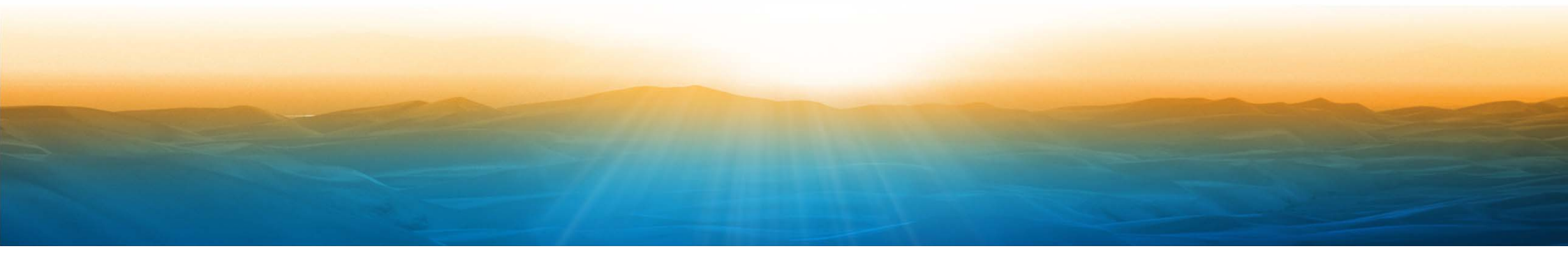


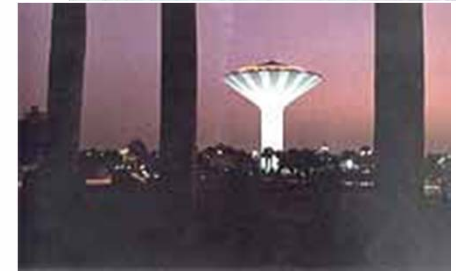
بسم الله الرحمن الرحيم

مدينة الملك عبد الله للطاقة
الذرية والمتجددة K.A.CARE



Saudi Arabia's Renewable Energy Strategy and Solar Energy Deployment Roadmap





Kingdom of Saudi Arabia

- Oil wealth has made possible rapid economic development, which began in the 1960's and accelerated in the 1970's.
- Saudi oil & gas reserves are the largest in the world, and Saudi Arabia is the world's leading oil producer and exporter.
- The population of Saudi Arabia is approximately 26,534,504
 - 0-14 years: 28.8%
 - 15-64 years: 68.2%
 - 65 years and over: 3%



King Abdullah City for Atomic and Renewable Energy





Established by Royal Order April 17,
2010, the Mission is to be:

“ ...The driving force for making atomic and renewable energy an integral part of a national sustainable energy mix, creating and leveraging the competitive advantages of relevant technologies for the social and economic development of the Kingdom of Saudi Arabia... ”





Mandate



Key K.A.CARE Objectives

- **CREATE** a sustainable economic sector for Saudi Arabia anchored by local alternative energy demand market
- **CONTRIBUTE** to job creation, GDP growth, environmental footprint reduction and sustainable development
- **MAINTAIN** highest levels of safety, security and transparency



Execution of K.A.CARE Mandate

- **SUGGEST** alternative energy mix →
- **DEVELOP & LEAD** execution plans →
- **PLAN** for and **BUILD** physical city →

Sustainable and efficient energy future for KSA



Maximizing Return

Oil
Saved

Economic
Sector

Sustainability

How Much **Can** We Do ?

- Demand Growth
- Demand Pattern
- Technology Characteristics

How Much **Should** We Do ?

- Economics
- Sustainability
- Technology maturity



Building the Optimum New Energy Mix

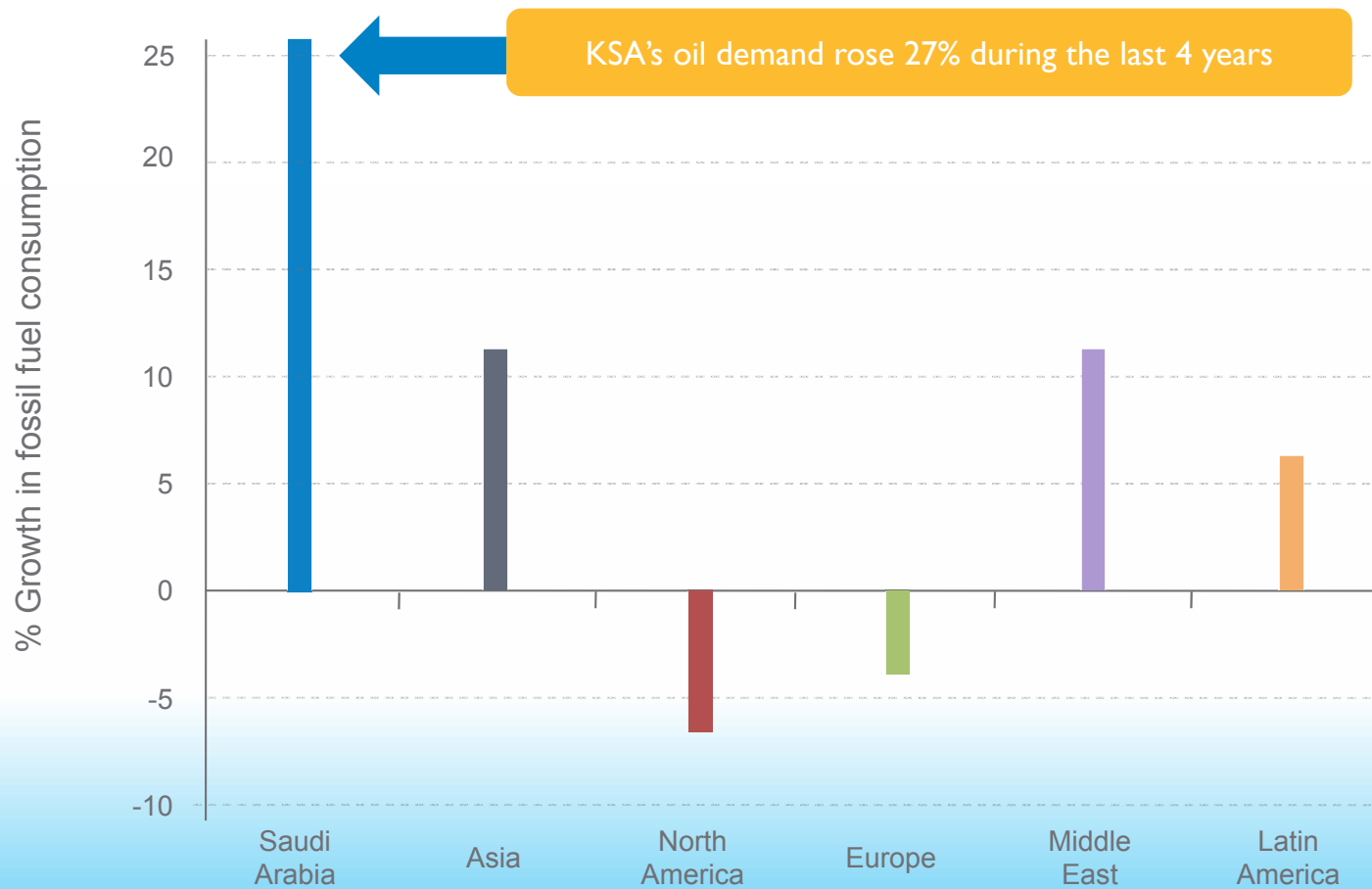


Energy growth drivers

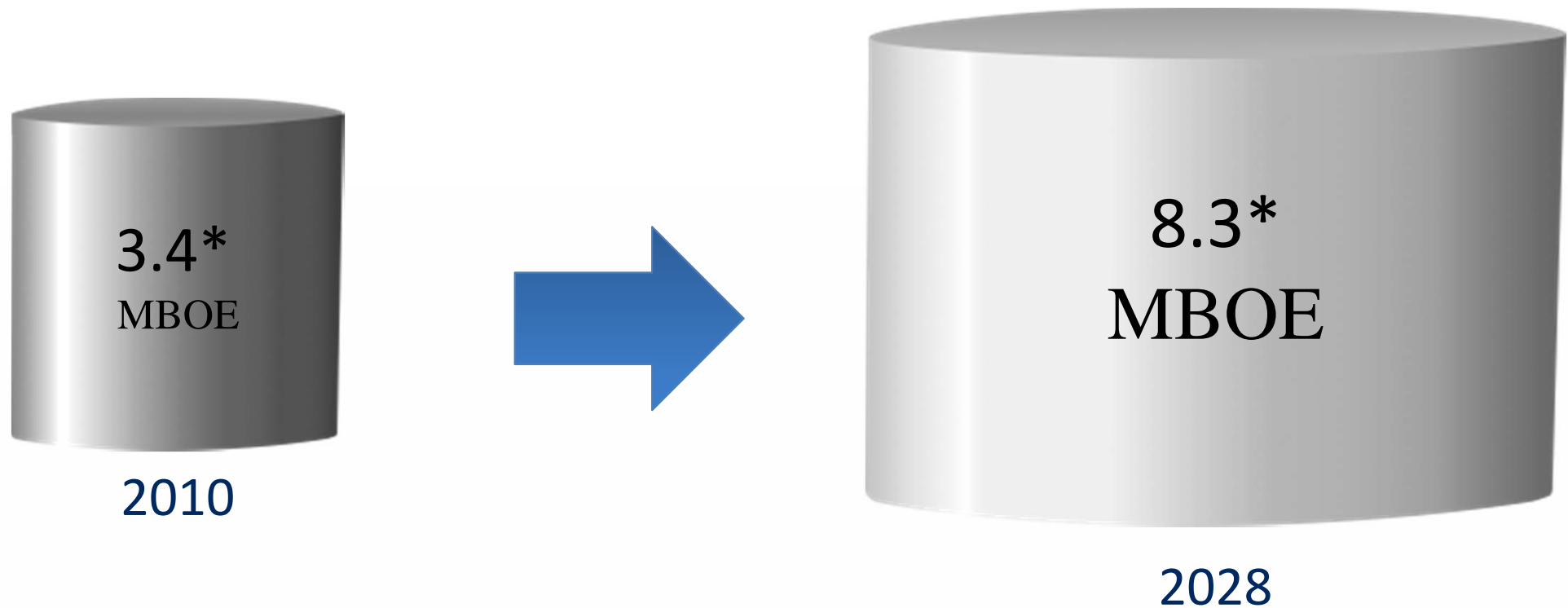
- **POPULATION** growth at an annual rate of 3.2% (2004 – 2010)
- Robust **ECONOMIC** growth (4.3% 2008, 0.1% 2009, 3.8% 2010, 6.8% 2011)
- **INDUSTRIAL** production growth* of 6.6% (2008, 2.9% 2009, 5.3% 2010)



