

Asia Pacific Solid Oxide Fuel Cells Market By Type (Planar and Tubular), By Application (Stationary, Transportation and Portable), By End User (Commercial, Data Centers, Military & Defense and Others), By Country, By Competition Forecast & Opportunities, 2018-2028

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Abstracts

Asia Pacific Solid Oxide Fuel Cells Market has valued at USD 391.47 million in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 15.04% through 2028. The market is experiencing growth due to emerging opportunities in various applications. Solid oxide fuel cells (SOFCs) have been developed as efficient and cost-effective sources of electricity, both as reversible SO cells and solid oxide electrolyzers (SOECs). These technologies find applications in distributed generation, energy storage, telecom backup, combined heat and power, sensors, power to chemicals and fuels, data centers, ships, and more. The increasing adoption of solid oxide fuel cells in data centers is a significant driver of their global demand. They offer high-efficiency electricity while utilizing existing natural gas infrastructure as a fuel source. Notably, the United States alone hosts nearly three million data centers.

Key Market Drivers

Growing Demand for Clean Energy Solutions

The Asia Pacific Solid Oxide Fuel Cells (SOFC) market is witnessing strong growth due to the increasing demand for clean energy solutions in the region. As countries grapple with the adverse effects of climate change and the imperative to reduce greenhouse gas emissions, SOFCs have emerged as a promising technology that can address

these pressing concerns. These fuel cells generate electricity through an electrochemical process that produces minimal pollutants, rendering them an attractive option for power generation.

One of the key drivers behind the growth of the SOFC market in Asia Pacific is the region's commitment to sustainability and environmental conservation. Countries like Japan, South Korea, and China have set ambitious targets to reduce carbon emissions and transition to a low-carbon economy. SOFCs are viewed as a valuable tool in achieving these goals as they efficiently convert various fuels, including natural gas and biogas, into electricity without the harmful emissions associated with conventional fossil fuel combustion.

Furthermore, the increasing adoption of renewable energy sources, such as wind and solar power, has created a demand for energy storage solutions. SOFCs can play a crucial role in this regard by providing a reliable and efficient means of storing excess electricity generated from renewables. This capability enhances the stability and resilience of the energy grid, reducing reliance on fossil fuels for backup power generation.

Moreover, governments across the Asia Pacific region are implementing supportive policies and incentives to promote the adoption of SOFC technology. These policies include subsidies, tax incentives, and research grants, which encourage both research and development activities and the deployment of SOFC systems in various applications, including stationary power generation, distributed energy generation, and transportation.

In conclusion, the increasing demand for clean energy solutions in the Asia Pacific region, driven by environmental concerns and the need to reduce carbon emissions, is a significant driver of the SOFC market's growth. The technology's versatility in using multiple fuel sources and its potential to enhance renewable energy integration have made it a compelling choice for governments, businesses, and consumers alike. With continued support from governments and ongoing advancements in SOFC technology, the Asia Pacific market is poised for substantial expansion in the coming years.

Increasing Focus on Energy Efficiency and Sustainability

The Asia Pacific Solid Oxide Fuel Cells (SOFC) market is witnessing rapid growth driven by a growing focus on energy efficiency and sustainability. As countries in the region strive to meet their energy requirements while minimizing their environmental

impact, SOFCs have emerged as a viable solution that aligns with these objectives.

One of the primary catalysts for the SOFC market is the demand for highly efficient energy conversion technologies. SOFCs are renowned for their exceptional efficiency in converting fuel into electricity, often surpassing 60%, which is significantly higher than traditional combustion-based power generation methods. This efficiency results in reduced fuel consumption and lower greenhouse gas emissions, making SOFCs an appealing choice for industries, utilities, and residential applications alike.

Furthermore, as concerns about air quality and pollution continue to escalate in densely populated urban areas across Asia Pacific, SOFCs offer a clean and low-emission power generation alternative. These fuel cells produce minimal emissions, with water vapor and carbon dioxide being the primary byproducts. This not only helps enhance air quality but also supports countries' endeavors to mitigate the impacts of climate change.

