

Evaluating Solar Rooftop Systems and Microgrids: The Optimal Solution for Residential Energy Needs

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Agenda

01 Overview of Solar Rooftop

02 Challenges in Residential Solar Energy Adoption

03 Individual Solar Systems vs. Microgrids

04 Case Study: Application in Oman

05 Recommendations and Future Outlook

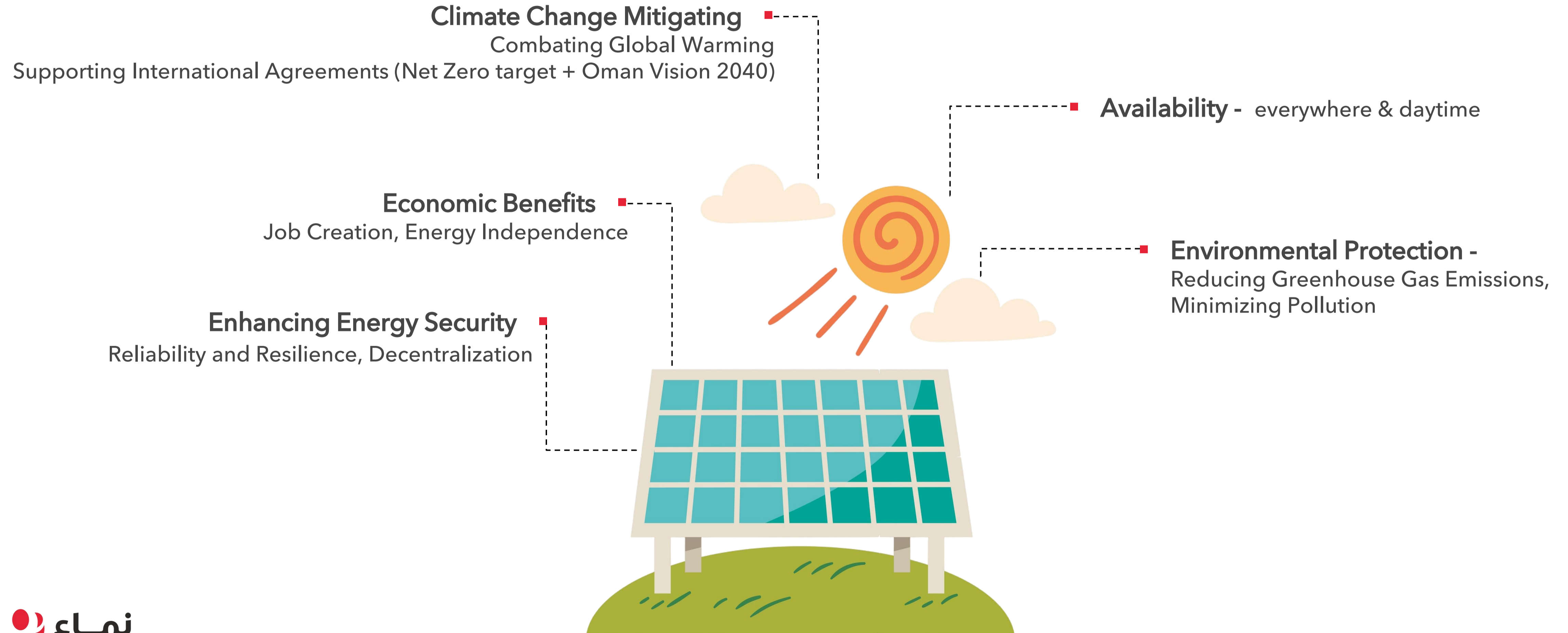
Definition to Highlight

Rooftop Solar System: standalone solar power systems installed on individual properties



Microgrids Solar System: Localized energy grids that can operate independently or in conjunction with the main electrical grid.