Growth in Fossil Fuel Consumption Already High



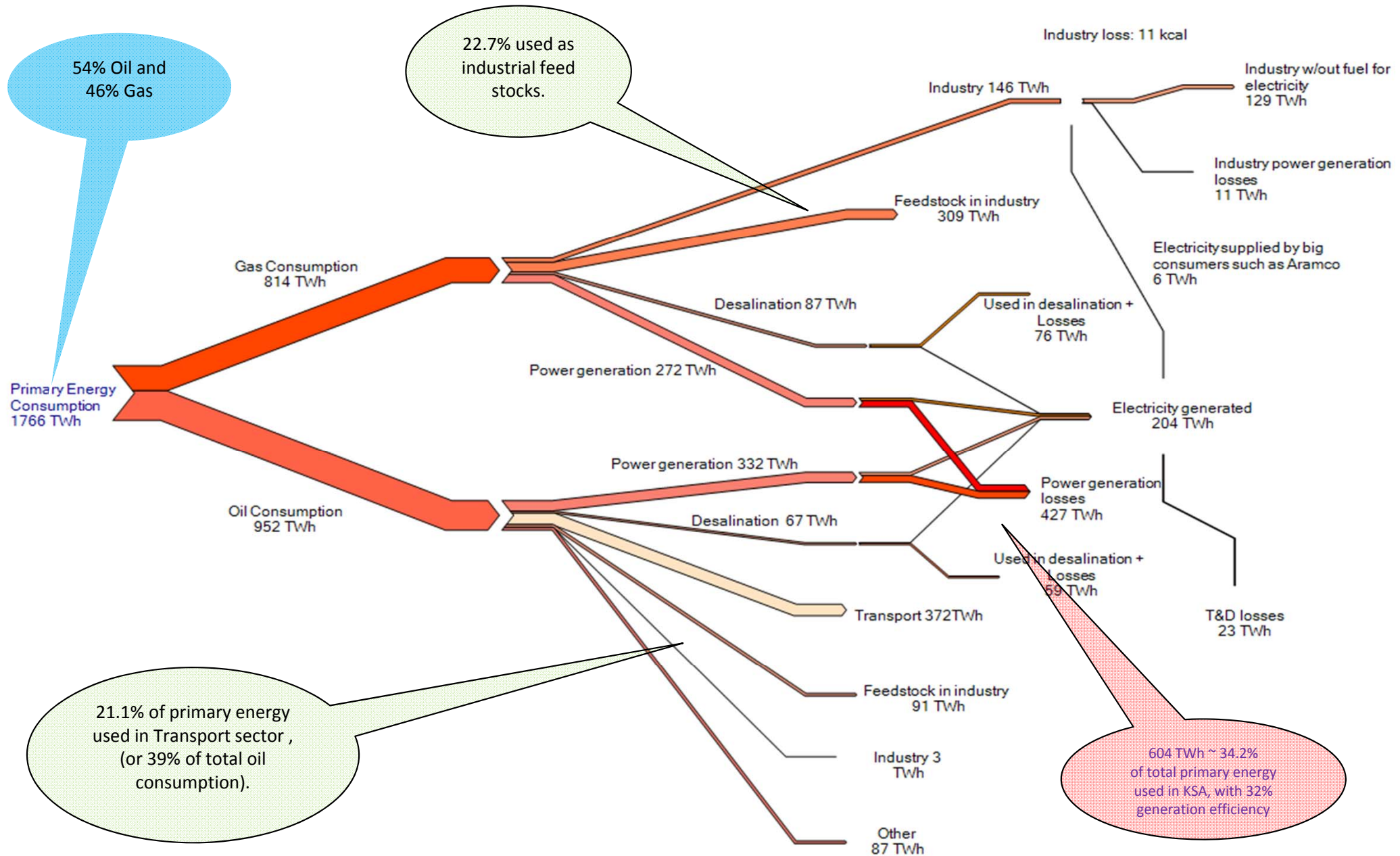
Forecast of energy demand growth



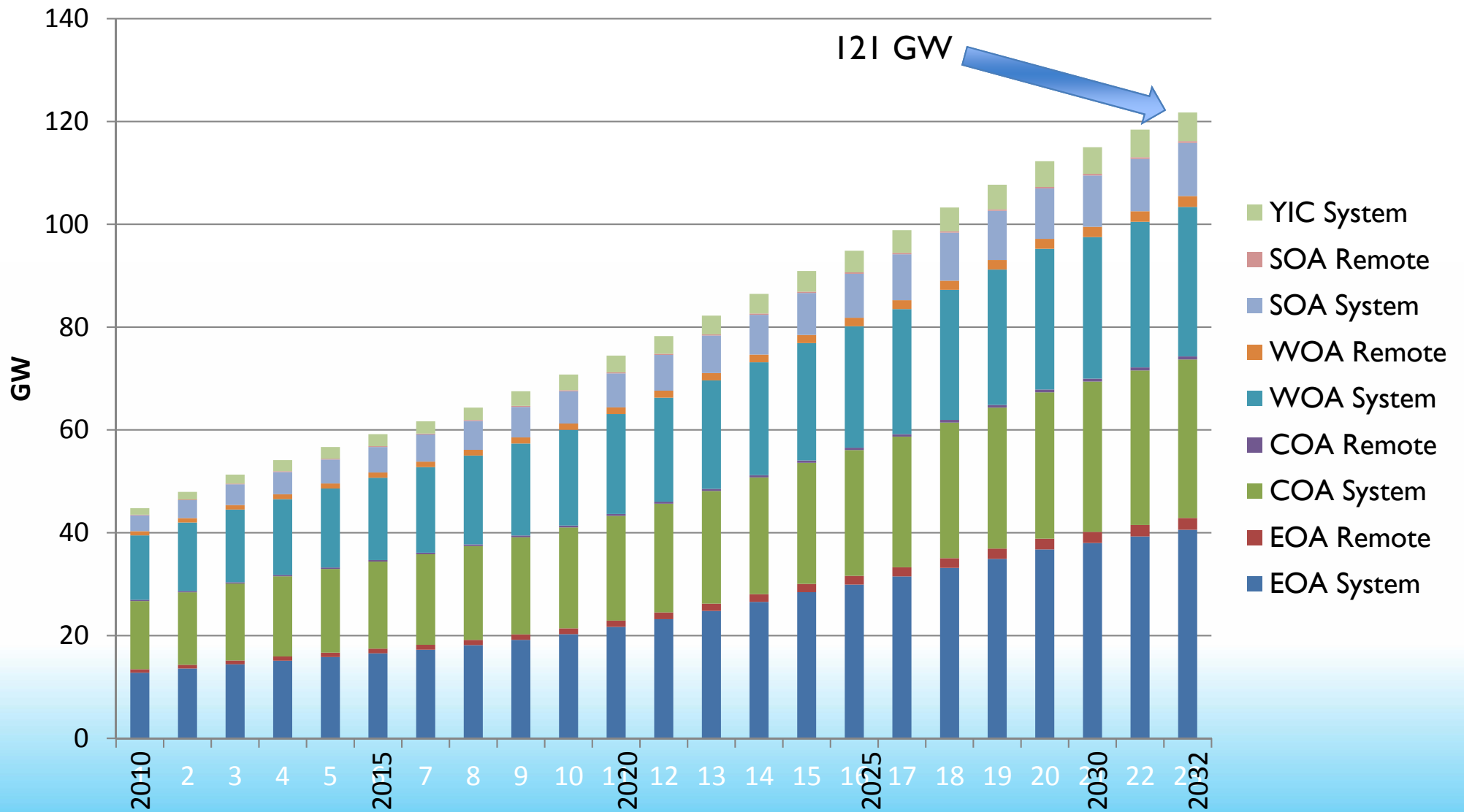
At current pace, domestic consumption of fossil fuels is expected to nearly triple by 2030



Energy flow in the Kingdom of Saudi Arabia

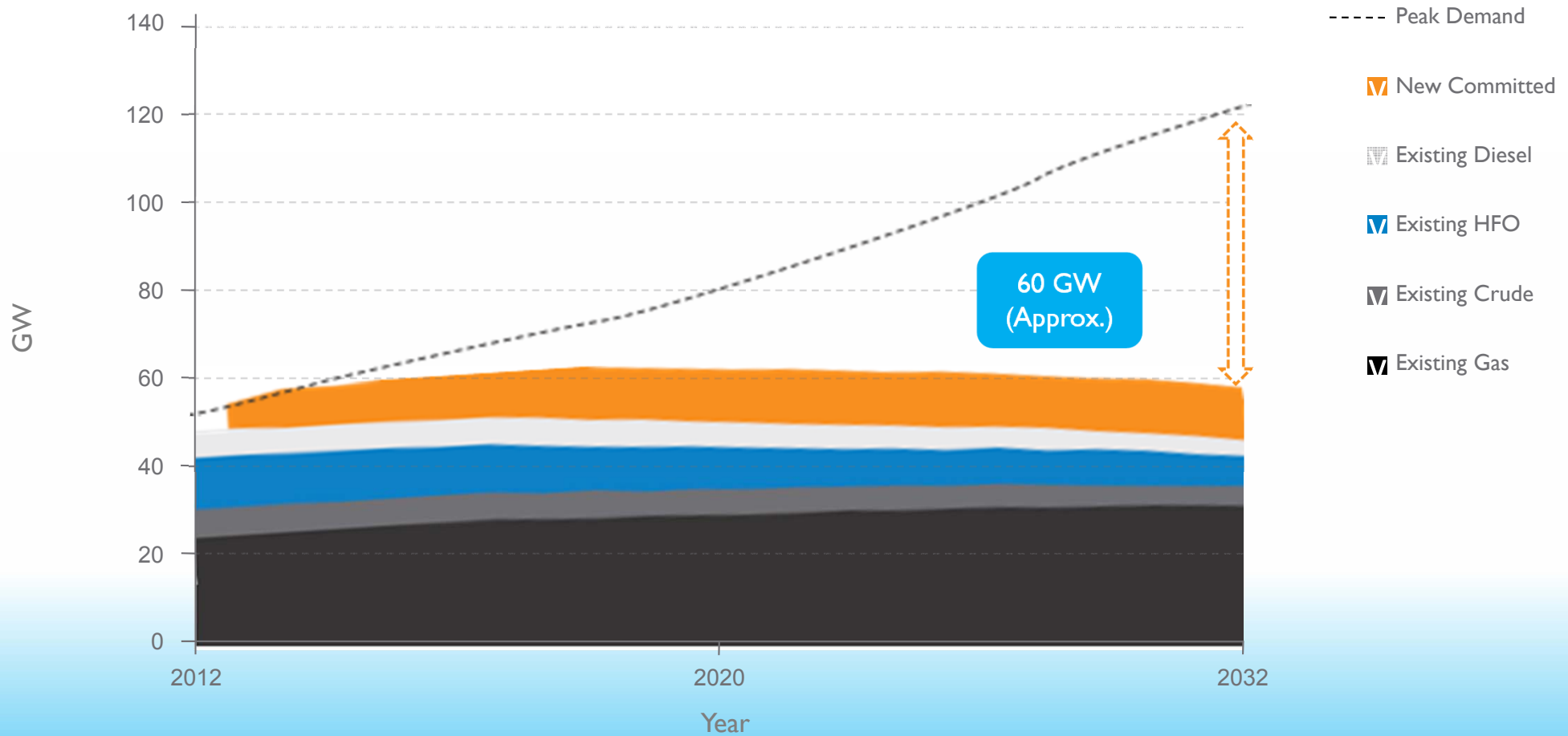


Peak Power Demand Will Nearly Triple in Next 20 Years...



