

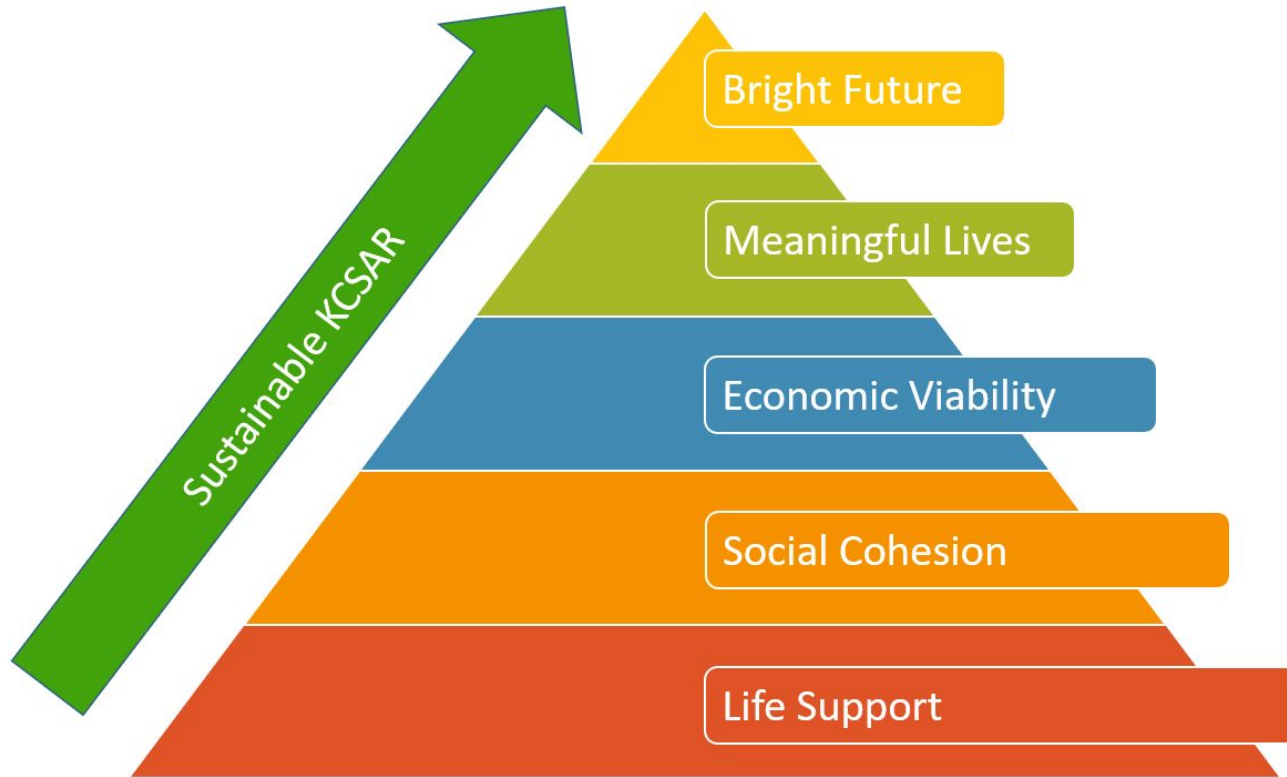


Korolev Crater

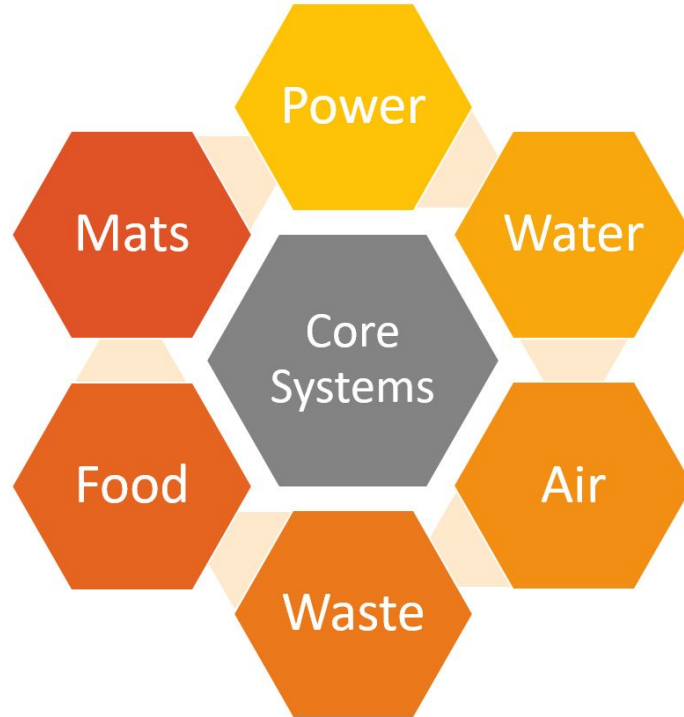
SAR

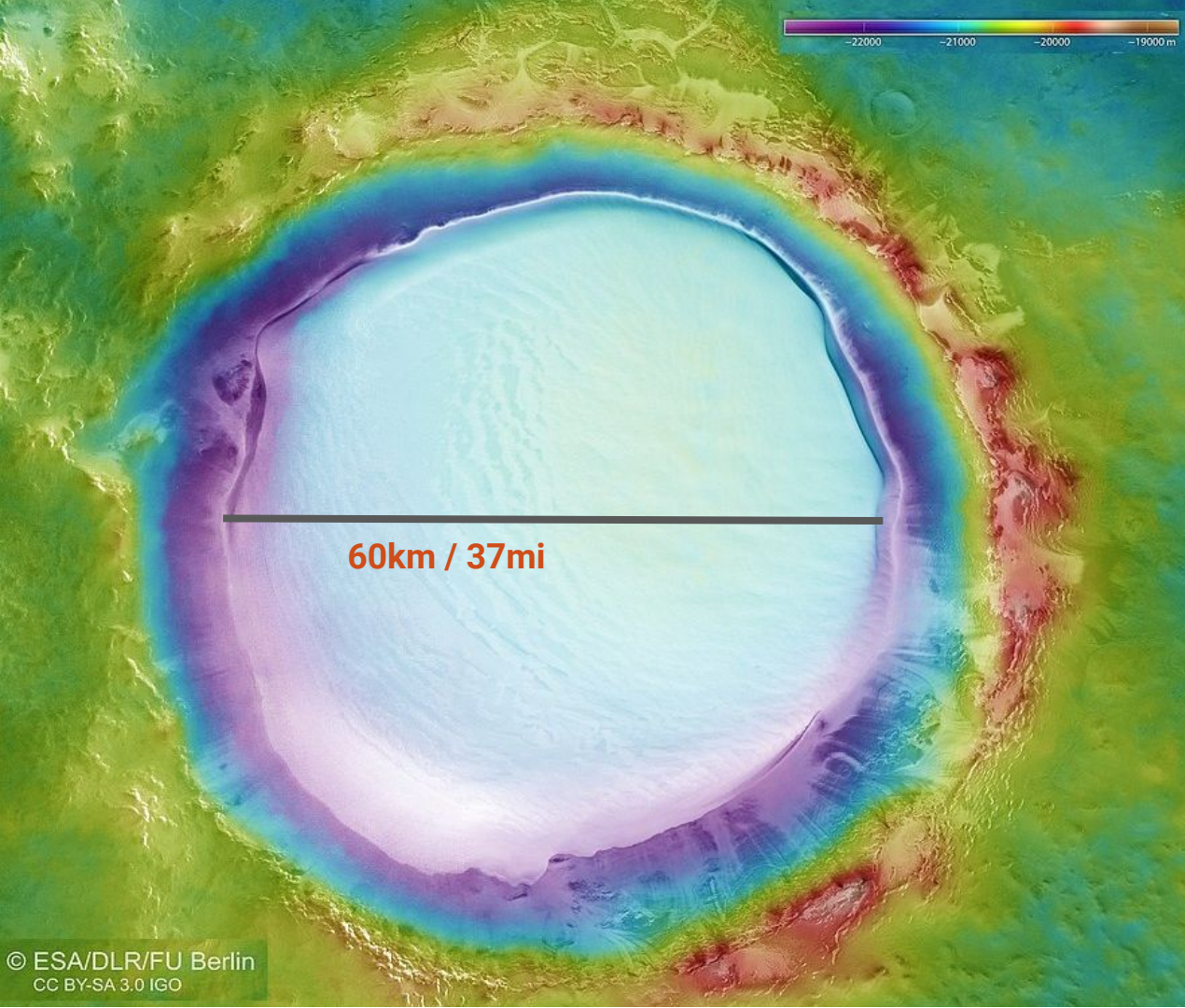
Alex Sharp, Saleem Ameen, John Walker

Building a *Sustainable* Korolev Crater SAR



Life Support Systems





Why Korolev?

- 1 Heatsink for power production
- 2 Access to fresh water
- 3 Cost-efficient excavation
- 4 Radiation shielding
- 5 Cold but reasonable climate
- 6 Opportunities for mining

Power

Construction

- 12GWth
- Fast spectrum nuclear reactor
- Disposable molten salt fuel pins (Moltex)
- Molten salt coolant

Generation

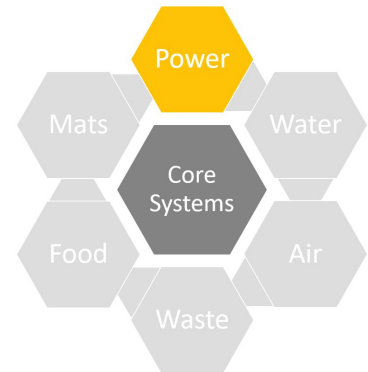
- Approx 1-3 GWe via 3d printed low pressure turbines
- 4GWe from cryobattery
- Neutron capture in thermalized region
- Products in SNF