Governments in the Asia Pacific region also play a pivotal role in driving the adoption of SOFC technology. They have implemented various policies and incentives to promote clean energy solutions, including subsidies, tax incentives, and renewable energy targets. These initiatives encourage businesses and individuals to invest in SOFC systems and integrate them into their energy portfolios.

Additionally, the versatility of SOFCs makes them suitable for various applications beyond stationary power generation. They are increasingly utilized in combined heat and power (CHP) systems, which capture and utilize waste heat for heating and cooling purposes, further enhancing energy efficiency. Moreover, SOFCs are gaining traction in the transportation sector, particularly in the development of fuel cell electric vehicles (FCEVs), which provide zero-emission mobility solutions.

In conclusion, the increasing emphasis on energy efficiency, sustainability, and reduced emissions is a significant driver of the SOFC market in the Asia Pacific region. The technology's capability to deliver highly efficient and clean power generation aligns with the evolving energy landscape and the region's commitment to environmental conservation. With sustained support from governments and growing awareness of the benefits of SOFCs, the market is poised for continued expansion in the years to come.

Advancements in SOFC Technology and Manufacturing

The Asia Pacific Solid Oxide Fuel Cells (SOFC) market is being propelled by notable advancements in SOFC technology and manufacturing processes. These innovations

are resulting in enhanced performance, reliability, and cost-effectiveness, rendering SOFCs increasingly attractive for a wide range of applications in the region.

One of the key drivers behind the growth of the SOFC market is the ongoing research and development efforts aimed at enhancing SOFC technology. These endeavors have yielded more efficient and durable fuel cell stacks, innovative materials, and improved system designs. Progress in materials science, including the development of new electrolytes and catalysts, has contributed to higher fuel cell efficiency and longevity, addressing historical challenges associated with SOFCs.

Moreover, manufacturing processes for SOFCs have become more streamlined and cost-effective. Mass production techniques and economies of scale have reduced the overall manufacturing cost of SOFC components, enhancing their competitiveness against other power generation technologies. This reduction in manufacturing costs has had a cascading effect on the market, rendering SOFCs more accessible to a broader range of industries and applications.

Asia Pacific countries, particularly Japan and South Korea, have been at the forefront of these technological advancements. Government-funded research programs and collaborations with industry players have expedited the development and commercialization of SOFC technology. Consequently, these countries are not only leading the region in terms of SOFC deployment but are also exporting their expertise and products to international markets.

Furthermore, the development of hybrid energy systems that integrate SOFCs with other renewable energy sources and energy storage technologies is further expanding the market. These hybrid systems enhance the reliability and grid integration capabilities of SOFCs, making them a valuable component of future energy ecosystems.

In conclusion, the Asia Pacific SOFC market is benefiting from continuous advancements in technology and manufacturing processes. These innovations are addressing previous limitations and making SOFCs more competitive and reliable. With governments and industry stakeholders heavily investing in research and development, the region is well-positioned to maintain its leadership in the global SOFC market and drive further adoption across diverse applications, from stationary power generation to transportation.

Key Market Challenges

High Initial Costs and Capital Intensity

One of the primary challenges confronting the Asia Pacific Solid Oxide Fuel Cells (SOFC) market is the substantial initial capital costs associated with the deployment of SOFC systems. Despite the numerous advantages offered by SOFCs, such as high efficiency and low emissions, their upfront expenses can be significant, dissuading potential adopters.

The capital intensity of SOFCs primarily arises from the intricate manufacturing processes and the utilization of advanced materials necessary for their construction. The incorporation of specialized ceramic materials, like yttria-stabilized zirconia, for the fuel cell components further contributes to the cost. Additionally, SOFCs often necessitate resilient and sophisticated balance-of-plant components, including heat exchangers, compressors, and power electronics, which further augment the overall cost.

The considerable initial investment required for deploying SOFC systems can pose a substantial barrier for smaller businesses, municipalities, and individuals, thereby limiting their capacity to embrace this clean energy technology. To address this challenge, stakeholders in the Asia Pacific region must focus on research and development endeavors aimed at reducing material costs, enhancing manufacturing processes, and scaling up production to attain economies of scale. Furthermore, governments and financial institutions should explore innovative financing models and incentives to promote wider adoption and alleviate the financial burden on potential users.