Why Solar PV System for residential customer



Residential Solar System



FEBI

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Solar Panels



Inverters



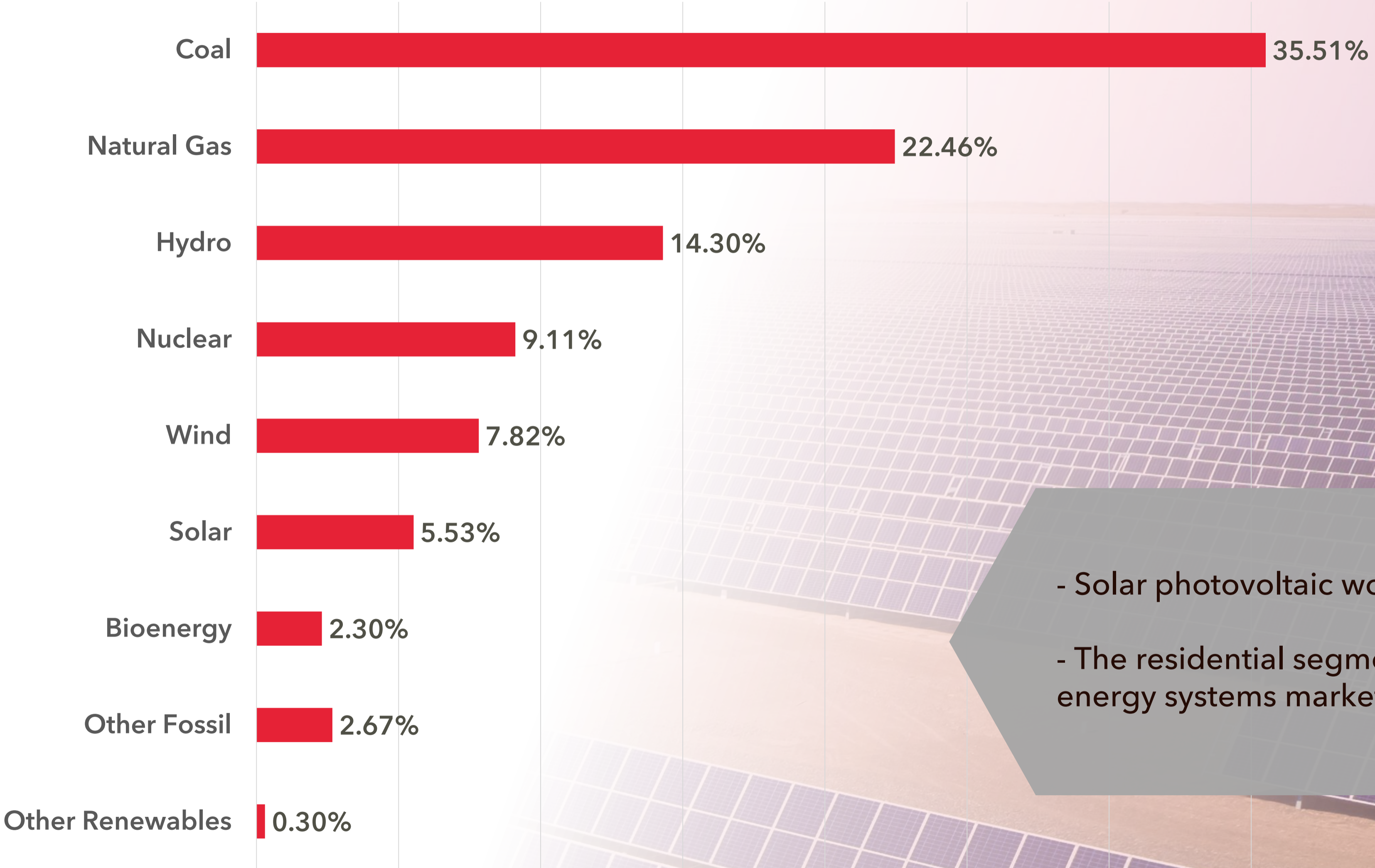
Main meter



Interface protection

Overview of Solar Energy Adoption Globally

Distribution of electricity generation worldwide in 2023, by energy source ***



- Solar photovoltaic worldwide capacity share reached 1411 TW in 2023 *

- The residential segment accounted for roughly 15 percent of the solar energy systems market worldwide in 2023 **

* Renewable energy statistics 2023 - IRENA

** Market value of residential solar energy systems worldwide from 2021 to 2023, with a forecast until 2031 - <https://www-statista.com>

*** Global electricity mix 2023, by energy source - <https://www-statista.com>

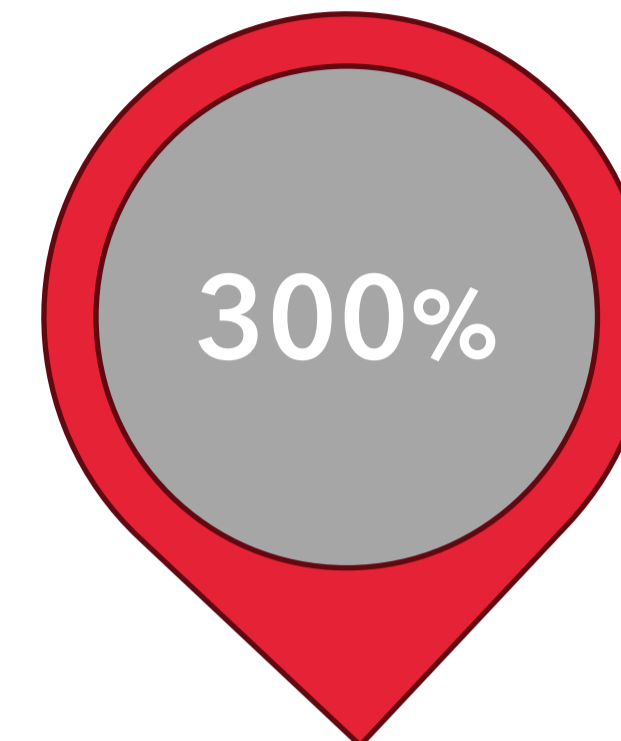
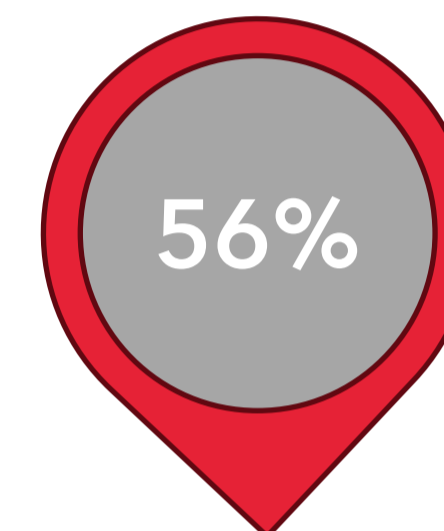
Residential Solar Energy in Oman

Most of the residential solar systems are roof-mounting structures.