Storage

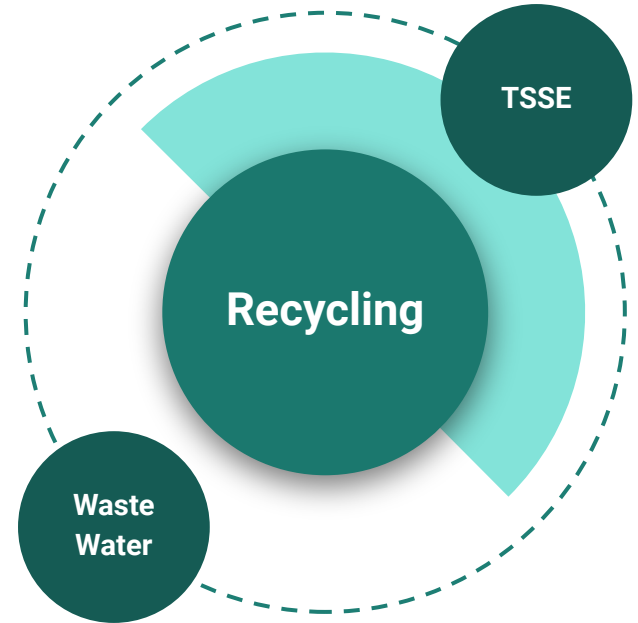
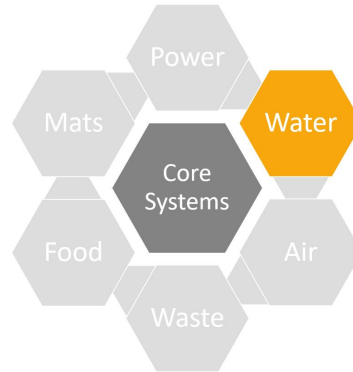
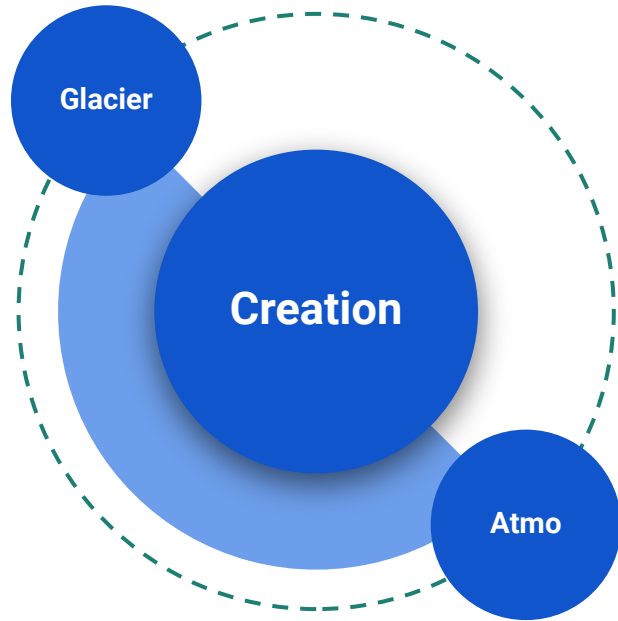
- LN₂ cryogenic battery, 96 GWh capacity

Distribution

- Smart electrical / thermal grid



Water



Atmosphere

Creation

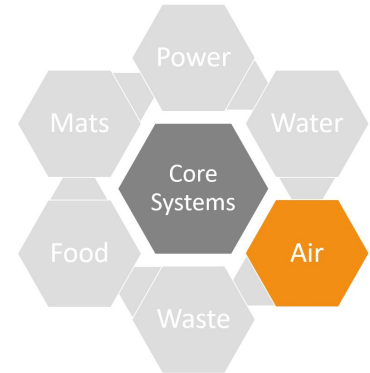
- Mining
- Photosynthesis
- Water splitting (Zn/S/I)

Maintenance

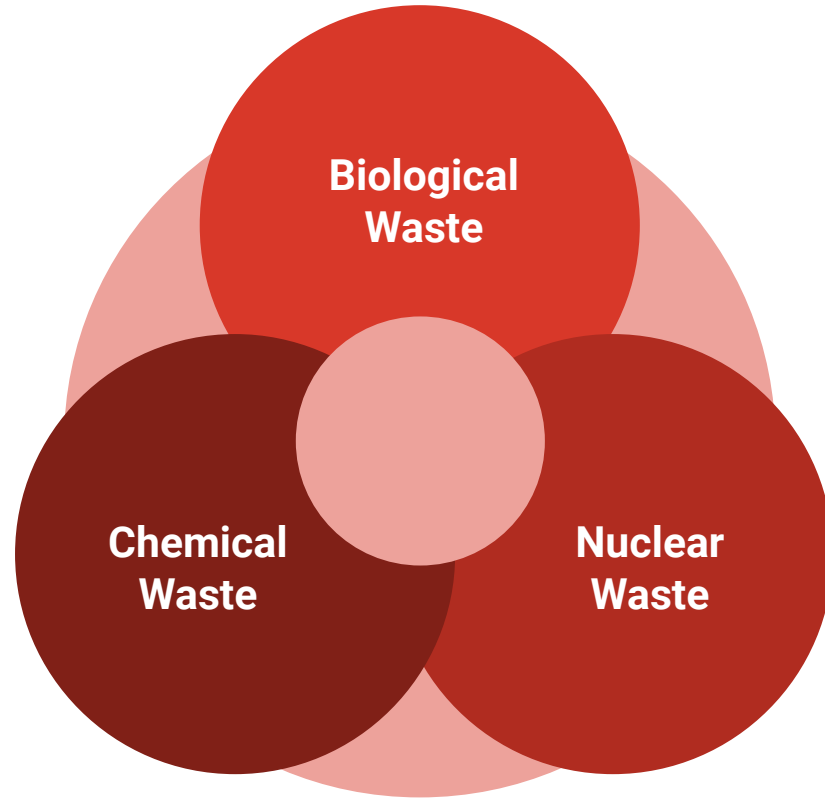
- Monitoring
- Cryogenic store
- Biological scrubbers
- Venting