Technological Challenges and Durability

Despite significant progress in Solid Oxide Fuel Cell (SOFC) technology, durability and reliability remain persistent challenges in the Asia Pacific SOFC market. SOFCs are subjected to harsh operating conditions, including high temperatures and thermal cycling, which can lead to degradation of fuel cell components over time. This degradation can result in decreased efficiency and increased maintenance costs, thus reducing the overall economic viability of SOFC systems.

The durability of SOFCs is particularly crucial for stationary power generation applications, where long-term performance and reliability are paramount. The need for continuous, uninterrupted power supply in critical sectors such as healthcare,

telecommunications, and data centers demands high levels of reliability that can be challenging to achieve with current SOFC technology.

Addressing durability challenges requires ongoing research in materials science, innovative coatings, and improved manufacturing techniques. Additionally, system design and engineering must focus on minimizing thermal stresses and ensuring uniform temperature distribution within the fuel cell stack. Collaborative efforts between governments, research institutions, and industry players are necessary to expedite the development of more durable SOFC systems that can withstand the rigors of long-term operation.

Infrastructure and Fuel Supply

The Asia Pacific SOFC market encounters infrastructure and fuel supply challenges that may impede widespread adoption. Effective operation of SOFCs relies on a consistent and uninterrupted fuel supply, typically natural gas or biogas. However, in certain regions, the availability and accessibility of these fuels can be limited, presenting a significant hurdle for potential users.

In remote or rural areas, where energy access is a critical concern, the absence of natural gas infrastructure poses challenges for deploying SOFC systems. Moreover, ensuring the quality and consistency of fuel sources is crucial for the efficient operation of SOFCs, necessitating investments in gas purification and conditioning systems.

Furthermore, the development of a hydrogen supply infrastructure, a potential fuel source for SOFCs, is still in its early stages across many parts of the Asia Pacific region. Establishing hydrogen production, storage, and distribution infrastructure requires substantial investments and coordination among multiple stakeholders.

To overcome these infrastructure and fuel supply challenges, collaboration between governments and industry stakeholders is imperative. Developing the necessary infrastructure, including natural gas pipelines, hydrogen production facilities, and biogas collection systems, is crucial. Additionally, in areas lacking existing infrastructure, exploring innovative approaches like onsite biogas generation can ensure a sustainable fuel supply for SOFCs.

In conclusion, although the Asia Pacific SOFC market holds immense potential for clean and efficient energy generation, it faces challenges concerning high initial costs, technological durability, and the availability of infrastructure and fuel supply. Addressing

these challenges will require concerted efforts from governments, research institutions, and industry stakeholders to unlock the full potential of SOFC technology in the region.

Key Market Trends

Increased Adoption of Solid Oxide Fuel Cells in Distributed Energy Systems

One notable trend in the Asia Pacific Solid Oxide Fuel Cells (SOFC) market is the growing adoption of SOFC technology in distributed energy systems. Distributed energy generation refers to the production of electricity at or near the point of use, commonly within residential, commercial, or industrial facilities. SOFCs are well-suited for distributed energy applications due to their high efficiency and ability to utilize diverse fuel sources, including natural gas, biogas, and hydrogen.

In recent years, there has been an increasing recognition of the benefits of distributed energy systems, particularly in areas with unreliable grid infrastructure or a desire for greater energy independence. Residential and commercial deployments of SOFCs provide combined heat and power (CHP), simultaneously generating electricity and useful thermal energy, such as hot water or space heating. This approach enhances energy efficiency, reduces dependence on the grid, and lowers energy costs for end-users.

Furthermore, advancements in micro-CHP systems based on SOFC technology have made them more compact, efficient, and cost-effective, further driving their adoption in residential and small business settings. These systems not only reduce electricity expenses but also contribute to environmental sustainability by reducing greenhouse gas emissions and reliance on centralized power plants.

As the momentum towards distributed energy systems continues to grow in the Asia Pacific region, SOFCs are expected to play a crucial role in decentralizing power generation, enhancing energy resilience, and promoting sustainability.