56% of received Solar applications by NEDC are for residential customers.

Having incentives increases the demand for residential applications by more than 300%

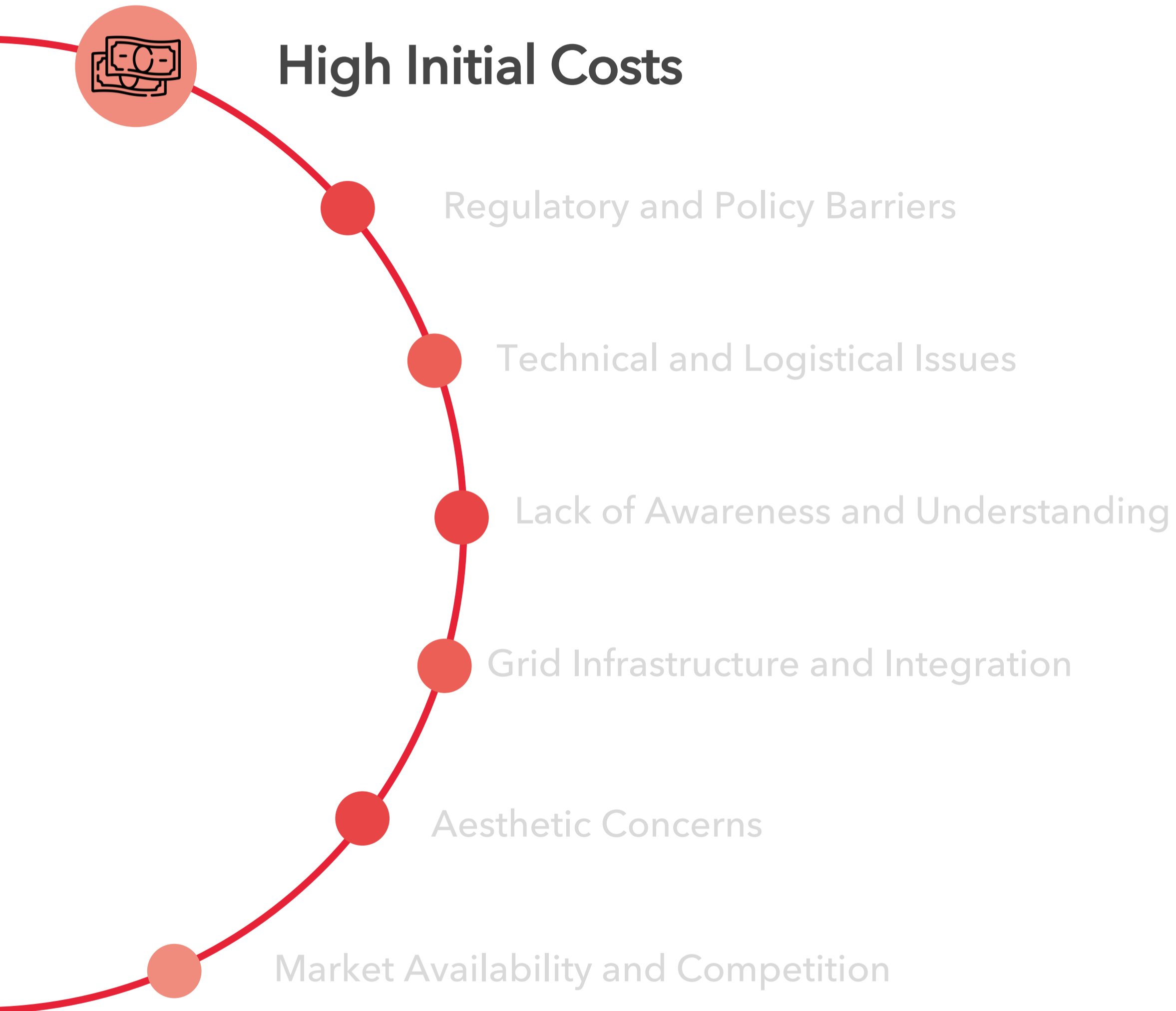
Solar rooftop systems reduced Electricity Bills.