Recycling

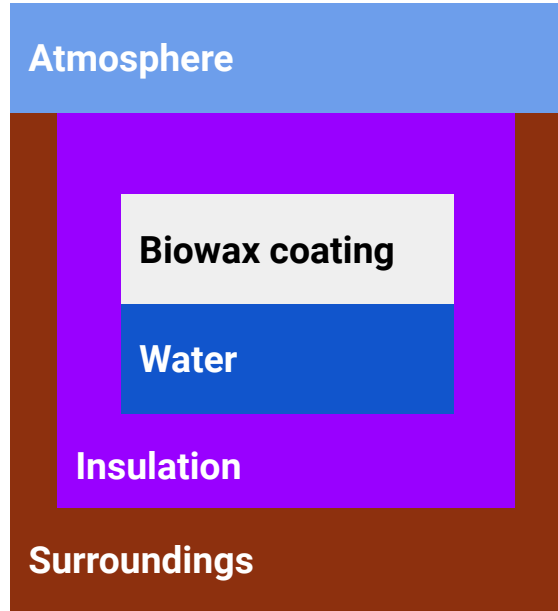
- Photosynthesis
- Chemical scrubbers



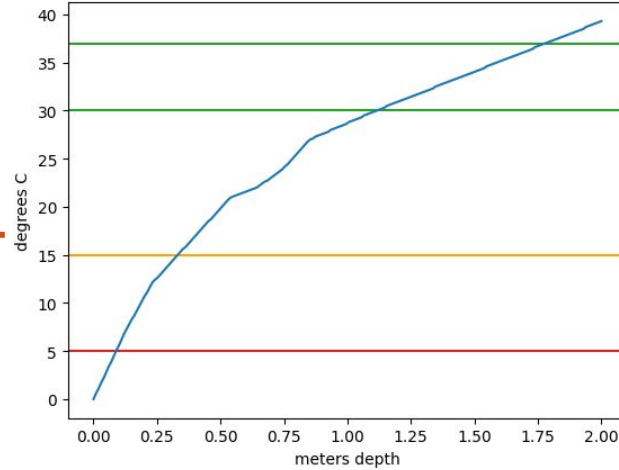
Waste



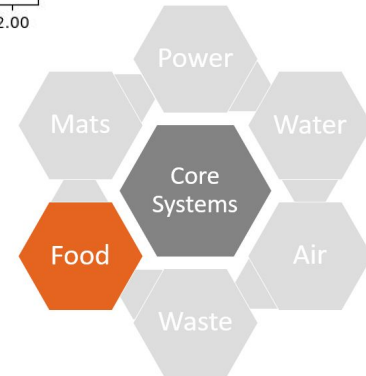
Farming Type 1: Ditch Farming



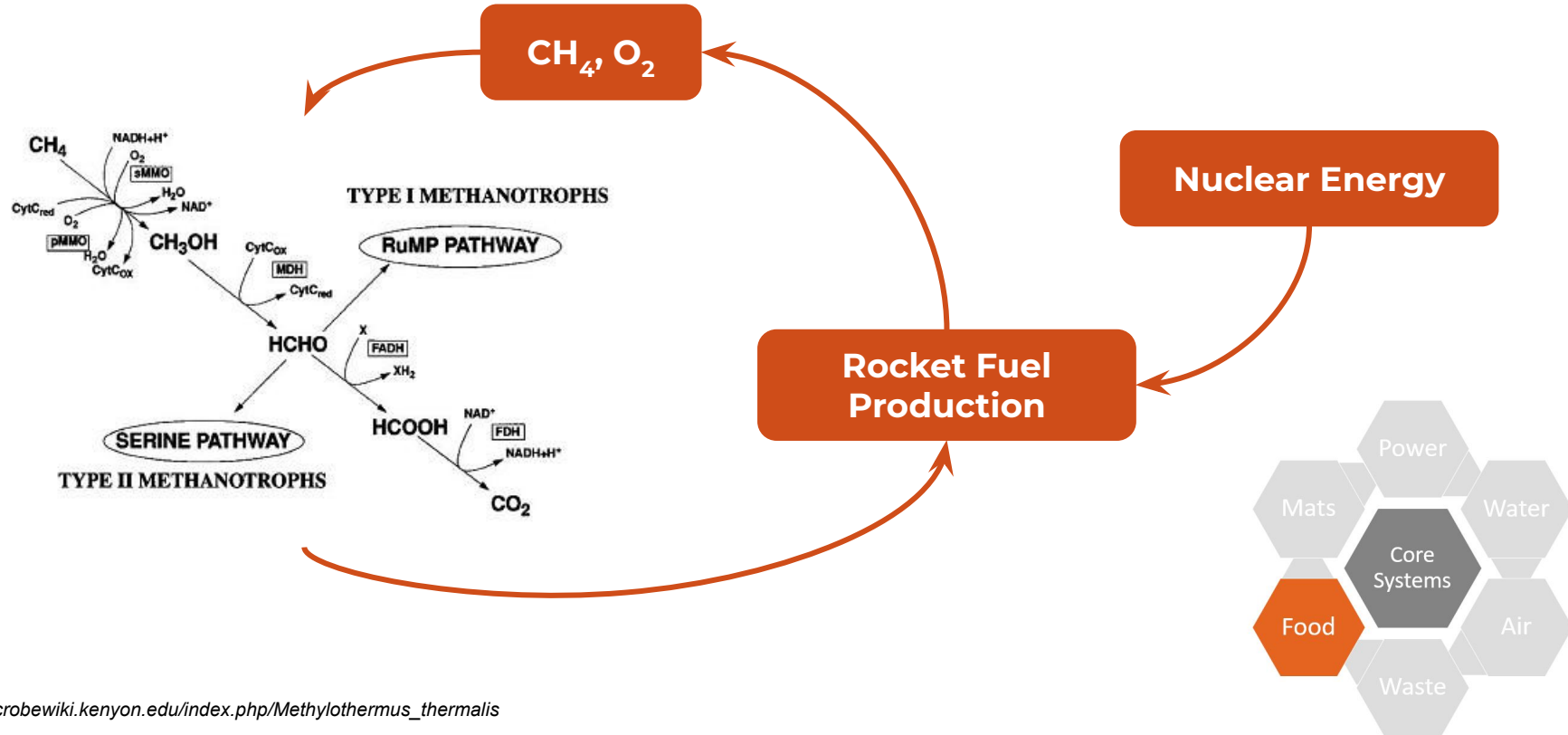
Growth
Temperature



Coating Depth

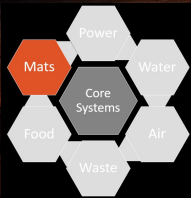


Farming Type 2: Xenotroph Farming

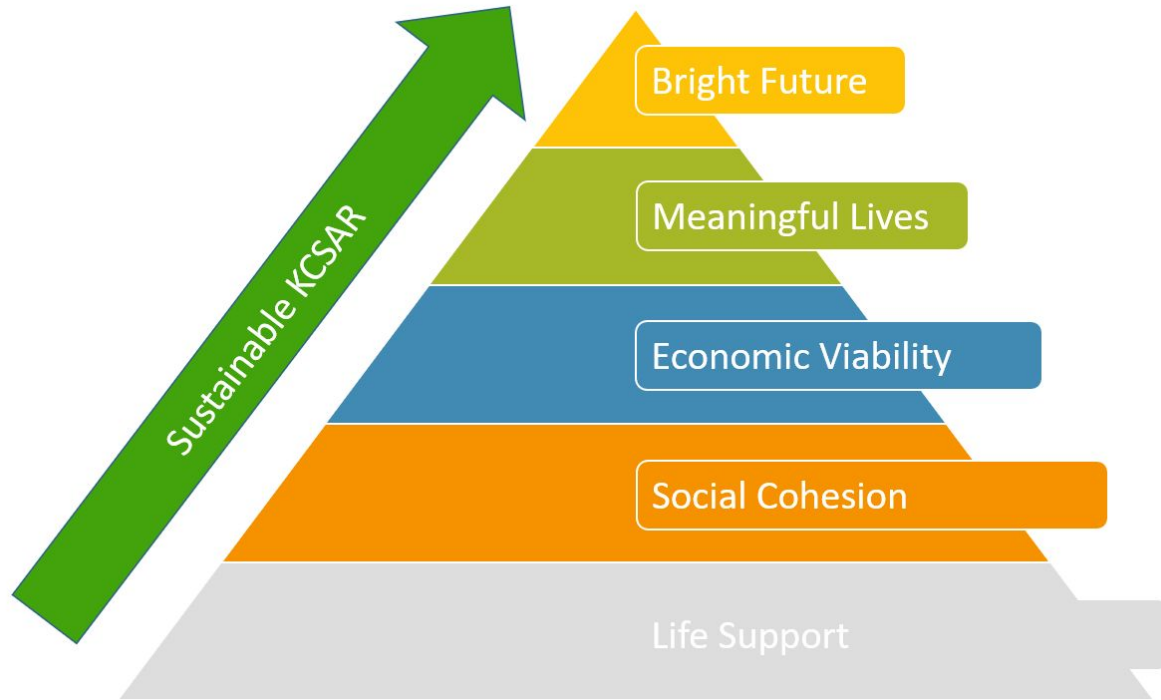


Critical Materials

- Raw materials
- Bulk materials
- (Bio)Chemical Processes
- Consumables / Factories

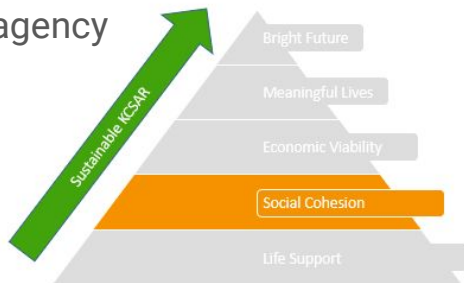


Social and Economic Design



Governance

- Special Autonomous Region of the United States
- Separation of powers: executive, legislative, judicial and auditor arms
- “Delegative democracy” that approximates direct democracy
 - Each citizen has a right to vote on every issue but usually delegates it to another
 - Relies on novel technologies:
 - Cryptographic primitives - anonymous, secure voting
 - Robotic index voting - publically available, auditable decision-making
 - Maximises social welfare, government transparency and individual agency



The Role of Government

1. Respond to immediate threats

2. Provide social planning and programs

3. Source revenue responsibly

4. Prevent abuse of market power

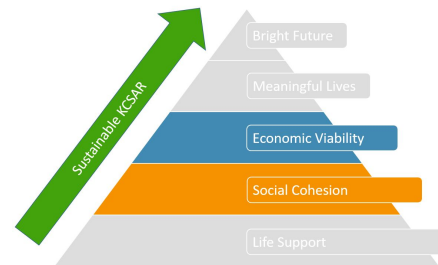
Government Programs

Immediate Threats

- Low fertility rates
- Critical skills
- Law and order

Social Planning

- Universal Basic Income
- Universal healthcare
- Universal education
- Sovereign Wealth Fund