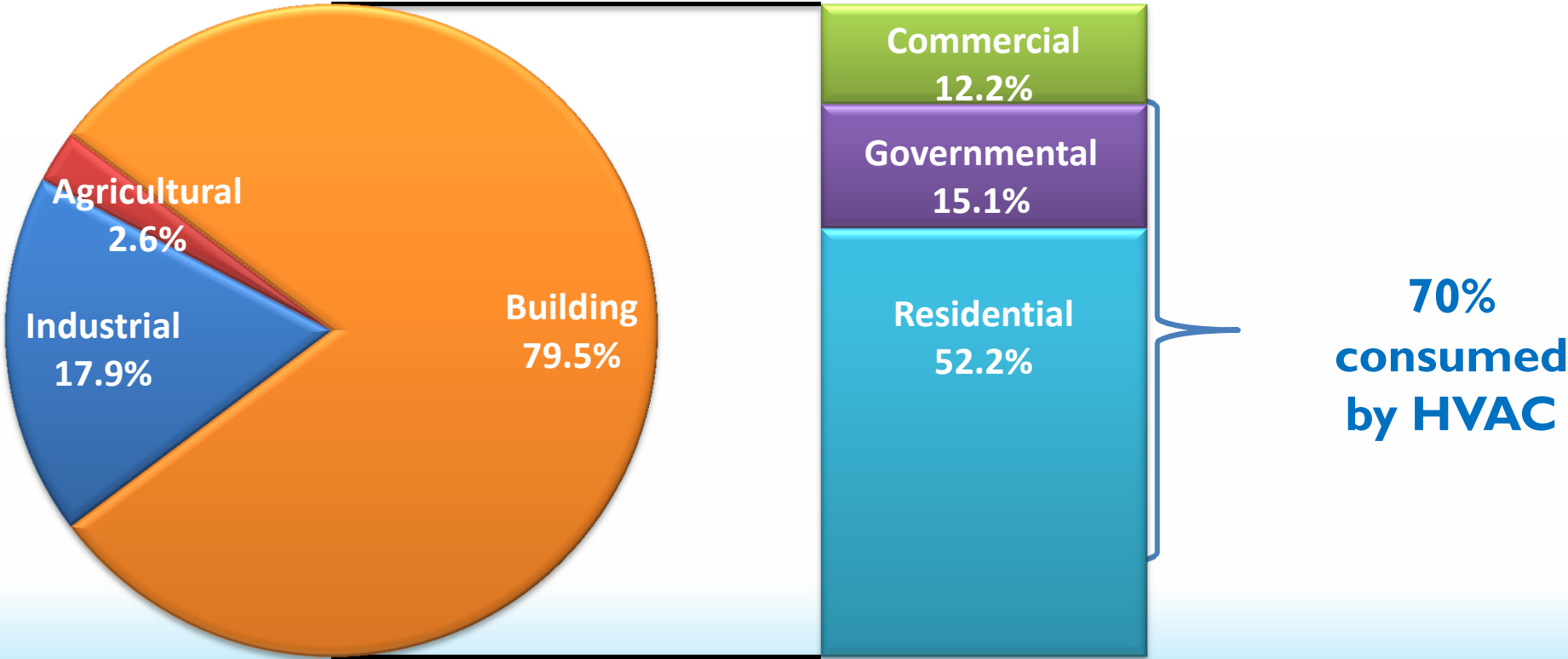
...Creating Tremendous Capacity Gap

Gap between peak demand and existing + planned capacity

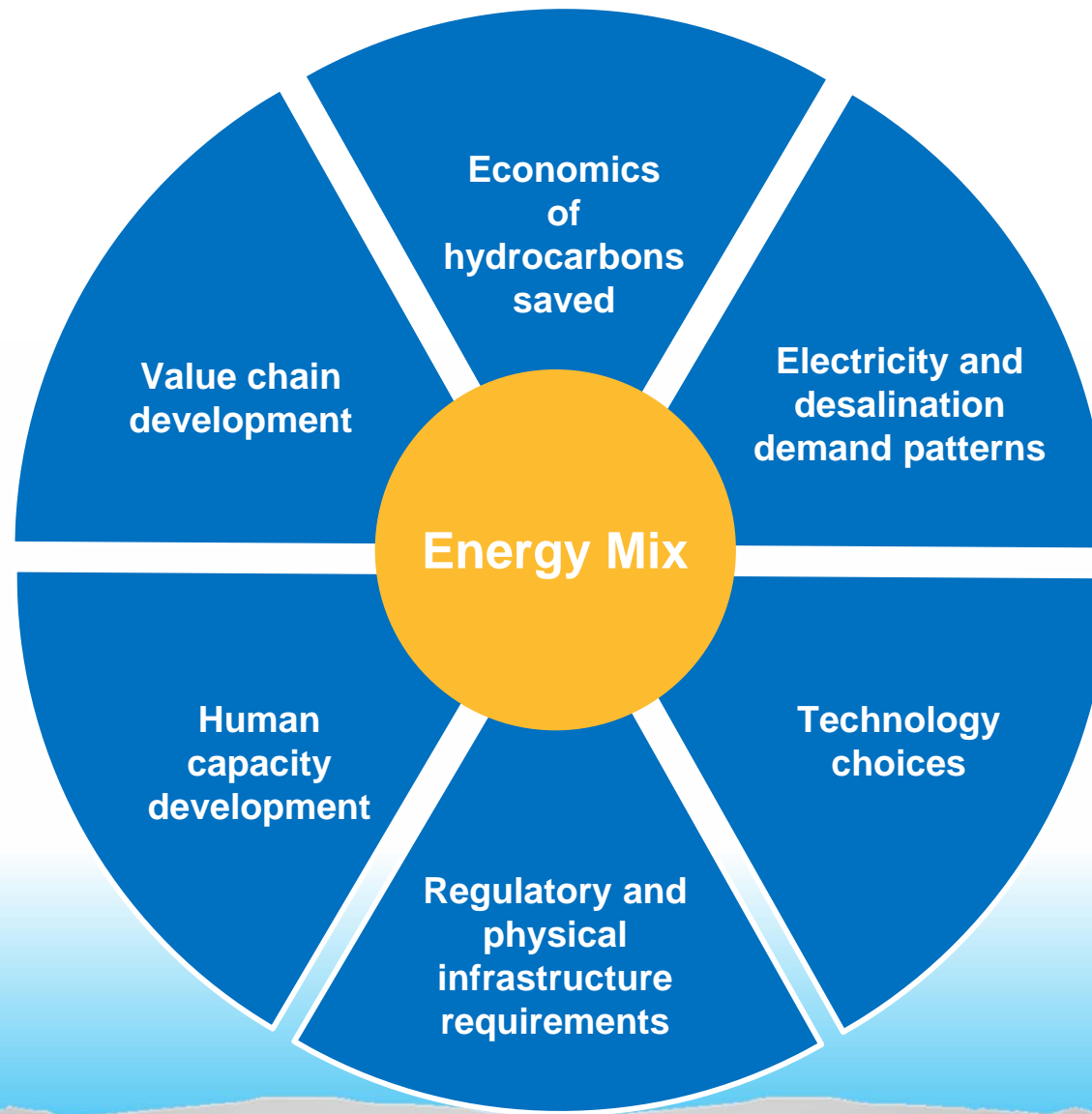


Energy Consumption Patterns