Challenges in Residential Solar Energy Adoption



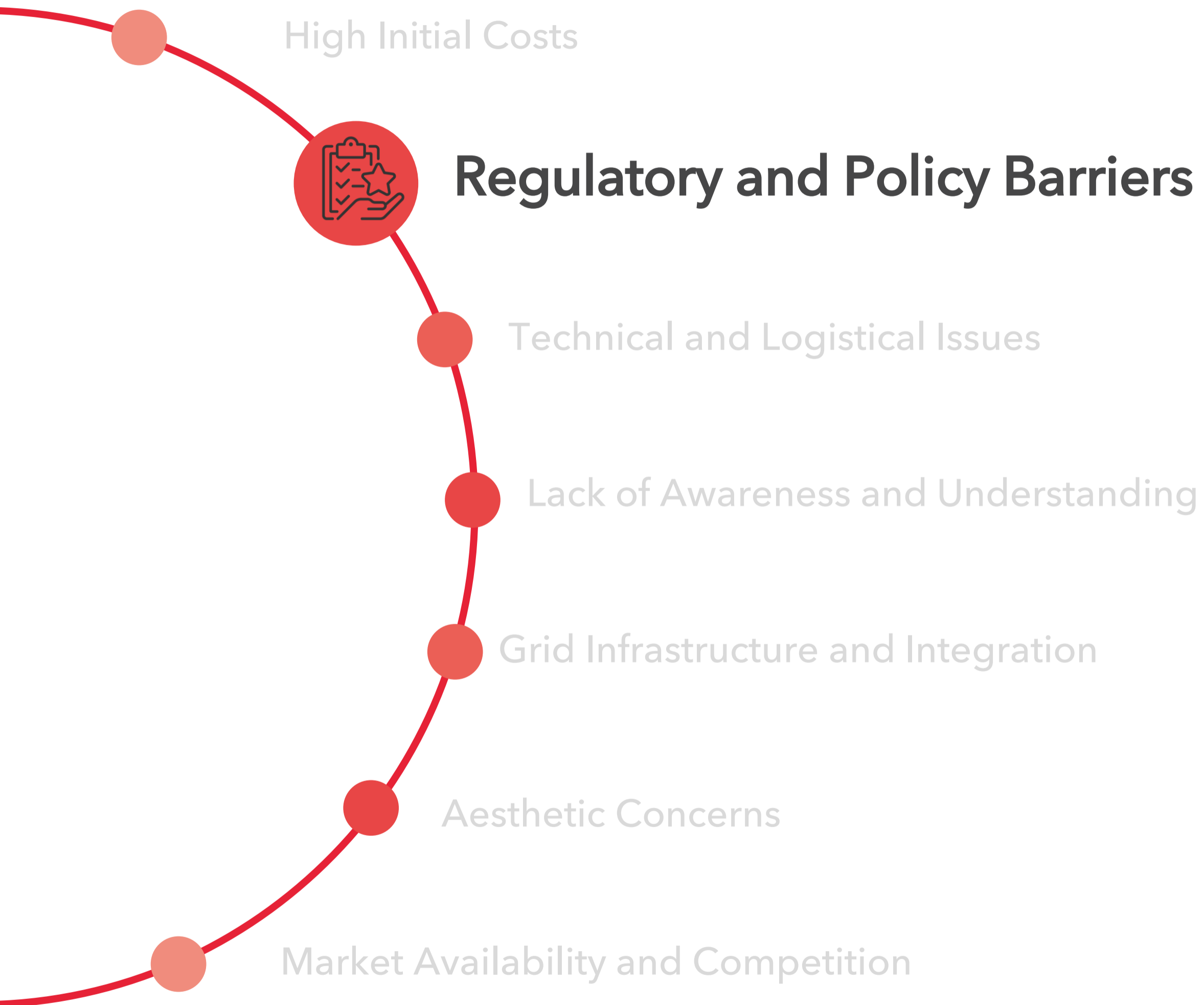
Challenges in Residential Solar Energy Adoption



- **Installation Costs:** The upfront cost of purchasing and installing solar panels can be high, even though long-term savings are significant.

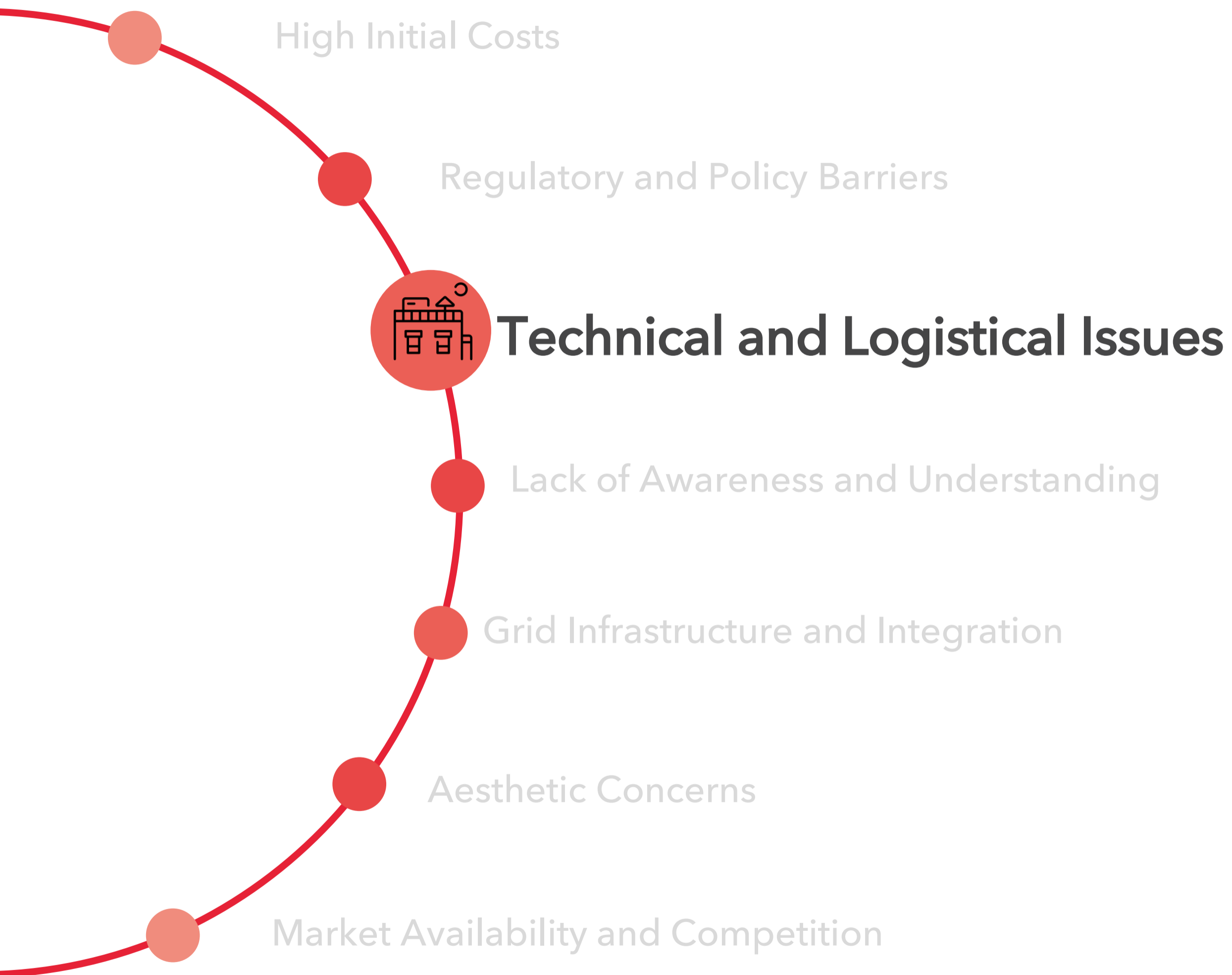
- **Financing Options:** Although loans, leases, and power purchase agreements (PPAs) are available, understanding and navigating these financial products can be complex.