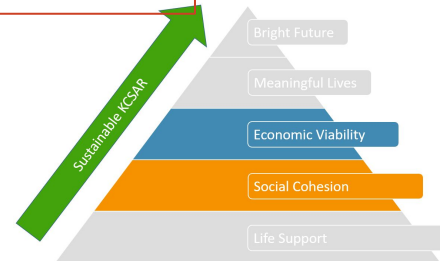
Taxation and Economic Regulation

Taxation Mix

- Income taxation
- Taxes on capital
- Land tax
- Sovereign Wealth Fund levy

Monopoly Regulation

- Regulate natural monopolies to prevent abuse of market power
- Board seats
- Audit branch oversight



KCSAR's External Position

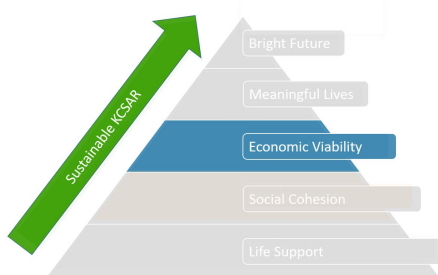
Medium-term reliance on imports:

- Pharmaceuticals/gametes
- Silicon chips, chemical reagents, rare earth metals

1. Export market size and diversity

2. Transportation costs

3. Debt servicing capacity



Export Market Strength

Potential exports

- Quantum Machine Learning (D-wave)
- Intellectual property
- Telescopes, probes and mirrors
- Nuclear isotopes/reactive or gravity-sensitive alloys
- Zero/low-gravity research and products such as ZBLAN fiber

Transportation Costs

Cost of rockets

- Support leasing market
- Provide government reinsurance
- Allow for formation of Collateralized Debt Obligations and re-rating of debt for sale on Earth