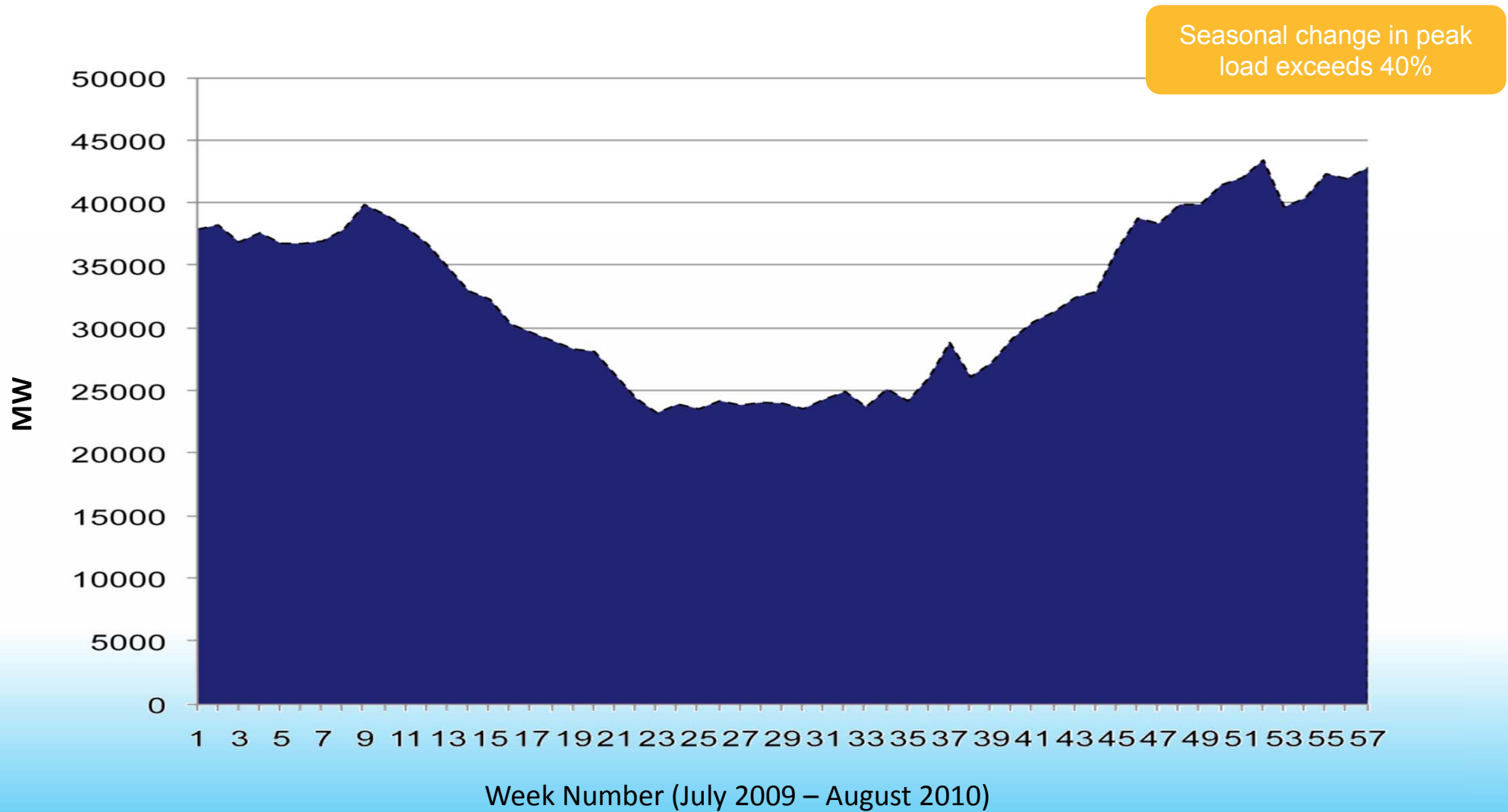
Total of 193,472 GWH



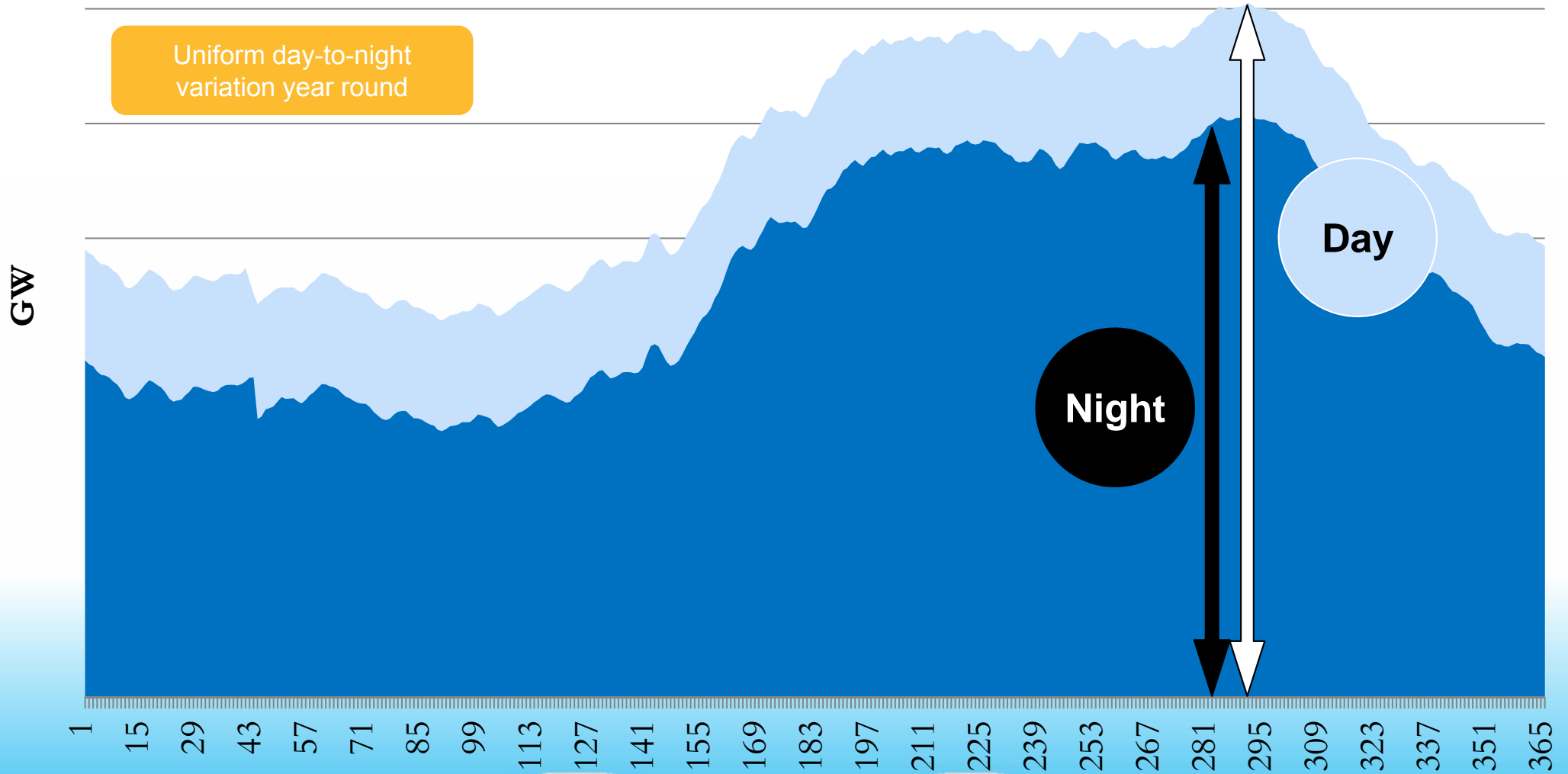
Parameters Affecting Energy Mix Development



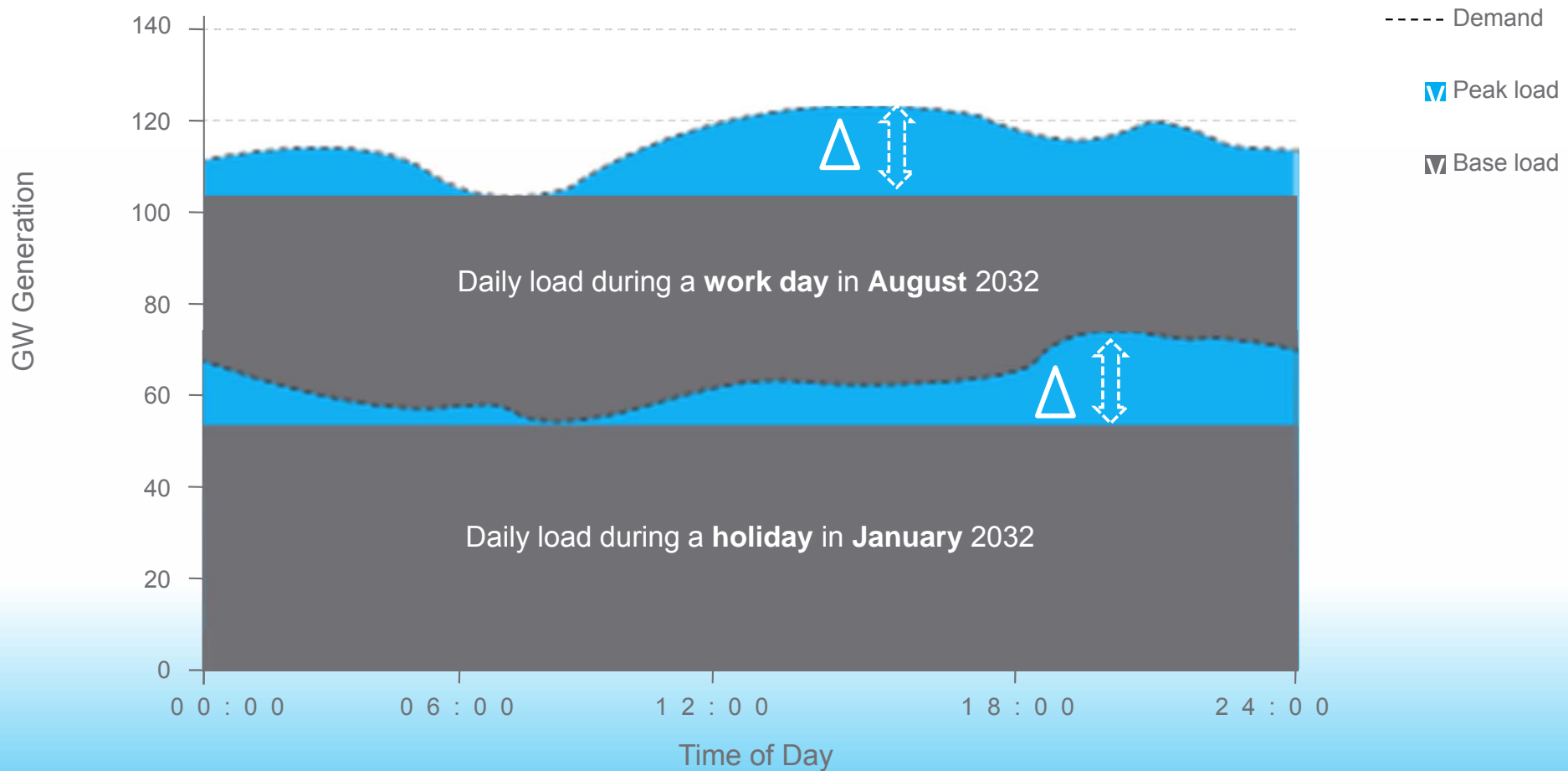
Annual Electricity Demand Pattern in KSA