Challenges in Residential Solar Energy Adoption



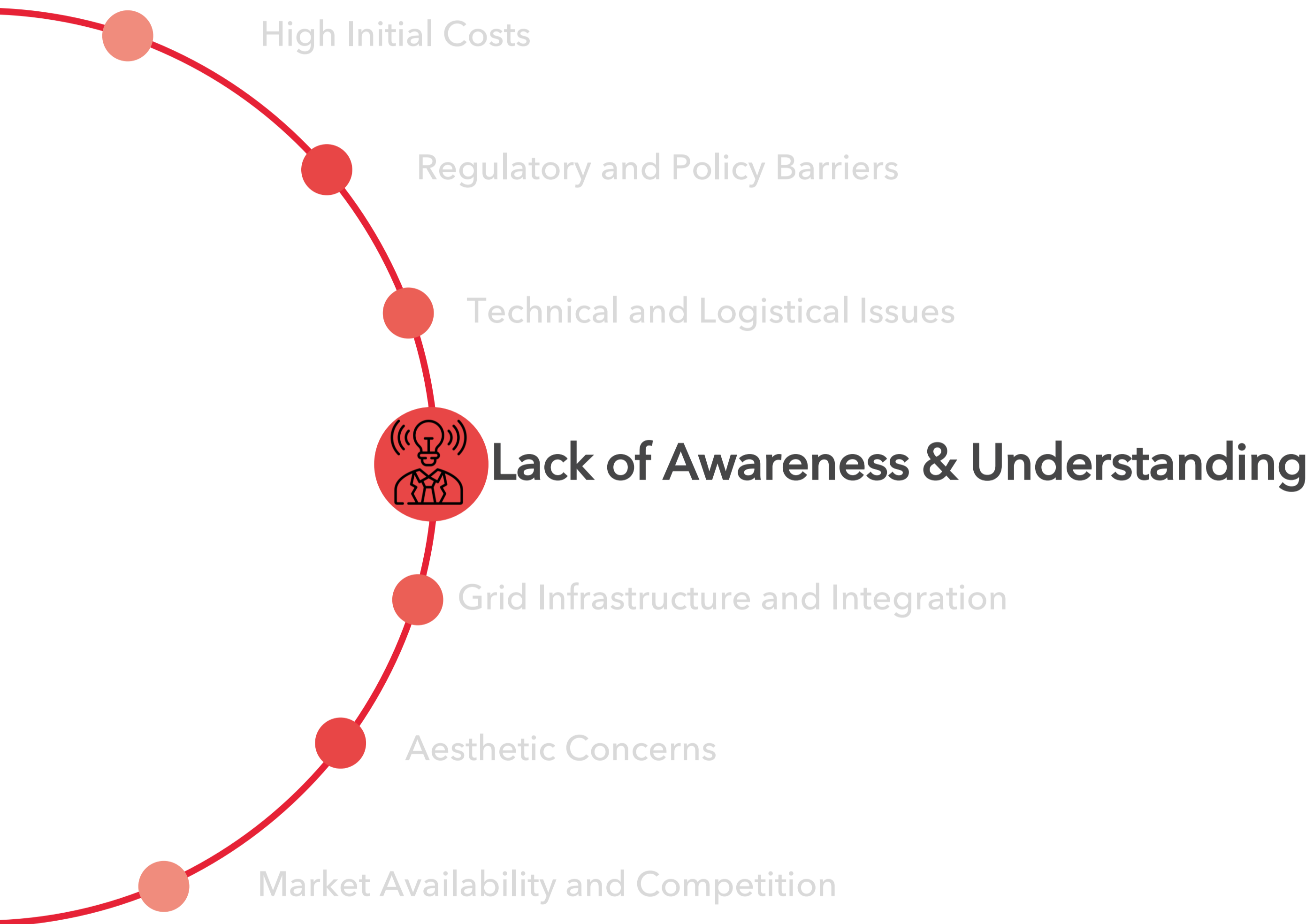
- Unclear policy
- Lack of Incentives
- Lack of Green fund

