

| Multi-Element Resources Classification, Tonnage and Grade   |                |                |                          |                                      |             |             |            |                                      |           | Contained Metal |            |                                     |                                        |          |
|-------------------------------------------------------------|----------------|----------------|--------------------------|--------------------------------------|-------------|-------------|------------|--------------------------------------|-----------|-----------------|------------|-------------------------------------|----------------------------------------|----------|
| Cut-off<br>(U <sub>3</sub> O <sub>8</sub> ppm) <sup>1</sup> | Classification | M tonnes<br>Mt | TREO <sup>2</sup><br>ppm | U <sub>3</sub> O <sub>8</sub><br>ppm | LREO<br>ppm | HREO<br>ppm | REO<br>ppm | Y <sub>2</sub> O <sub>3</sub><br>ppm | Zn<br>ppm | TREO<br>Mt      | HREO<br>Mt | Y <sub>2</sub> O <sub>3</sub><br>Mt | U <sub>3</sub> O <sub>8</sub><br>M lbs | Zn<br>Mt |
| <b><i>Kvanefjeld - February 2015</i></b>                    |                |                |                          |                                      |             |             |            |                                      |           |                 |            |                                     |                                        |          |
| 150                                                         | Measured       | 143            | 12,100                   | 303                                  | 10,700      | 432         | 11,100     | 978                                  | 2,370     | 1.72            | 0.06       | 0.14                                | 95.21                                  | 0.34     |
| 150                                                         | Indicated      | 308            | 11,100                   | 253                                  | 9,800       | 411         | 10,200     | 899                                  | 2,290     | 3.42            | 0.13       | 0.28                                | 171.97                                 | 0.71     |
| 150                                                         | Inferred       | 222            | 10,000                   | 205                                  | 8,800       | 365         | 9,200      | 793                                  | 2,180     | 2.22            | 0.08       | 0.18                                | 100.45                                 | 0.48     |
| 150                                                         | Total          | 673            | 10,900                   | 248                                  | 9,600       | 400         | 10,000     | 881                                  | 2,270     | 7.34            | 0.27       | 0.59                                | 368.02                                 | 1.53     |
| 200                                                         | Measured       | 111            | 12,900                   | 341                                  | 11,400      | 454         | 11,800     | 1,048                                | 2,460     | 1.43            | 0.05       | 0.12                                | 83.19                                  | 0.27     |
| 200                                                         | Indicated      | 172            | 12,300                   | 318                                  | 10,900      | 416         | 11,300     | 970                                  | 2,510     | 2.11            | 0.07       | 0.17                                | 120.44                                 | 0.43     |
| 200                                                         | Inferred       | 86             | 10,900                   | 256                                  | 9,700       | 339         | 10,000     | 804                                  | 2,500     | 0.94            | 0.03       | 0.07                                | 48.55                                  | 0.22     |
| 200                                                         | Total          | 368            | 12,100                   | 310                                  | 10,700      | 409         | 11,200     | 955                                  | 2,490     | 4.46            | 0.15       | 0.35                                | 251.83                                 | 0.92     |
| 250                                                         | Measured       | 93             | 13,300                   | 363                                  | 11,800      | 474         | 12,200     | 1,105                                | 2,480     | 1.24            | 0.04       | 0.10                                | 74.56                                  | 0.23     |
| 250                                                         | Indicated      | 134            | 12,800                   | 345                                  | 11,300      | 437         | 11,700     | 1,027                                | 2,520     | 1.72            | 0.06       | 0.14                                | 101.92                                 | 0.34     |
| 250                                                         | Inferred       | 34             | 12,000                   | 306                                  | 10,800      | 356         | 11,100     | 869                                  | 2,650     | 0.41            | 0.01       | 0.03                                | 22.91                                  | 0.09     |
| 250                                                         | Total          | 261            | 12,900                   | 346                                  | 11,400      | 440         | 11,800     | 1,034                                | 2,520     | 3.37            | 0.11       | 0.27                                | 199.18                                 | 0.66     |
| 300                                                         | Measured       | 78             | 13,700                   | 379                                  | 12,000      | 493         | 12,500     | 1,153                                | 2,500     | 1.07            | 0.04       | 0.09                                | 65.39                                  | 0.20     |
| 300                                                         | Indicated      | 100            | 13,300                   | 368                                  | 11,700      | 465         | 12,200     | 1,095                                | 2,540     | 1.34            | 0.05       | 0.11                                | 81.52                                  | 0.26     |
| 300                                                         | Inferred       | 15             | 13,200                   | 353                                  | 11,800      | 391         | 12,200     | 955                                  | 2,620     | 0.20            | 0.01       | 0.01                                | 11.96                                  | 0.04     |
| 300                                                         | Total          | 194            | 13,400                   | 371                                  | 11,900      | 471         | 12,300     | 1,107                                | 2,530     | 2.60            | 0.09       | 0.21                                | 158.77                                 | 0.49     |
| 350                                                         | Measured       | 54             | 14,100                   | 403                                  | 12,400      | 518         | 12,900     | 1,219                                | 2,550     | 0.76            | 0.03       | 0.07                                | 47.59                                  | 0.14     |
| 350                                                         | Indicated      | 63             | 13,900                   | 394                                  | 12,200      | 505         | 12,700     | 1,191                                | 2,580     | 0.87            | 0.03       | 0.07                                | 54.30                                  | 0.16     |
| 350                                                         | Inferred       | 6              | 13,900                   | 392                                  | 12,500      | 424         | 12,900     | 1,037                                | 2,650     | 0.09            | 0.00       | 0.01                                | 5.51                                   | 0.02     |
| 350                                                         | Total          | 122            | 14,000                   | 398                                  | 12,300      | 506         | 12,800     | 1,195                                | 2,570     | 1.71            | 0.06       | 0.15                                | 107.45                                 | 0.31     |