Debt Servicing Capacity

Low-risk debt

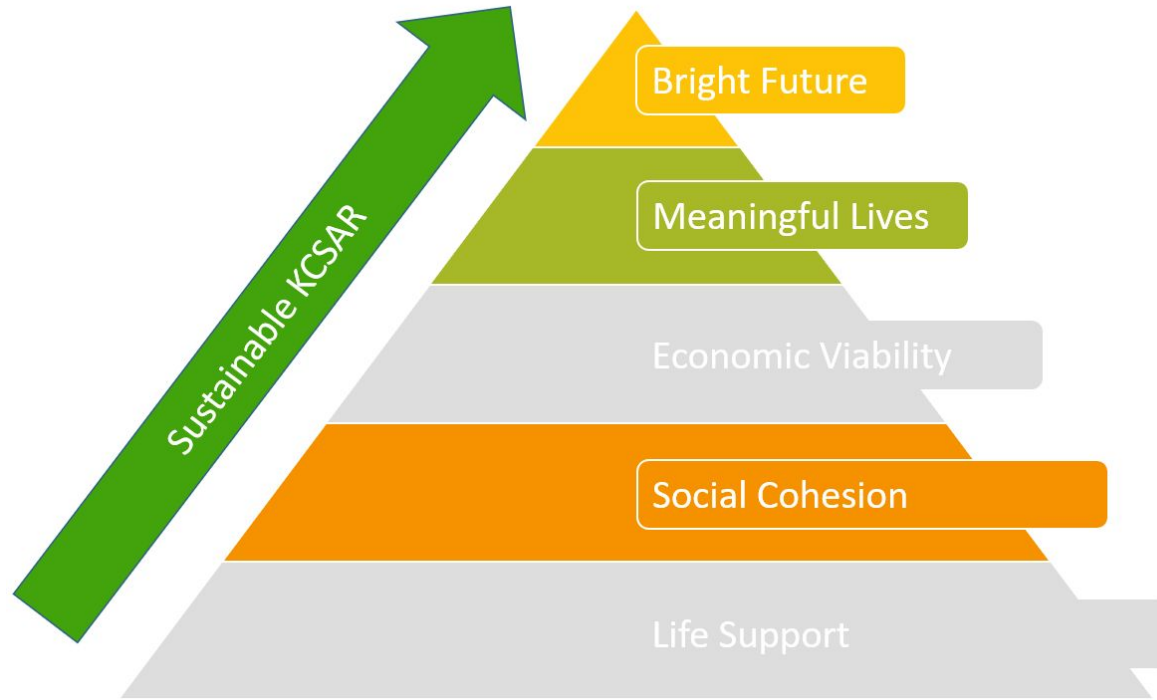
Types of debt

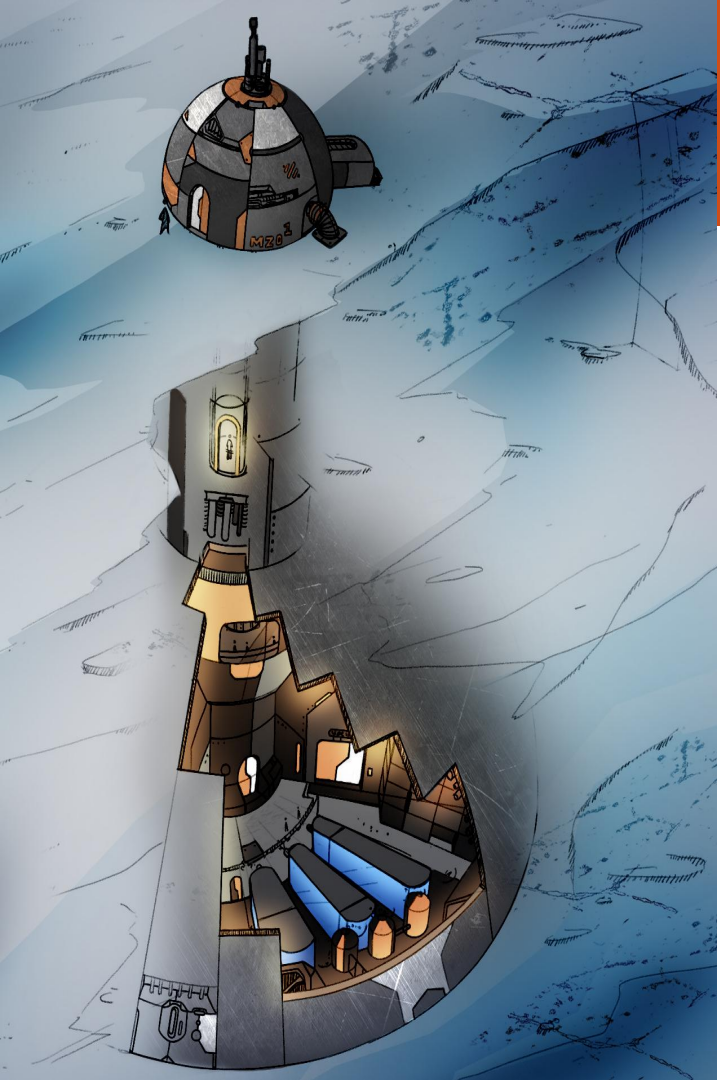
- SWF debt cap is 120bn
- Mortgage-backed securities Cap is 736bn

Economy size

- KCSAR is projected to produce \$28bn bn/year
- The yearly tax burden is set at roughly \$4.2 bn/year

Aesthetic and Cultural Design





Interconnected Network of Stacked Dome Towers

**Residential /
Cultural Domes**

- **Parametric Design**
- **Bauhaus Design Principles**

Brutalist Features

**Industrial /
Commercial
Domes**

Neoclassical Features

**Government /
Administrative
Domes**



Architecture of a Single Dome Tower

Surface Domes

- *Connected to an intricate network of roads and rail systems*

Vertically Stacked Sub-Surface Domes

- *~ 5 Domes @ 150m (w) x 20m (h) @ capacity 2000 people / dome*

Each Dome

- *~ 5 Floors + access to a light rail system to move between domes*

Fostering a Novel Martian Culture

**Socially Minded
Behaviours**

**Close Familial
and Communal
Relations**

**Embracing
Innovative
Thinking**

“Cultural Nudges” Through the Design of Physical Spaces

01

Spartan Style Apartments

- Large Apartments (Space = Cheap)
- Shared Kitchen and Dining Area (Stuff = Expensive)

02

Commercial Retail Space

- Cinema
- Arcade
- Food

03

Cultural Centre

- Three concentric circles
- Outermost circles celebrates local creators
- Innermost circle hosts activities