Challenges in Residential Solar Energy Adoption



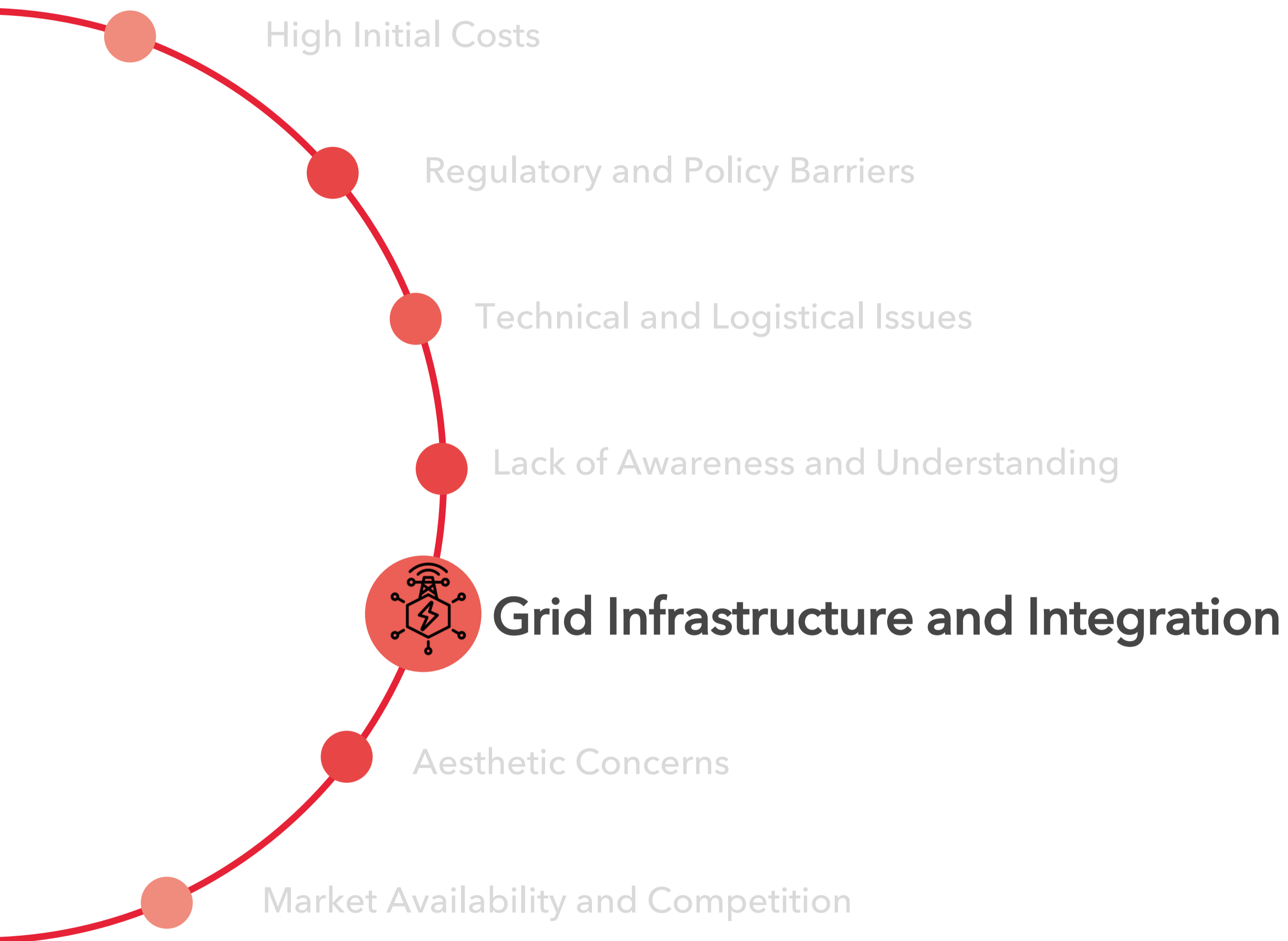
- **Roof Suitability:** Not all roofs are suitable for solar panels due to orientation, shading, or structural issues (Structural Concerns Related to Solar Panel Weight).
- **Roof Space limitation:** Not all roofs are with enough space
- **Shading Effects:** from Surrounding Buildings and Trees and the roof itself.
- **Installation Complexity:** The process of obtaining some permits can be lengthy and complex.
- **Cleaning and Maintaining the system**

Challenges in Residential Solar Energy Adoption



- **Information Overload:** The complexity of the technology, financing options, and varying regulations can overwhelm homeowners, leading to decision paralysis.
- **Misconceptions:** Some homeowners may have misconceptions about solar energy efficiency, cost, or reliability. Also, some have a misunderstanding about the bill credit.