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| <b>Sørensen - March 2012</b>                                |                    |                |                          |                                      |              |             |               |                                      |              |                 |             |                                     |                                        |             |
| 150                                                         | Inferred           | 242            | 11,000                   | 304                                  | 9,700        | 398         | 10,100        | 895                                  | 2,602        | <b>2.67</b>     | 0.10        | 0.22                                | <b>162.18</b>                          | 0.63        |
| 200                                                         | Inferred           | 186            | 11,600                   | 344                                  | 10,200       | 399         | 10,600        | 932                                  | 2,802        | <b>2.15</b>     | 0.07        | 0.17                                | <b>141.28</b>                          | 0.52        |
| 250                                                         | Inferred           | 148            | 11,800                   | 375                                  | 10,500       | 407         | 10,900        | 961                                  | 2,932        | <b>1.75</b>     | 0.06        | 0.14                                | <b>122.55</b>                          | 0.43        |
| 300                                                         | Inferred           | 119            | 12,100                   | 400                                  | 10,700       | 414         | 11,100        | 983                                  | 3,023        | <b>1.44</b>     | 0.05        | 0.12                                | <b>105.23</b>                          | 0.36        |
| 350                                                         | Inferred           | 92             | 12,400                   | 422                                  | 11,000       | 422         | 11,400        | 1,004                                | 3,080        | <b>1.14</b>     | 0.04        | 0.09                                | <b>85.48</b>                           | 0.28        |
| <b>Zone 3 - May 2012</b>                                    |                    |                |                          |                                      |              |             |               |                                      |              |                 |             |                                     |                                        |             |
| 150                                                         | Inferred           | 95             | 11,600                   | 300                                  | 10,200       | 396         | 10,600        | 971                                  | 2,768        | <b>1.11</b>     | 0.04        | 0.09                                | <b>63.00</b>                           | 0.26        |
| 200                                                         | Inferred           | 89             | 11,700                   | 310                                  | 10,300       | 400         | 10,700        | 989                                  | 2,806        | <b>1.03</b>     | 0.04        | 0.09                                | <b>60.00</b>                           | 0.25        |
| 250                                                         | Inferred           | 71             | 11,900                   | 330                                  | 10,500       | 410         | 10,900        | 1,026                                | 2,902        | <b>0.84</b>     | 0.03        | 0.07                                | <b>51.00</b>                           | 0.20        |
| 300                                                         | Inferred           | 47             | 12,400                   | 358                                  | 10,900       | 433         | 11,300        | 1,087                                | 3,008        | <b>0.58</b>     | 0.02        | 0.05                                | <b>37.00</b>                           | 0.14        |
| 350                                                         | Inferred           | 24             | 13,000                   | 392                                  | 11,400       | 471         | 11,900        | 1,184                                | 3,043        | <b>0.31</b>     | 0.01        | 0.03                                | <b>21.00</b>                           | 0.07        |
| <b>All Deposits – Grand Total</b>                           |                    |                |                          |                                      |              |             |               |                                      |              |                 |             |                                     |                                        |             |
| 150                                                         | Measured           | 143            | 12,100                   | 303                                  | 10,700       | 432         | 11,100        | 978                                  | 2,370        | <b>1.72</b>     | 0.06        | 0.14                                | <b>95.21</b>                           | 0.34        |
| 150                                                         | Indicated          | 308            | 11,100                   | 253                                  | 9,800        | 411         | 10,200        | 899                                  | 2,290        | <b>3.42</b>     | 0.13        | 0.28                                | <b>171.97</b>                          | 0.71        |
| 150                                                         | Inferred           | 559            | 10,700                   | 264                                  | 9,400        | 384         | 9,800         | 867                                  | 2,463        | <b>6.00</b>     | 0.22        | 0.49                                | <b>325.66</b>                          | 1.38        |
| <b>150</b>                                                  | <b>Grand Total</b> | <b>1010</b>    | <b>11,000</b>            | <b>266</b>                           | <b>9,700</b> | <b>399</b>  | <b>10,100</b> | <b>893</b>                           | <b>2,397</b> | <b>11.14</b>    | <b>0.40</b> | <b>0.90</b>                         | <b>592.84</b>                          | <b>2.42</b> |

<sup>1</sup>There is greater coverage of assays for uranium than other elements owing to historic spectral assays. U<sub>3</sub>O<sub>8</sub> has therefore been used to define the cutoff grades to maximise the confidence in the resource calculations.