Day-Night Load Variation for Saudi Arabia



Forecasted Daily Electricity Demand Pattern 2032



Energy Development Targets



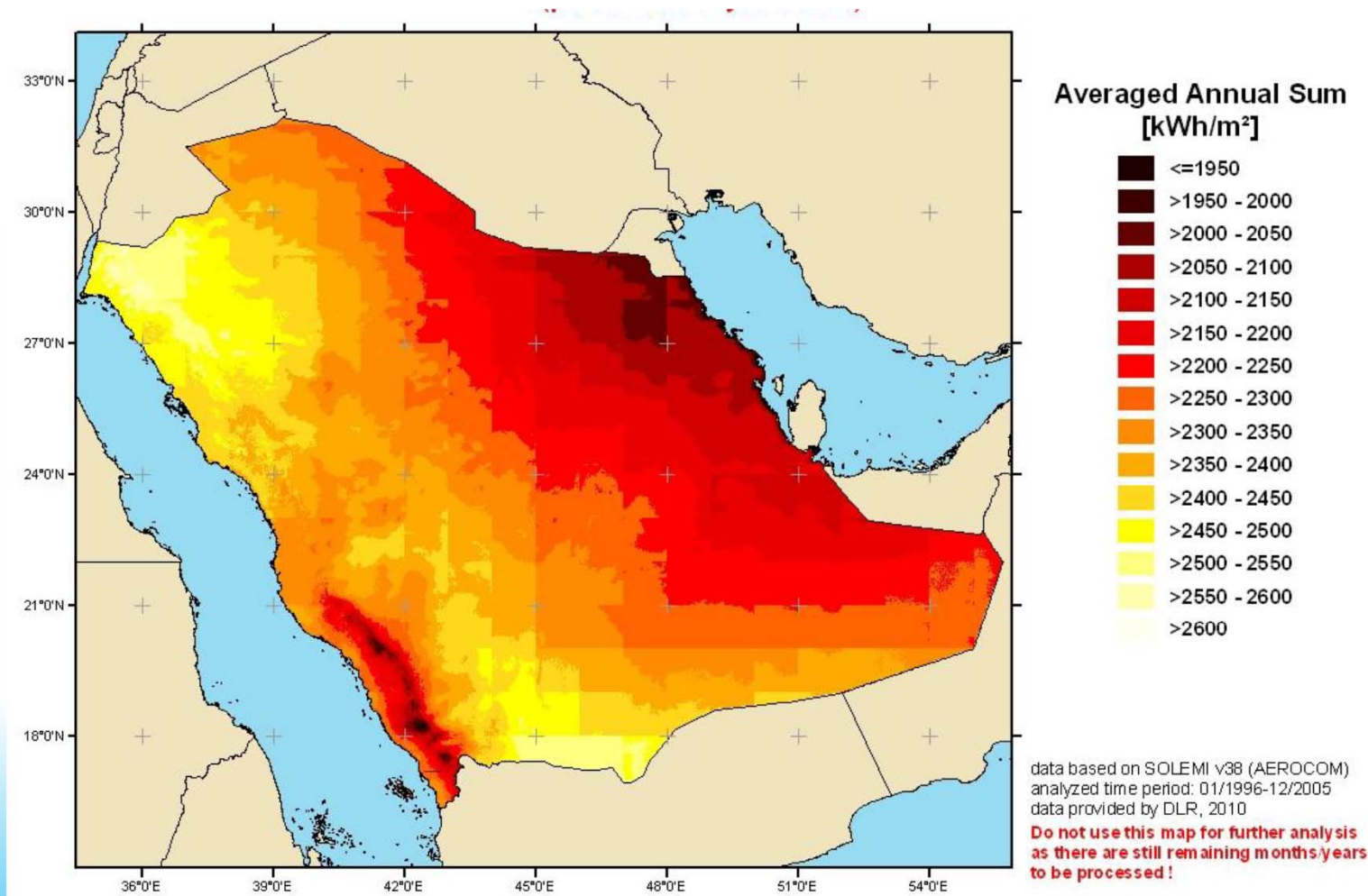
Target Renewable Capacity by 2032

Maximizing Renewable Deployment Return

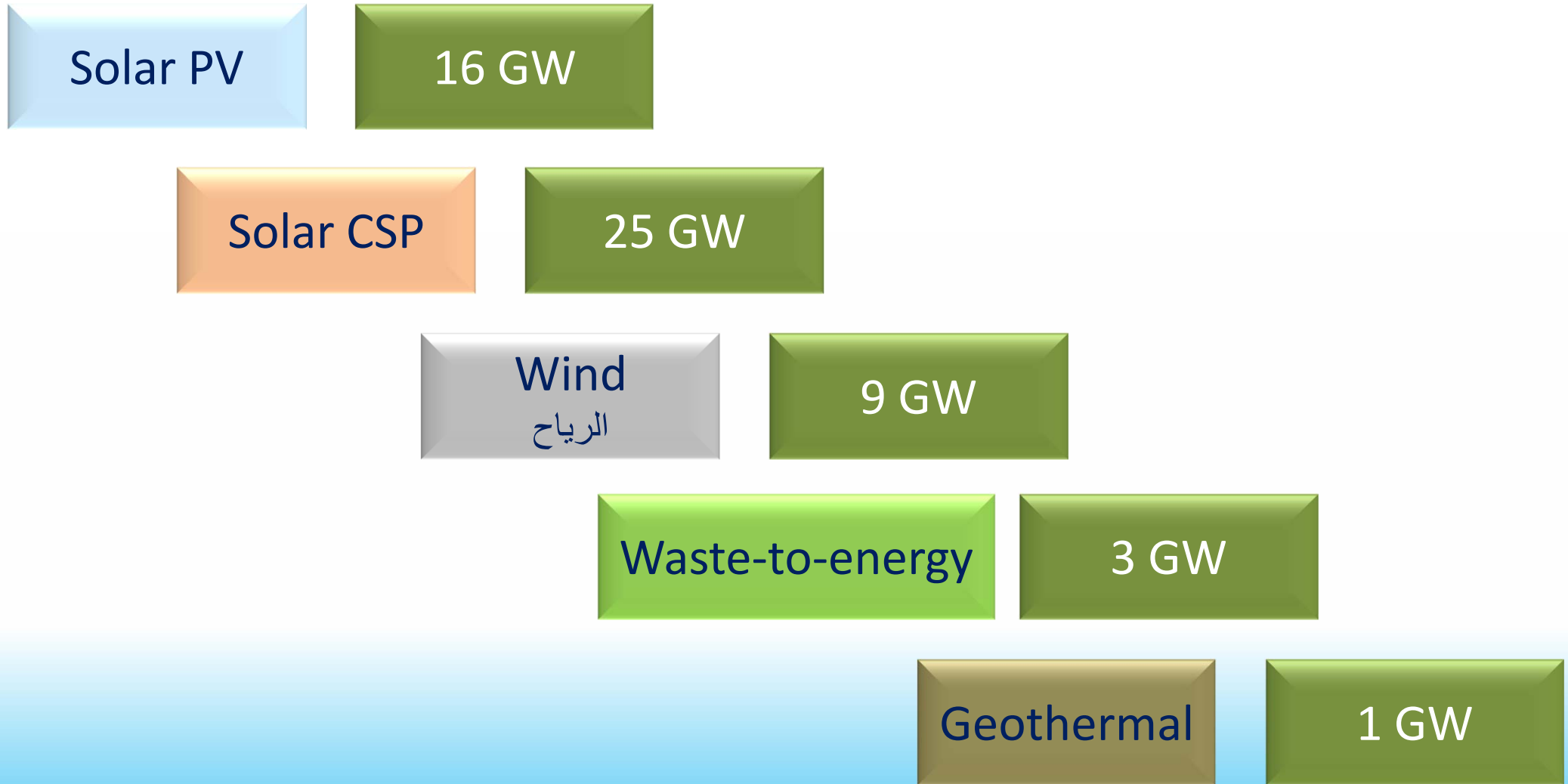
54 GW



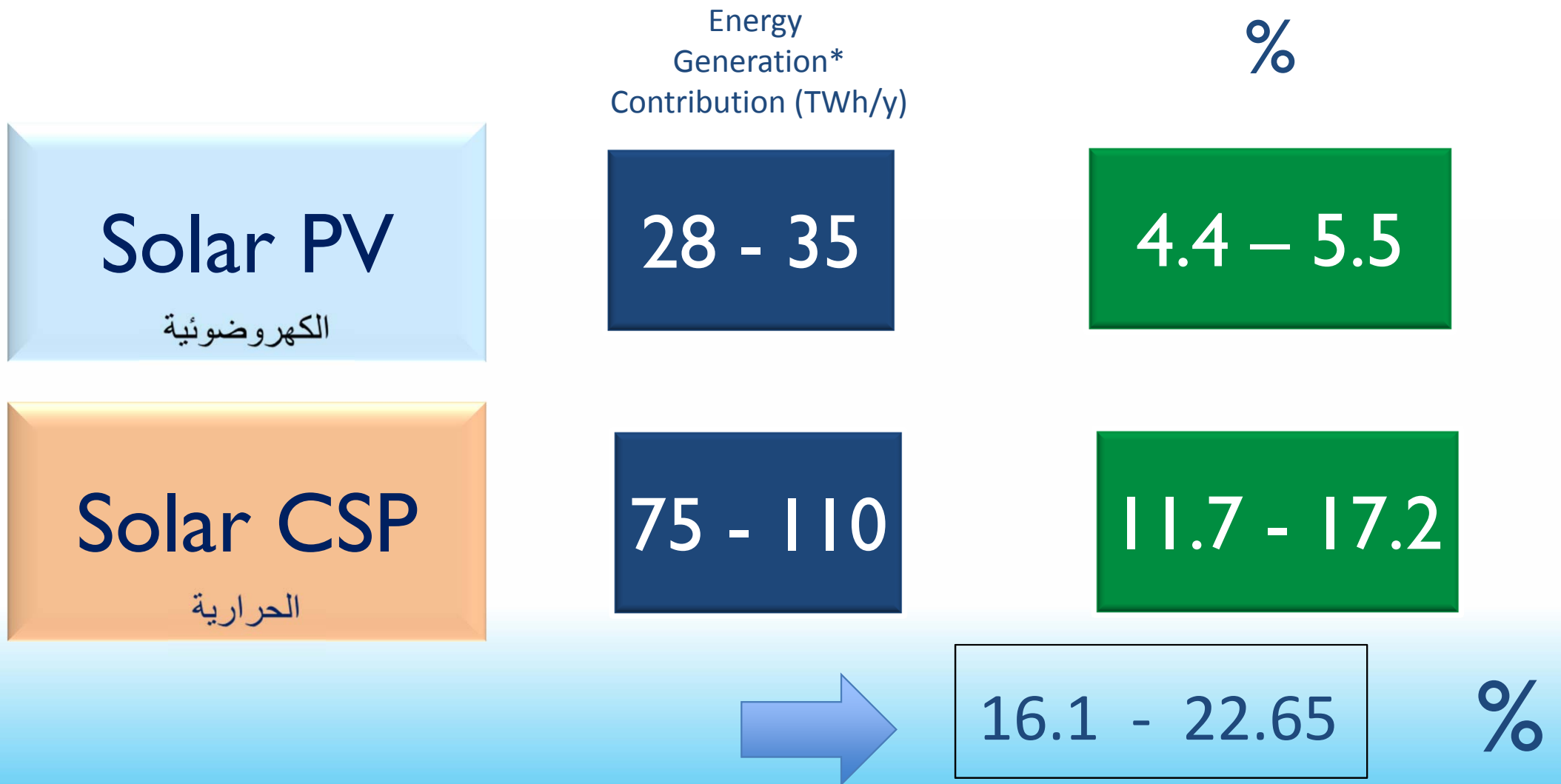
Solar Resources in KSA



Target Renewable Capacity by 2032



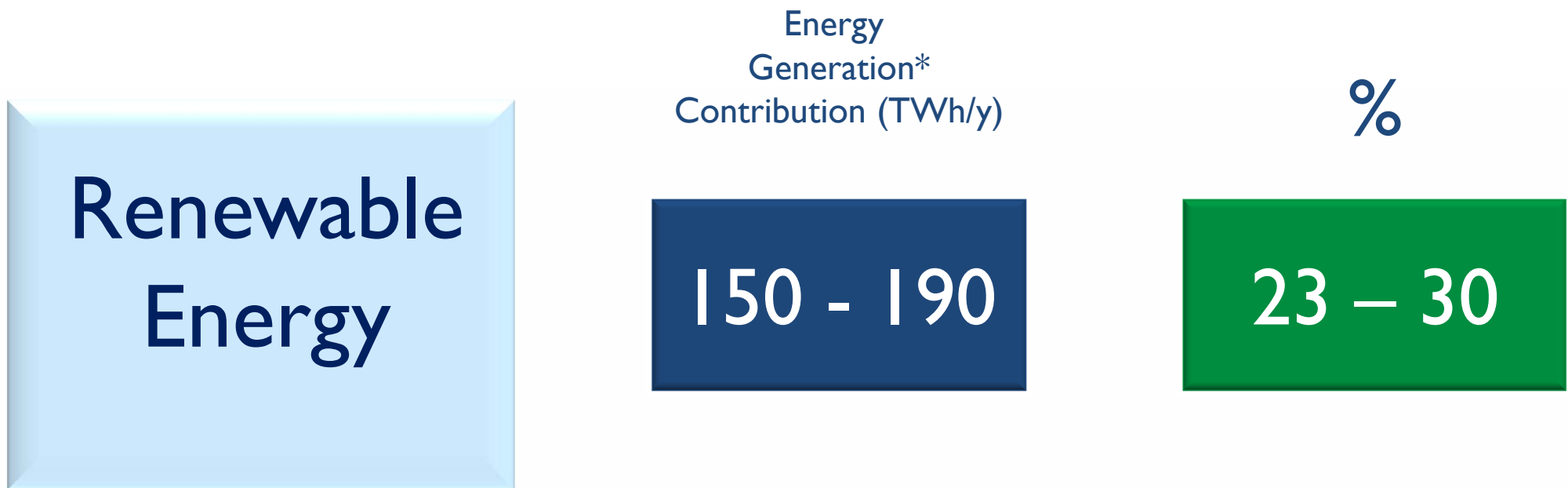
Target Solar Capacity by 2032



* Load factor: PV = 0.2 - 0.25, CSP = 0.34 - 0.5



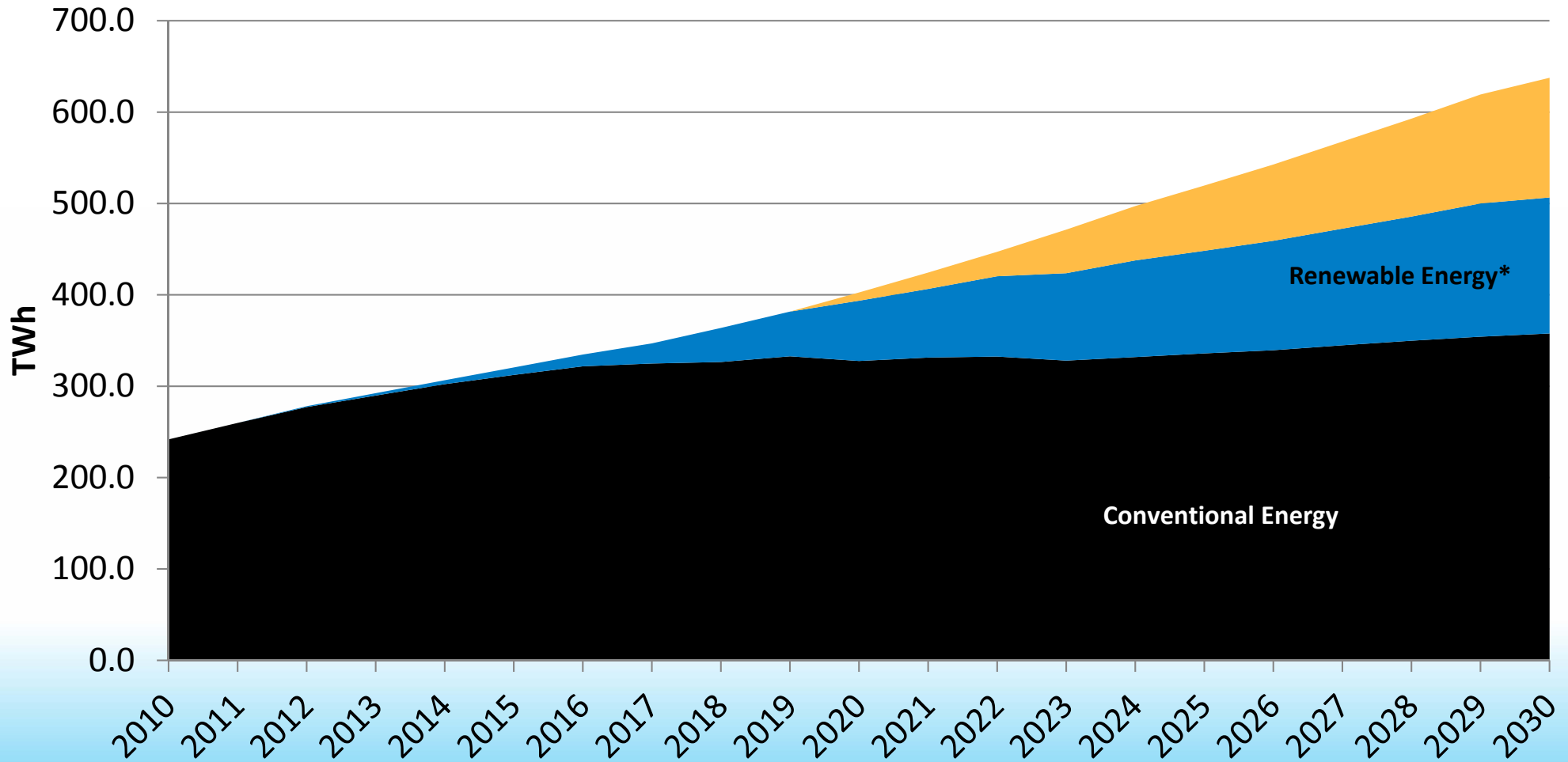
Target Renewable Energy Contribution by 2032



* Load factor: PV = 0.2 – 0.25, CSP = 0.34 – 0.5, Wind = 0.2, Geothermal = 0.9, Waste-to-energy = 0.85



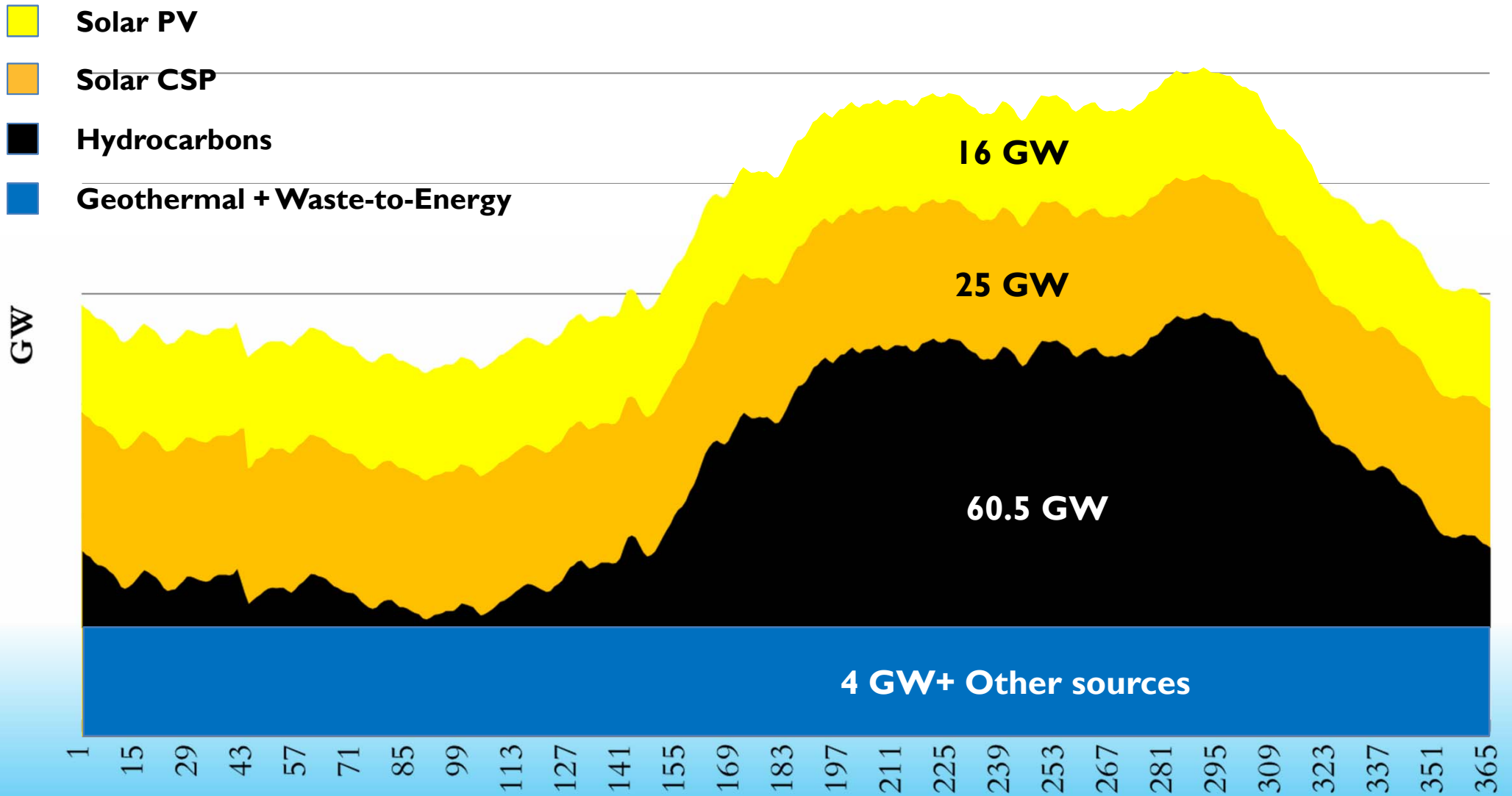
Gradual Deployment of Alternative Energy



* Load factor: PV = 0.2 , CSP = 0.34, Wind = 0.2, Geothermal = 0.9, Waste-to-energy = 0.85

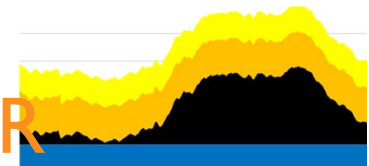


Proposed Energy Mix 2032



Load-Specific Technology Component of the Proposed Energy Mix by 2032

- **PV** will meet total day time demand year round