Challenges in Residential Solar Energy Adoption



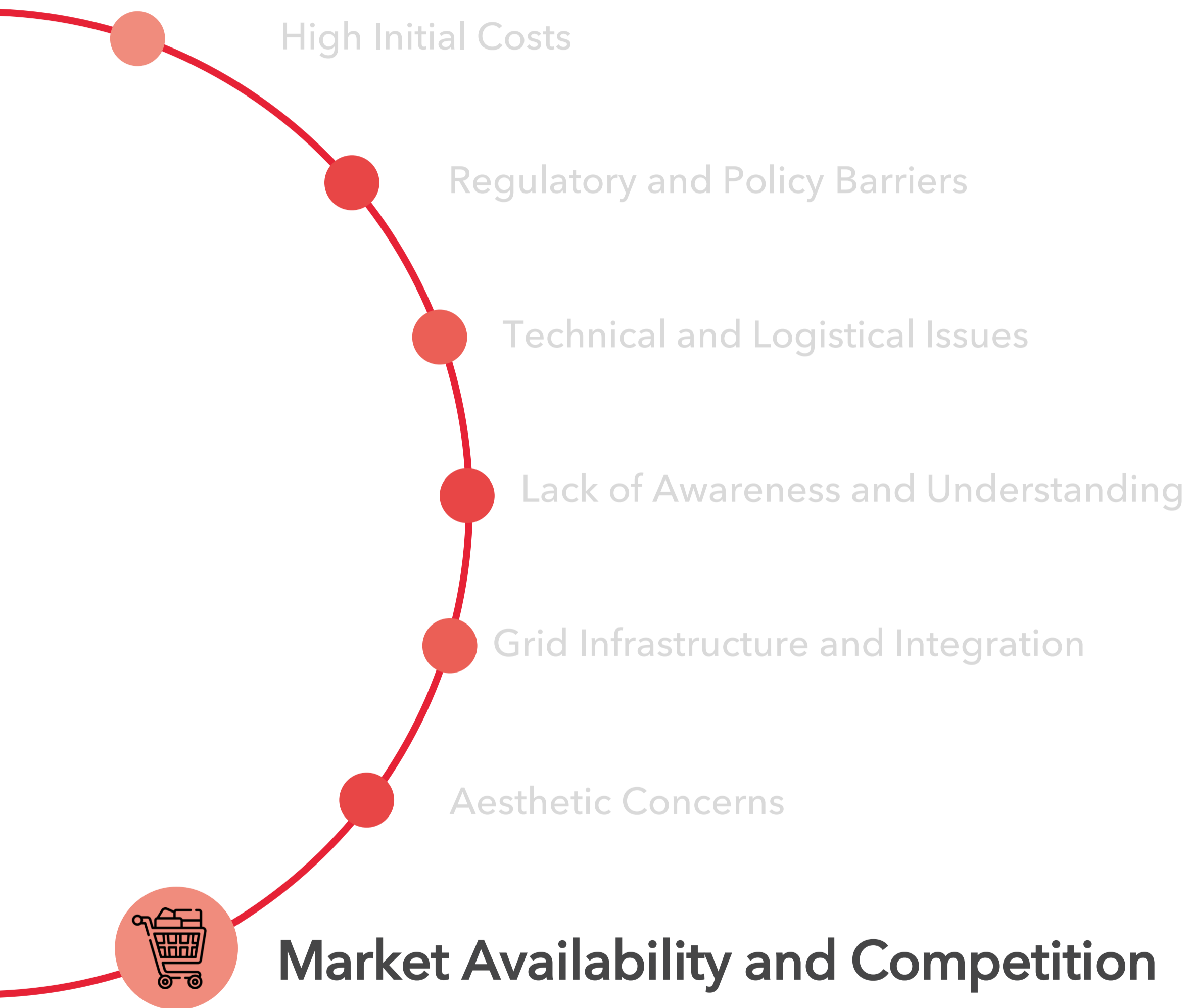
- **Grid Limitations:** In some areas, the existing grid infrastructure may not be well-equipped to handle increased solar energy inputs, leading to potential issues with energy stability.
- **Energy Storage:** The need for efficient energy storage solutions to manage solar energy generated during non-peak times remains a significant challenge.

Challenges in Residential Solar Energy Adoption



- **Visual Impact:** Some homeowners may be concerned about the appearance of solar panels on their property, which can deter adoption, particularly in communities with strict aesthetic standards.

Challenges in Residential Solar Energy Adoption



- **Limited Supplier Options:** there may be limited competition among solar providers, leading to higher prices and fewer choices for consumers.

- **Product Quality and Service:** Variability in the quality of products and services can lead to issues with reliability and maintenance.

Individual Solar Systems vs. Microgrids

Individual Solar Systems

standalone solar power systems installed on individual properties

design to meet the energy needs of a single household and limited by the available space.

Dependent on individual factors like roof orientation, shading, and local weather. Efficiency can be lower if the system is not optimized.

Upfront per kW is very high (400-450 OMR), so the payback take +10 years

Some entities start making incentives for its employees. Still, no green fund support the small scale.

Definition

Scale

Efficiency

Cost

Financing

Microgrids Solar Systems

Localized energy grids that can operate independently or in conjunction with the main electrical grid.

Larger and more complex, serving multiple buildings or a community.