Integration of Solid Oxide Fuel Cells in Renewable Energy Hybrid Systems

Another noteworthy trend in the Asia Pacific SOFC market is the integration of SOFCs into renewable energy hybrid systems. Renewable energy sources such as wind and solar power have experienced significant growth in the region. However, they inherently face intermittency and dependence on weather conditions. In this context, SOFCs serve as a valuable complement, offering stable, on-demand power generation and energy

storage capabilities.

Within hybrid systems, SOFCs work in tandem with renewable sources to address the challenges of intermittency and ensure reliable electricity supply. During periods of excess renewable energy production, surplus electricity can be utilized for hydrogen production through water electrolysis, which is then stored for later use in the SOFC system. Consequently, when renewable energy generation is insufficient to meet demand, the stored hydrogen can be fed into the SOFCs to generate electricity, thereby ensuring a continuous power supply.

The integration of SOFCs with renewable energy sources aligns with the Asia Pacific's ongoing efforts to transition towards a sustainable, low-carbon energy landscape. This emerging trend not only enhances the reliability of renewable energy systems, but also facilitates grid stabilization and promotes the efficient utilization of surplus renewable energy, thereby reducing waste and emissions.

Anticipated government policies and incentives aimed at promoting the integration of renewable energy and fuel cell technologies are expected to further drive the adoption of SOFCs in hybrid energy systems across the Asia Pacific region.

Segmental Insights

Type Insights

The Planar segment emerged as the dominant player in 2022. Stationary Power Generation encompasses the utilization of SOFC applications to provide electricity and heat to residential, commercial, and industrial facilities. It offers an alternative to conventional power generation methods and contributes to the stability of the grid. In the realm of transportation, SOFCs are employed in fuel cell electric vehicles (FCEVs) to facilitate clean and efficient transportation. This sector displays promising growth potential, particularly as countries in the Asia Pacific region strive to reduce carbon emissions within the transportation industry.

Energy and Utilities includes the adoption of SOFCs by utilities and energy companies for distributed generation and grid support. It also encompasses the implementation of SOFC technology in power plants for combined heat and power (CHP) applications. Additionally, SOFCs find applications across various manufacturing and industrial processes, including metal production, chemical manufacturing, and glass manufacturing. They provide these industries with efficient and environmentally friendly

power and heat solutions. Notably, SOFCs can operate on natural gas or biogas, making them suitable for regions with established gas infrastructure and access to biogas sources.

China, as one of the largest markets for SOFC technology in the Asia Pacific region, presents significant opportunities for manufacturers, researchers, and investors. The market benefits from government support and a growing industrial base. Japan, on the other hand, boasts a well-established SOFC industry with a particular focus on residential and commercial applications. The country's technological expertise and proactive initiatives serve as key drivers for market development.

Application Insights

The Transportation segment is projected to experience rapid growth during the forecast period. Solid oxide fuel cells (SOFCs) can serve as range extenders in electric vehicles, enabling longer driving distances and faster refueling compared to battery-only EVs. They boast high energy density and rapid refueling, rendering them suitable for commercial vehicles such as buses and trucks. Moreover, SOFCs have the potential to power ships and boats, thereby curbing emissions in the maritime industry.

Governments in the Asia Pacific region have been setting stringent emissions reduction targets, with SOFCs being viewed as a viable means to attain these objectives in the transportation sector. Renowned for their exceptional energy efficiency, SOFCs can also contribute to cost savings for transportation companies.

The adoption of SOFCs in the transportation segment is projected to witness significant growth as governments and businesses actively seek cleaner and more efficient energy solutions. The implementation of government incentives and policies aimed at promoting clean energy and zero-emission transportation will play a pivotal role in fostering the expansion of SOFCs in the transportation sector.

Country Insights

China emerged as the dominant player in 2022. The country's rapidly expanding industrial and commercial sectors, combined with the growing demand for power, have propelled the adoption of SOFCs for distributed energy generation. The market has experienced significant growth, and this upward trend is expected to persist due to China's commitment to reducing carbon emissions and transitioning to cleaner energy sources.

The Chinese government has implemented various policies and initiatives to foster the development and uptake of SOFC technology. These encompass subsidies, research grants, and incentives to stimulate both research endeavors and commercial deployment. China's unwavering support for clean energy technologies positions SOFCs favorably within the country's energy landscape.