- **GEOHERMAL + WASTE-TO-ENERGY + OTHER SOURCES** will meet base-load demand up to night time demand during winter
- **CSP** with storage will meet maximum demand difference between **PV** and base-load technologies
- **HYDROCARBONS** will meet the rest of the demand
- **WIND** will be dedicated for desalination

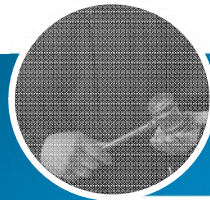


Overview of the execution plans



Policy

- Approval and publishing of a national policy on nuclear and renewable energy



Laws and regulations

- Development of laws and regulation
- Creation of regulator bodies
- Ratification of treaties
- Revising existing laws



Investment vehicles and strategy

- Creation of Alternative Energy Technology Company
- Setup of loan guarantees and soft loan programs



Operating model

- Creation of holding company for nuclear power
- Formation of standalone off-taker for sector



R&D and human capital development

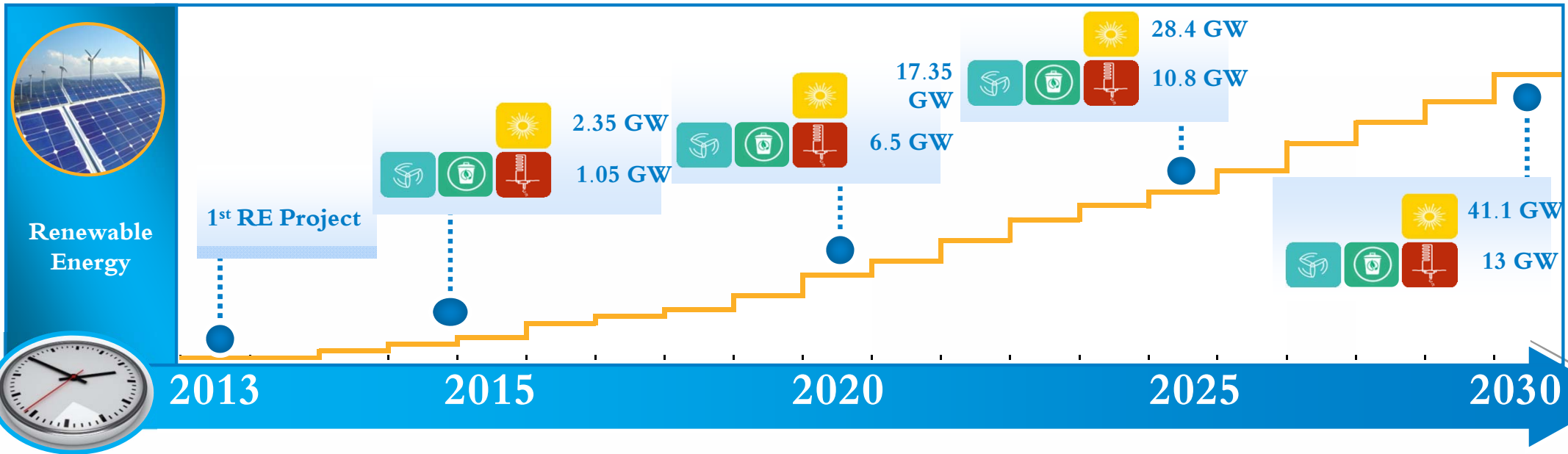
- Development of R&D capabilities
- Development of engineers, technicians and other specialists