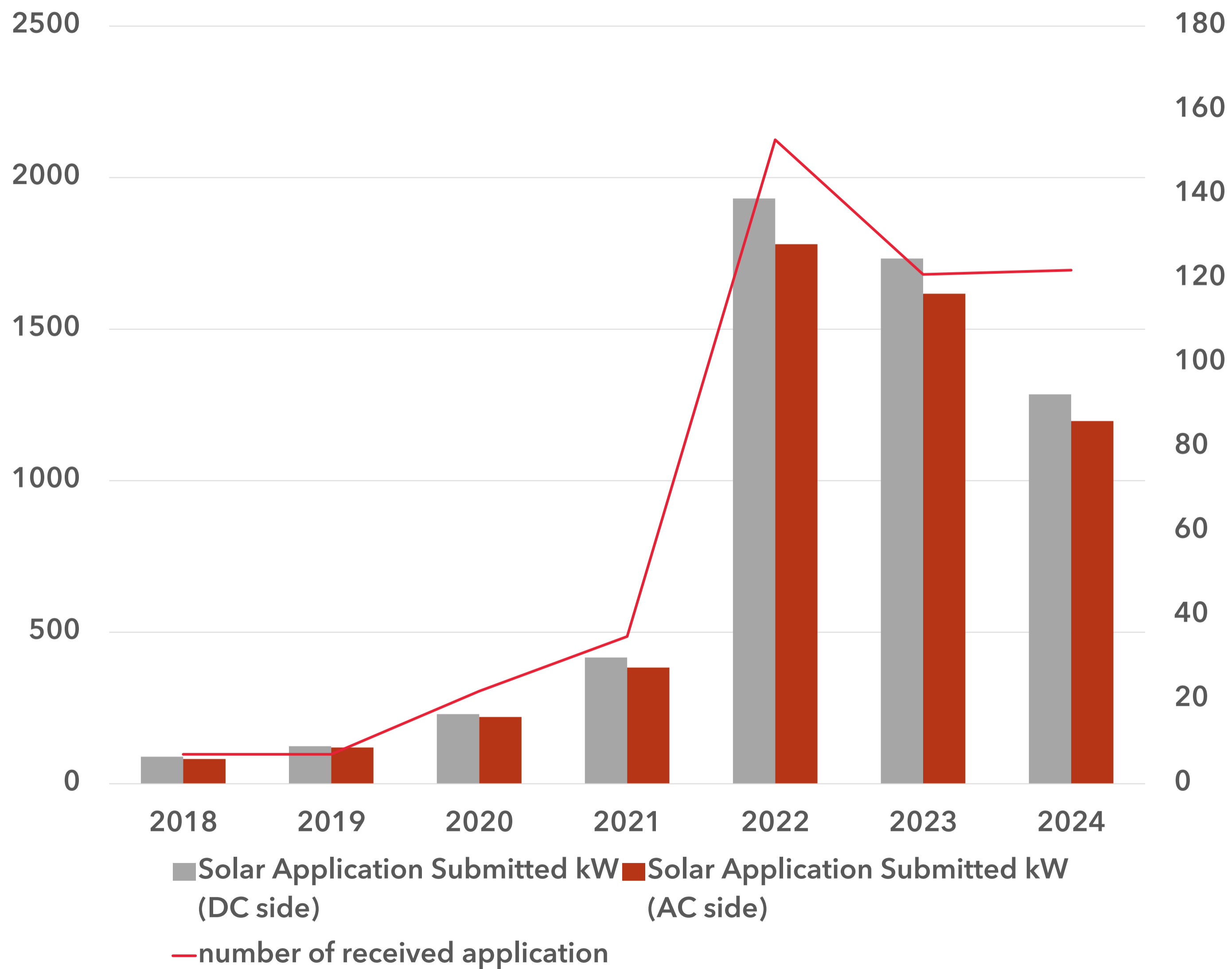
more efficient due to the ability to balance loads and incorporate diverse energy sources.

Upfront per kW is lower than the individual system (300-350 OMR), so the payback take less time

Microgrids may attract international investment. Having green fund for it much easier.

Overview of the Solar Small-Scale Landscape in Oman

Received Application		
Total Number of Application	833	
Total DC capacity	106.57	MWp
Total AC capacity	90.66	MW
Connected Application		
Total Number of Applications	577	
Total DC capacity	64.92	MWp
Total AC capacity	55.51	MW
In-process Application		
Total Number of Application	256	
Total DC capacity	41.66	MWp
Total AC capacity	35.15	MW



Cost-Effectiveness and Economic Viability

	Individual Rooftop Solar Systems	Microgrids
Energized Residential customer		314
AC capacity		3.9 MW
DC capacity		4.2 MW
Average capacity per house		12 kW ac
Installation cost	1,680 – 1,890 k OMR	1260 k OMR
Payback period	10 – 12 years	7 years

To ensure Availability, Durability, Reliability, Resilience & Continuity of supply, the microgrid systems should be distributed to different areas.

Strategic Recommendations and Future Outlook

- Policy and Investment Strategies for Enhancing Solar Adoption
- Potential for Scaling Microgrids in Similar Contexts in Oman
- Encourage the adoption of building codes that support solar panel installations, such as mandating solar-ready rooftops for new constructions.
- Develop a national strategy to promote the integration of microgrids in residential areas, especially in new housing developments.
- Provide more Incentives & green funds.
- Integration with Energy Storage Solutions





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