China possesses a robust manufacturing infrastructure and capabilities that are pivotal for the production of SOFC components and systems. The country's manufacturing expertise, coupled with economies of scale, holds the potential to drive down the costs of SOFC technology, thereby increasing its accessibility across a broader range of applications.

China's interest in fortifying energy resilience serves as another catalyst for the adoption of SOFCs. Distributed energy systems, powered by SOFCs, can furnish reliable electricity in regions with unstable grid infrastructure or during emergencies. This aligns with the country's objectives of ensuring uninterrupted power supply and bolstering energy security.

China has made substantial investments in renewable energy sources, including wind, solar, and hydropower. SOFCs can be seamlessly integrated with these renewables to deliver stable power generation and facilitate grid balancing. The synergy between SOFCs and renewables supports China's pursuit of a sustainable and diversified energy mix.

Key Market Players

Bloom Energy

FuelCell Energy

Toshiba Energy Systems & Solutions Corporation

Mitsubishi Power

Kyocera Corporation

JX Nippon Oil & Energy Corporation

Doosan Fuel Cell

Panasonic Corporation

Neatec Solutions

Hexis AG

Report Scope:

In this report, the Asia Pacific Solid Oxide Fuel Cells Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Asia Pacific Solid Oxide Fuel Cells Market, By Type:

Planar

Tubular

Asia Pacific Solid Oxide Fuel Cells Market, By Application:

Stationary

Transportation

Portable

Asia Pacific Solid Oxide Fuel Cells Market, By End User:

Commercial

Data Centers

Military & Defense

Others

Asia Pacific Solid Oxide Fuel Cells Market, By Country:

China

Japan

India

South Korea

Australia

Vietnam

Indonesia

Malaysia

Singapore

Philippines

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Asia Pacific Solid Oxide Fuel Cells Market.

Available Customizations:

Asia Pacific Solid Oxide Fuel Cells market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

Contents

1. PRODUCT OVERVIEW

- 1.1. Market Definition
- 1.2. Scope of the Market
 - 1.2.1. Markets Covered
 - 1.2.2. Years Considered for Study
 - 1.2.3. Key Market Segmentations

2. RESEARCH METHODOLOGY

- 2.1. Objective of the Study
- 2.2. Baseline Methodology
- 2.3. Formulation of the Scope
- 2.4. Assumptions and Limitations
- 2.5. Sources of Research
 - 2.5.1. Secondary Research
 - 2.5.2. Primary Research
- 2.6. Approach for the Market Study
 - 2.6.1. The Bottom-Up Approach
 - 2.6.2. The Top-Down Approach
- 2.7. Methodology Followed for Calculation of Market Size & Market Shares
- 2.8. Forecasting Methodology
 - 2.8.1. Data Triangulation & Validation

3. EXECUTIVE SUMMARY

4. VOICE OF CUSTOMERS

5. ASIA PACIFIC SOLID OXIDE FUEL CELLS MARKET OUTLOOK

- 5.1. Market Size & Forecast
 - 5.1.1. By Value
- 5.2. Market Share & Forecast
 - 5.2.1. By Type (Planar and Tubular)
 - 5.2.2. By Application (Stationary, Transportation and Portable)

- 5.2.3. By End User (Commercial, Data Centers, Military & Defense and Others)
- 5.2.4. By Country
- 5.3. By Company (2022)
- 5.4. Market Map

6. CHINA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

- 6.1. Market Size & Forecast
 - 6.1.1. By Value
- 6.2. Market Share & Forecast
 - 6.2.1. By Type
 - 6.2.2. By Application
 - 6.2.3. By End User

7. JAPAN SOLID OXIDE FUEL CELLS MARKET OUTLOOK

- 7.1. Market Size & Forecast
 - 7.1.1. By Value
- 7.2. Market Share & Forecast
 - 7.2.1. By Type
 - 7.2.2. By Application
 - 7.2.3. By End User

8. INDIA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

- 8.1. Market Size & Forecast
 - 8.1.1. By Value
- 8.2. Market Share & Forecast
 - 8.2.1. By Type
 - 8.2.2. By Application
 - 8.2.3. By End User