Deployment Roadmap



Renewable Energy Deployment Roadmap



Renewable Energy Value Chain Development



Value Chain Development

Building a World-Class Alternative Energy Sector:



Industrial investment

Research, development and innovation

Technology development

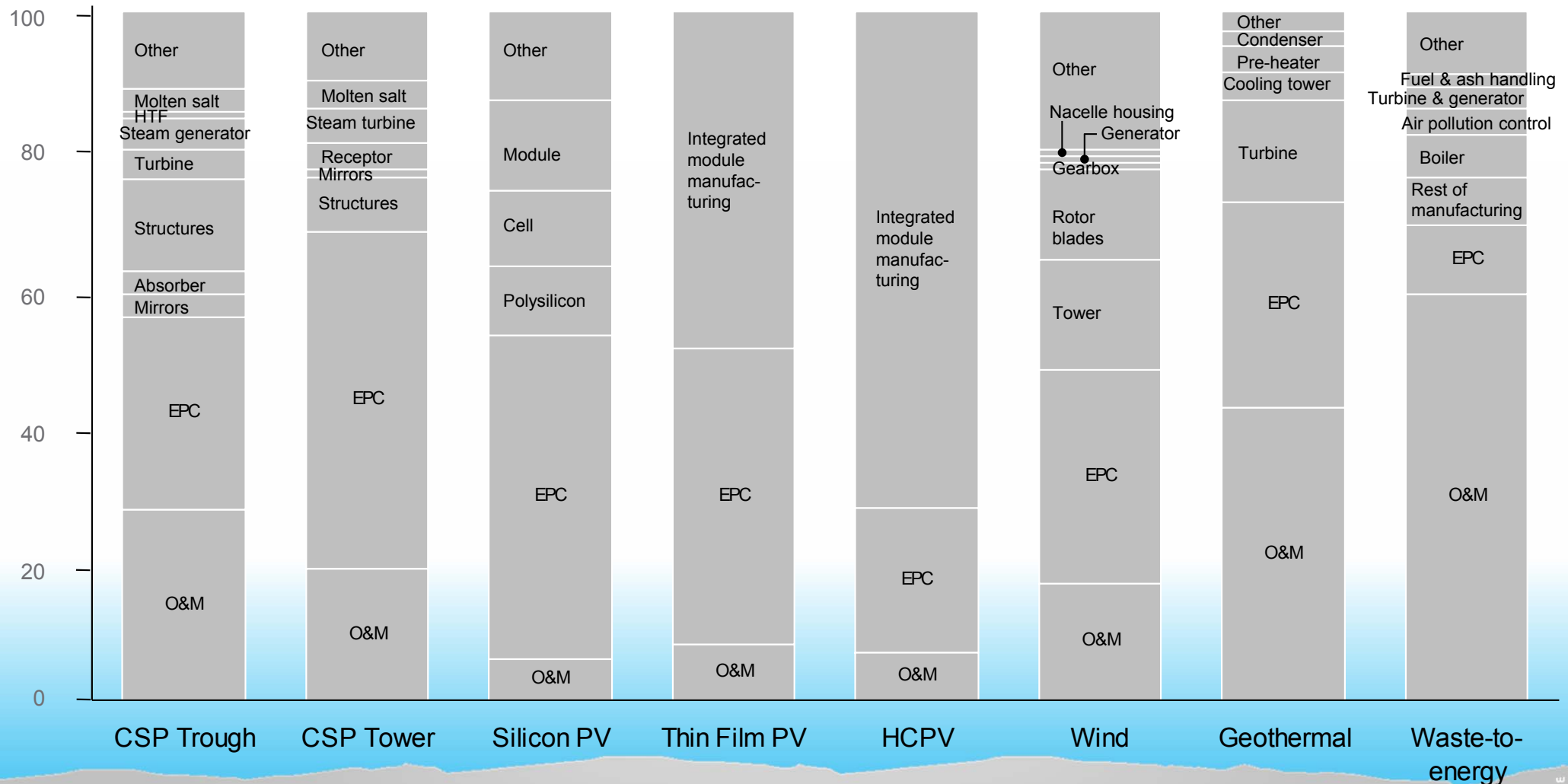
Education and training

Human capacity development



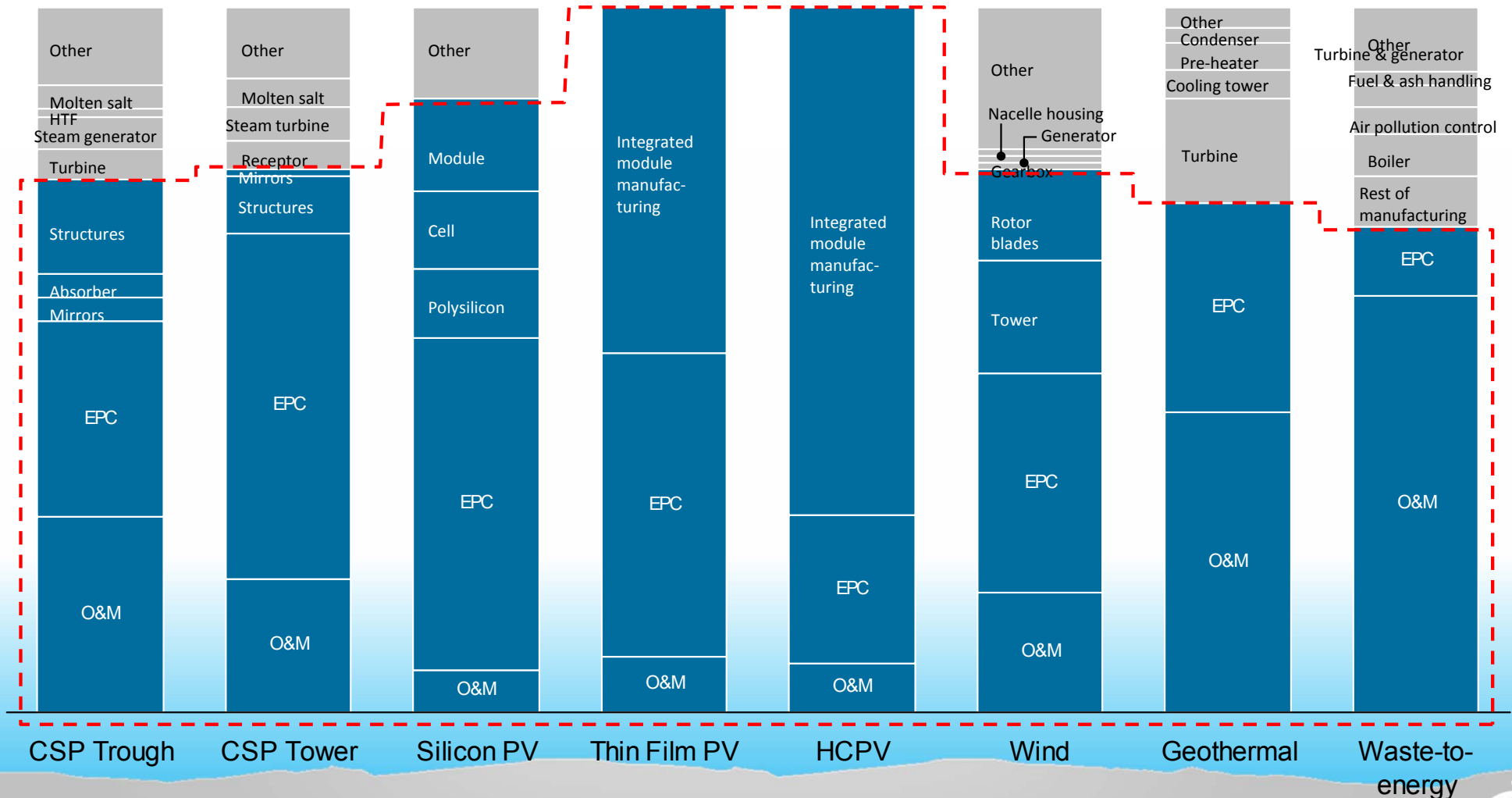
Renewables Manufacturing, EPC and O&M split

% total capex and opex throughout the plant lifetime



Recommended Key Activities for Core Localization in Renewable Energy Total Spend

% total capex and opex throughout the plant lifetime



Value Chain Development: Beyond Solar Cell, Blade and Mirror



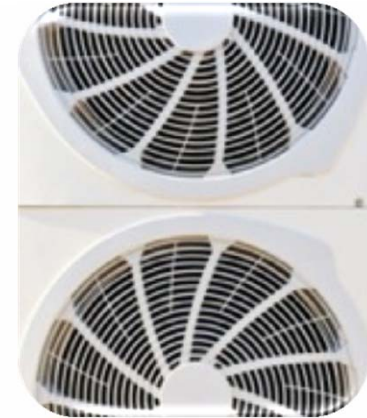
**Electricity
Generation**



**Industrial
Energy
Applications**



**Seawater
Desalination
& Water
Management
Applications**



**District &
Solar
Cooling**



Localization of Renewable Energy Industry

Maximizing benefits of alternative energy requires localization policies ...



...which depends highly on local skills...

...and cooperation and JV's



Value Chain Activation Plan

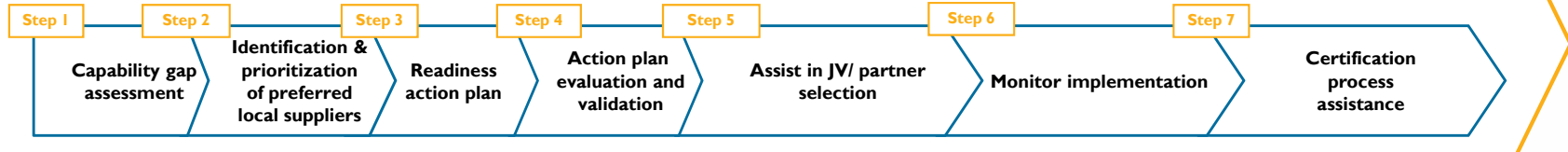
Value chain activation

Value chain enablers

- 1 Value chain organization capacity building
- 2 Independent quality assurance authority
- 3 Industrial readiness program (cost, quality, delivery)
- 4 SME development program
- 5 FDI attractiveness and promotion
- 6 Stakeholder engagement and communication
- 7 Global vendor engagement & qualification
- 8 Alignment with current and planned national initiatives



9 Value Chain Opportunities



- 10 Regulatory environment
- 11 Development of R&D centers and programs
- 12 Development of local human capabilities
- 13 Leveraged procurement
- 14 Feed-in tariff / PPA
- 15 Bid preparation
- 16 Program and project structure

Value chain interfaces



Socioeconomic, Environmental and Indirect Economic Impact



Potential Socioeconomic and Other Tangible Returns

Additional Returns from Alternative Energy Economic Sector Development	KPIs
Direct employment opportunities in alternative energy generation	137,000 jobs
GDP contribution from Alternative Energy employment opportunities for Saudis	USD 51 billion
Contribution to economy from export of Alternative Energy products and services	USD 40-60 billion
Reduction in CO₂ emissions from power plants	60%
Reduction in NOx emissions from power plants	75%
Reduction in SO₂ emissions from power plants	70%
Potential cross-border and intercontinental energy export (renewables)* during off-peak season	10-30 GW



Other Enablers



Sustainable Renewable Energy Sector:

- **Legal and Regulatory Framework:**

- **Locally:** sends a clear signal to the population, the private sector and all governmental entities that the Kingdom is dedicated to significantly expanding its renewable energy program.
- **Internationally:** sends a clear message to other nations that Saudi Arabia is serious in utilizing renewable sources of energy and in doing its part to protect the environment as a responsible global citizen.
- **Investors:** a single legislation that regulates the renewable sector will give investors confidence in the manner by which the Kingdom intends to regulate its renewable sector thereby encouraging investment i.e. legislation will provide stability to the sector and thus investor confidence.