<sup>2</sup>Total Rare Earth Oxide (TREO) refers to the rare earth elements in the lanthanide series plus yttrium.

Note: Figures quoted may not sum due to rounding.

**Kvanefjeld Ore Reserves Estimate – April 2015**

| Class        | Inventory (Mt) | TREO (ppm)    | LREO (ppm)    | HREO (ppm) | Y <sub>2</sub> O <sub>3</sub> (ppm) | U <sub>3</sub> O <sub>8</sub> (ppm) | Zn (ppm)     |
|--------------|----------------|---------------|---------------|------------|-------------------------------------|-------------------------------------|--------------|
| Proven       | 43             | 14,700        | 13,000        | 500        | 1,113                               | 352                                 | 2,700        |
| Probable     | 64             | 14,000        | 12,500        | 490        | 1,122                               | 368                                 | 2,500        |
| <b>Total</b> | <b>108</b>     | <b>14,300</b> | <b>12,700</b> | <b>495</b> | <b>1,118</b>                        | <b>362</b>                          | <b>2,600</b> |

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## ABOUT GREENLAND MINERALS AND ENERGY LTD.

Greenland Minerals and Energy Ltd (ASX: GGG) is an exploration and development company focused on developing high-quality mineral projects in Greenland. The Company's flagship project is the Kvanefjeld multi-element deposit (rare earth elements, uranium, zinc). A pre-feasibility study was finalised in 2012, and a comprehensive feasibility study was completed in 2015 and updated following pilot plant operations in 2016. The studies highlight the potential to develop Kvanefjeld as a long-life, low cost, and large-scale producer of rare earth elements; key enablers to the electrification of transport systems.

GMEL is working closely with major shareholder and strategic partner Shenghe Resources Holding Co Ltd to develop Kvanefjeld as a cornerstone of future rare earth supply. An exploitation (mining) license application for the initial development strategy has been undergoing review by the Greenland Government through the latter part of 2016 and through 2017.

In 2017, GMEL has been undertaking technical work programs with Shenghe Resources Holding Co Ltd that aim to improve the metallurgical performance, simplify the development strategy and infrastructure footprint in Greenland, enhance the cost-structure, and ensure that Kvanefjeld is aligned with downstream processing. In addition, the Company continues its focus on working closely with Greenland's regulatory bodies on the processing of the mining license application, and maintaining regular stakeholder updates.

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Greenland Minerals and Energy Ltd will continue to advance the Kvanefjeld project in a manner that is in accord with both Greenlandic Government and local community expectations, and looks forward to being part of continued stakeholder discussions on the social and economic benefits associated with the development of the Kvanefjeld Project.

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### **Competent Person Statement – Mineral Resources and Ore Reserves**

*The information in this report that relates to Mineral Resources is based on information compiled by Mr Robin Simpson, a Competent Person who is a Member of the Australian Institute of Geoscientists. Mr Simpson is employed by SRK Consulting (UK) Ltd ("SRK"), and was engaged by Greenland Minerals and Energy Ltd on the basis of SRK's normal professional daily rates. SRK has no beneficial interest in the outcome of the technical assessment being capable of affecting its independence. Mr Simpson has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Robin Simpson consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.*

*The information in the statement that relates to the Ore Reserves Estimate is based on work completed or accepted by Mr Damien Krebs of Greenland Minerals and Energy Ltd and Mr Scott McEwing of SRK Consulting (Australasia) Pty Ltd.*

*Damien Krebs is a Member of The Australasian Institute of Mining and Metallurgy and has sufficient experience that is relevant to the type of metallurgy and scale of project under consideration, and to the activity he is undertaking, to qualify as Competent Persons in terms of The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 edition). The Competent Persons consent to the inclusion of such information in this report in the form and context in which it appears.*

*Scott McEwing is a Fellow and Chartered Professional of The Australasian Institute of Mining and Metallurgy and has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration, and to the activity he is undertaking, to qualify as Competent Persons in terms of The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 edition). The Competent Persons consent to the inclusion of such information in this report in the form and context in which it appears.*

The mineral resource estimate for the Kvanefjeld Project was updated and released in a Company Announcement on February 12<sup>th</sup>, 2015. The ore reserve estimate was released in a Company Announcement on June 3<sup>rd</sup>, 2015. There have been no material changes to the resource estimate, or ore reserve since the release of these announcements.