04

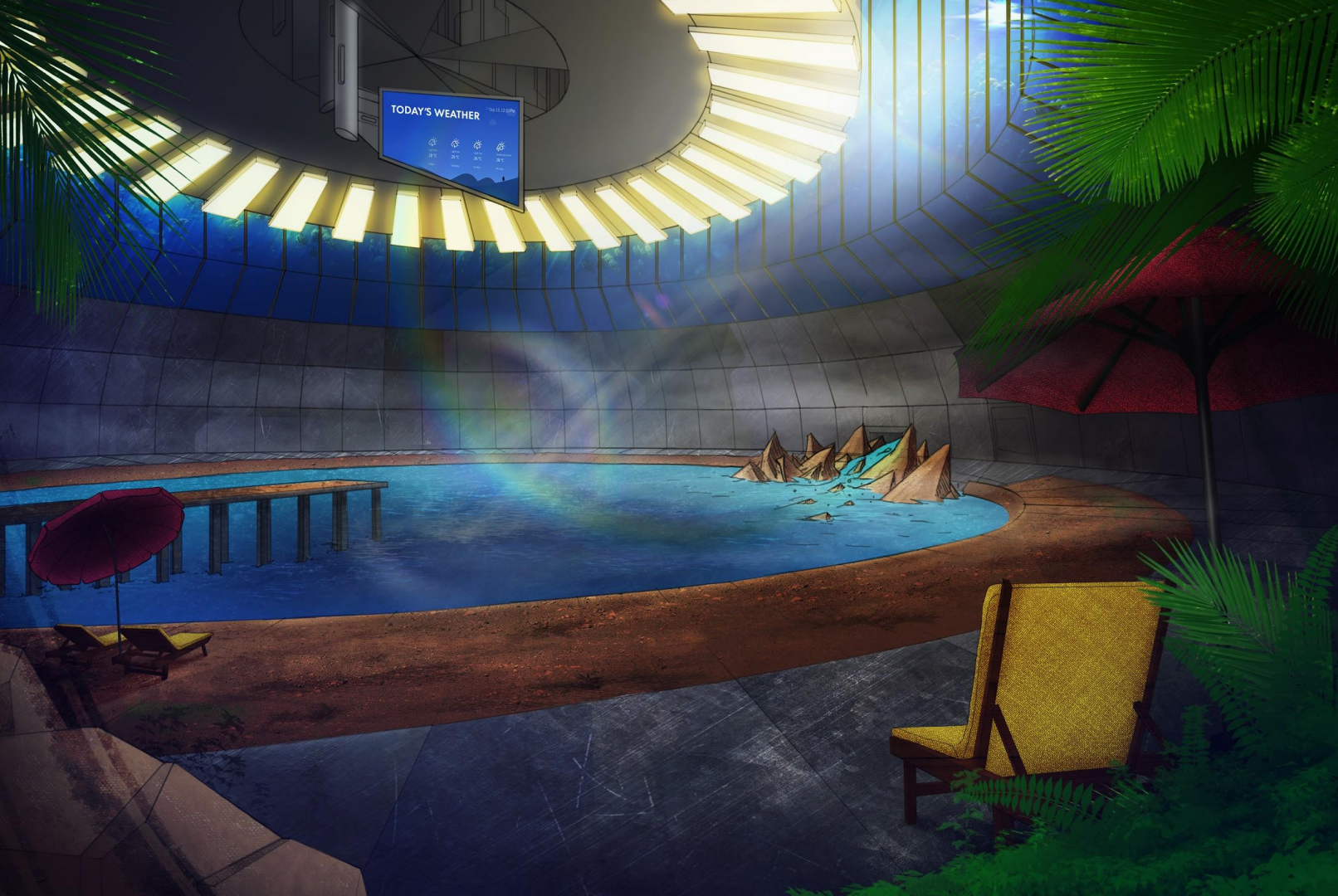
Park

- Utilises “green” space and “blue” space
- Local gardens and plants are offset against striking water features, fountains, and ice

05

Underground Beach

- At ~25-30m under the ice
- Small openings inside the dome beneath the subglacial lake generates artificial beach

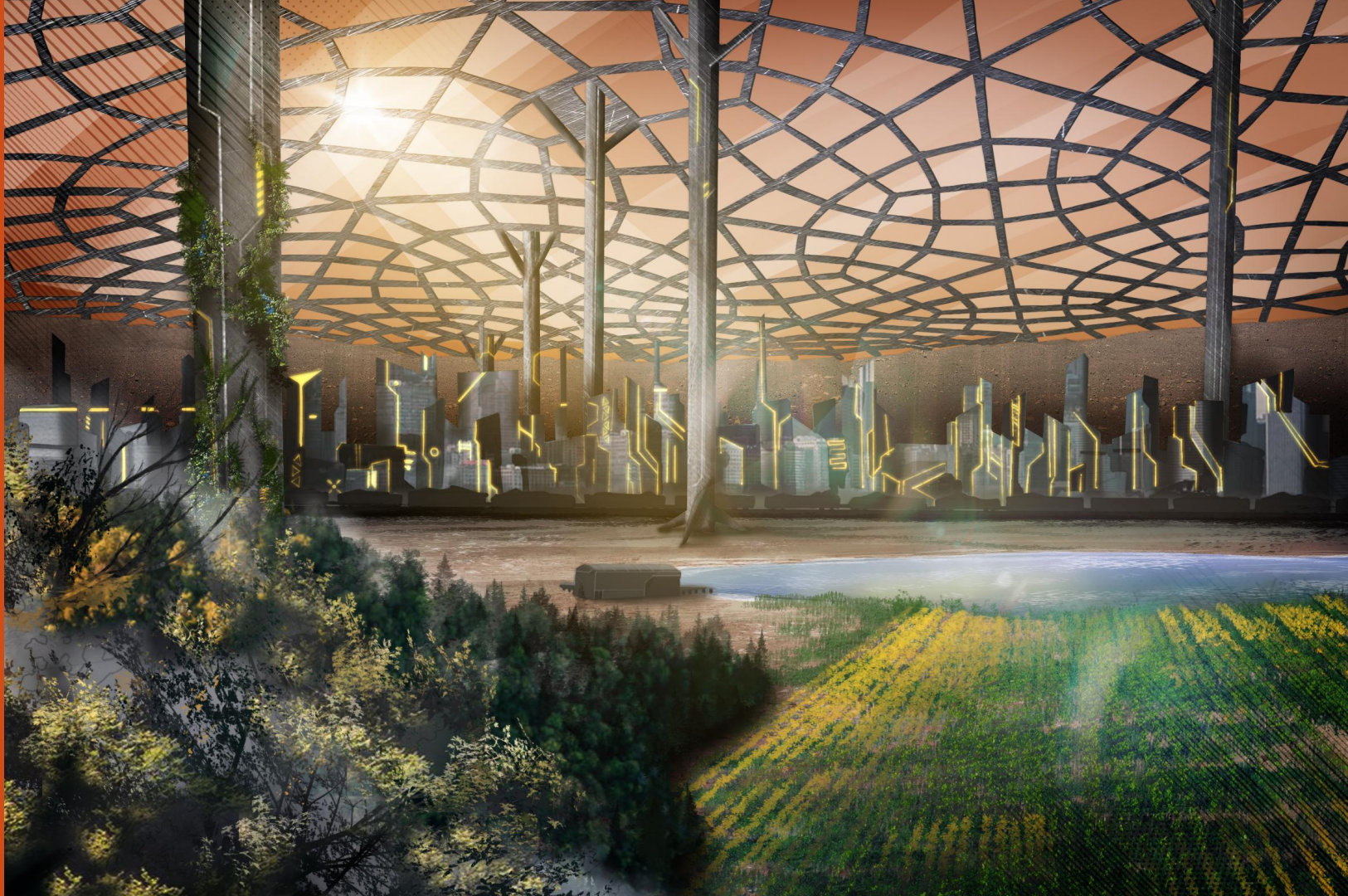


*Artist's
Rendition*

**Artificial
Beach**

**Under
Ground**

The
Future
Of
KCSAR



Thank You!

Any Questions?

For more information please read the paper/slides at:

<https://github.com/asharp/kcsar>

Or look at Marspedia for particular topics.