- **Licensing and permitting :**

- Identifying the roles and responsibilities of other governmental agencies such as ECRA, PME, MOMRA etc..



Sustainable Renewable Energy Sector:

- **Research, Development and Innovation:**

- The ultimate goal of K.A.CARE is defined by the mandate stated in the Royal decree on Apr. 17, 2010 to contribute to sustainable development in the Kingdom by using science, research and industries related to renewable.
- This project is intended to help drive towards this goal by developing the structure and framework of research capability through a network of National Labs and User facilities.
- Mission driven research.
- Cooperative research & development programs.



Sustainable Renewable Energy Sector:

- **Renewable resource monitoring and mapping program in the Kingdom of Saudi Arabia:**
 - The RRMM Program will collect and deliver accurate and high quality (spatial & ground)data for solar, wind, geothermal, and waste-to-energy resources to support research, industrial applications, and deployment projects.
 - The RRMM Program will support both the planned rapid deployment of renewable energy projects and the research programs to develop renewable technologies.
- **Energy Entrepreneurship Initiative:**
 - To foster the inherent capabilities and competitiveness of the Kingdom of Saudi Arabia's SME and entrepreneurial ecosystem, to capture the business opportunities, facilitate innovation and promote local content leveraged through the national renewable energy program.



Sustainable Renewable Energy Sector:

- **Grid impact:**
 - The success of K.A.CARE in delivery of reliable and stable sustainable energy at targeted levels is critically dependent on major new developments in grid capacity, capability and operations.
- **Exporting electricity:**
 - The objectives of the study were to analyse the economic viability of electricity exports from the Kingdom to the EU and to explore the practical arrangements needed to achieve the economic benefit. Furthermore, the study was to investigate alternate markets other than the EU to export to. In summary, the aim of the study was to answer three fundamental strategic questions:
 - Is electricity trading with the EU economically viable for the Kingdom?
 - If so, is electricity trading with the EU practically achievable?
 - Which other potential markets should be investigated?



Sustainable Renewable Energy Sector:

- **Micro Generation :**

- Remote locations that are not grid-connected, such as border posts, highway family rest areas and remotely located mosques, small size villages represent an excellent potential for micro generation, with hybrid designs including solar energy and desalination, solar energy and cooling, etc, The daily needs of the electricity are fulfilled, normally, via diesel generators, where the fuel is transferred periodically to these bases.

- **K.A.CARE Renewable Energy Competitive Procurement:**

- Maximize the economic benefit from its resources, including its hydrocarbon sector. Falling costs of renewable energy make clean power a viable option where it is used to displace the burning of oil; as long as that oil is valued at the international selling price.
- As part of this diversification, the tender program is intended to establish benchmark prices across each of the sectors in a local context and to provide jobs and skills for Saudis.



K.A.CARE City



K.A.CARE City

The K.A.CARE city will include the following

- National Sustainable Energy Laboratory
- Industrial clusters
- Alternative energy farm
- Energy park
- Technical training institutions
- Technical incubators
- Commercial facilities
- Convention centers, exhibition halls and other public amenities
- KA-CARE headquarters and residential facilities
- Basic infrastructure



First Phase of K.A.CARE City

City infrastructure requirements for Phase 1



City energy requirement from renewables



3-5 year R&D focused development program for 8,000 to 10,000 residents (including 800 scientists)



K•A•CARE Renewable Energy Competitive Procurement



Competitive Procurement Portal:

- Learn about K.A.CARE's renewable energy vision for the Kingdom, including the program stages and timeline and the related Overview of the Competitive Procurement Process (CPP).
- View the CPP White Paper which offers a more detailed process and specific goals for the program.
- Submit feedback on the CPP White Paper for K.A.CARE to consider in finalizing the subsequent documents.
- Allow potential developer /investor to register to gain access to the successive Requests for Proposal (RFPs) and Power Purchase Agreements (PPAs) and to receive the latest news and updates related to the Program Status & Timeline.



CPP White Paper:

- Initially, the CPP will consist of an Introductory Round with pre-packaged sites identified by K.A.CARE, followed by additional procurement rounds scheduled sequentially thereafter.
- These initial rounds are the focus of this officially released White Paper titled, “Proposed Competitive Procurement Process for the Renewable Energy Program”.

	Total size (MW)	Sector breakdown (MW)
Introductory Round	500-800	5-7 projects across the wind and solar sectors
1st procurement round	2,000-3,000	Solar PV - 1,100; STEG - 900 Wind – 650; Others: 50-350
2nd procurement round	3,000-4,000	Solar PV - 1,300; STEG - 1,200 Wind - 1,050; Other: 50-350



CPP White Paper:

- K.A.CARE is establishing a standalone government-backed entity, the Sustainable Energy Procurement Company (SEPC), responsible for administering the procurement and executing and managing the PPAs.
- Qualified proponents will be able to submit proposals electronically through this portal.
- The evaluation of proposals will combine price and non-price factors, enabling alignment of the CPP with the broader objectives of KA.CARE.
- Prior to the launch of each round, qualified proponents will have the opportunity to review and comment on draft RFPs and the terms of the PPAs, and K.A.CARE/SEPC may consider using this feedback in finalizing the RFPs and PPAs.

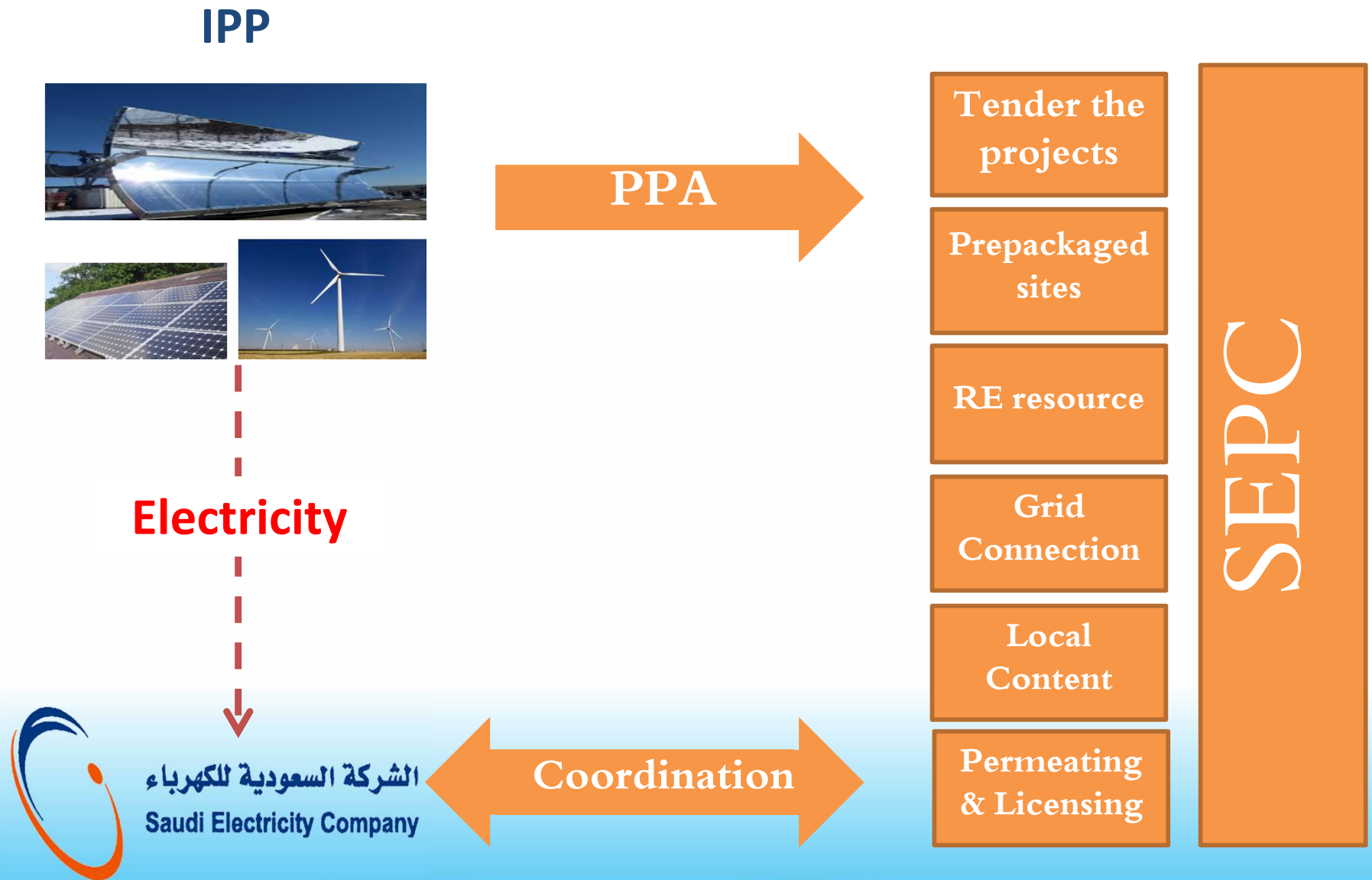


CPP White Paper:

Organisation	Role
King Abdullah City for Atomic and Renewable Energy (KA.CARE)	It is responsible for defining and implementing Saudi Arabia's clean energy programme
Sustainable Energy Procurement Company (SEPC)	SEPC is a standalone government-guaranteed entity responsible for administering the procurement and executing and managing the power purchase agreements
Sustainable Energy Research Fund (SERF)	A fund that will receive 1% of gross revenues from developers. This will be allocated to research applications that have potential for commercialisation. It will be administered by SESC.
Sustainable Energy Service Centre (SESC)	It is responsible for providing support to developers throughout the programme, including on local content issues
Sustainable Energy Training Fund (SETF)	A fund that will receive 1% of gross revenues from developers that will be allocated to sustainable energy training programmes. It will be administered by SESC.
Developer Research Advisory Council (DRAC)	To be part of the SESC and focused on R&D in the Kingdom, making recommendations on how to contribute to its intellectual capital. It will also sponsor an annual Sustainable Energy Research Conference and run a prize competition
Developer Training Advisory Council (DTAC)	Focused on training programmes and ensuring that developers' programmes are adequate.



Sustainable Energy Procurement Company:



The Kingdom of Sustainable Energy



Summary

New Energies Will :

- **CONTRIBUTE** to a sustainable future for Saudi Arabia
- **PRESERVE** non-renewable fossil fuel resources
- **SAFEGUARD** Saudi Arabia's international energy leadership
- **TRANSFORM** KSA into the Kingdom of Sustainable Energy



شكرا جزيلاً