9. SOUTH KOREA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

- 9.1. Market Size & Forecast
 - 9.1.1. By Value
- 9.2. Market Share & Forecast
 - 9.2.1. By Type
 - 9.2.2. By Application

9.2.3. By End User

10. AUSTRALIA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

10.1. Market Size & Forecast

10.1.1. By Value

10.2. Market Share & Forecast

10.2.1. By Type

10.2.2. By Application

10.2.3. By End User

11. VIETNAM SOLID OXIDE FUEL CELLS MARKET OUTLOOK

11.1. Market Size & Forecast

11.1.1. By Value

11.2. Market Share & Forecast

11.2.1. By Type

11.2.2. By Application

11.2.3. By End User

12. INDONESIA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

12.1. Market Size & Forecast

12.1.1. By Value

12.2. Market Share & Forecast

12.2.1. By Type

12.2.2. By Application

12.2.3. By End User

13. MALAYSIA SOLID OXIDE FUEL CELLS MARKET OUTLOOK

13.1. Market Size & Forecast

13.1.1. By Value

13.2. Market Share & Forecast

13.2.1. By Type

13.2.2. By Application

13.2.3. By End User

14. SINGAPORE SOLID OXIDE FUEL CELLS MARKET OUTLOOK

14.1. Market Size & Forecast

14.1.1. By Value

14.2. Market Share & Forecast

14.2.1. By Type

14.2.2. By Application

14.2.3. By End User

15. PHILIPPINES SOLID OXIDE FUEL CELLS MARKET OUTLOOK

15.1. Market Size & Forecast

15.1.1. By Value

15.2. Market Share & Forecast

15.2.1. By Type

15.2.2. By Application

15.2.3. By End User

16. MARKET DYNAMICS

16.1. Drivers

16.2. Challenge

17. MARKET TRENDS & DEVELOPMENTS

18. COMPANY PROFILES

18.1. Bloom Energy Corporation

18.1.1. Business Overview

18.1.2. Key Revenue and Financials

18.1.3. Recent Developments

18.1.4. Key Personnel

18.1.5. Key Product/Services

18.2. FuelCell Energy

18.2.1. Business Overview

18.2.2. Key Revenue and Financials

18.2.3. Recent Developments

18.2.4. Key Personnel

18.2.5. Key Product/Services

18.3. Toshiba Energy Systems & Solutions Corporation

- 18.3.1. Business Overview
- 18.3.2. Key Revenue and Financials
- 18.3.3. Recent Developments
- 18.3.4. Key Personnel
- 18.3.5. Key Product/Services

18.4. Mitsubishi Power

- 18.4.1. Business Overview
- 18.4.2. Key Revenue and Financials
- 18.4.3. Recent Developments
- 18.4.4. Key Personnel
- 18.4.5. Key Product/Services

18.5. Kyocera Corporation

- 18.5.1. Business Overview
- 18.5.2. Key Revenue and Financials
- 18.5.3. Recent Developments
- 18.5.4. Key Personnel
- 18.5.5. Key Product/Services

18.6. JX Nippon Oil & Energy Corporation

- 18.6.1. Business Overview
- 18.6.2. Key Revenue and Financials
- 18.6.3. Recent Developments
- 18.6.4. Key Personnel
- 18.6.5. Key Product/Services

18.7. Doosan Fuel Cell

- 18.7.1. Business Overview
- 18.7.2. Key Revenue and Financials
- 18.7.3. Recent Developments
- 18.7.4. Key Personnel
- 18.7.5. Key Product/Services

18.8. Panasonic Corporation

- 18.8.1. Business Overview
- 18.8.2. Key Revenue and Financials
- 18.8.3. Recent Developments
- 18.8.4. Key Personnel
- 18.8.5. Key Product/Services

18.9. Neatec Solutions

- 18.9.1. Business Overview
- 18.9.2. Key Revenue and Financials

18.9.3. Recent Developments

18.9.4. Key Personnel

18.9.5. Key Product/Services

18.10. Hexis AG

18.10.1. Business Overview

18.10.2. Key Revenue and Financials

18.10.3. Recent Developments

18.10.4. Key Personnel

18.10.5. Key Product/Services

19. STRATEGIC RECOMMENDATIONS

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