ENERGY
Energy Transition and CleanTech Advisory
accelerating smart energy transition

UNIDO Energy Efficiency Investment Opportunities

Deploying ESCO Business Models on Energy Efficiency Projects in EAC, ECOWAS and SADIC Regions

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

EACREEE Building a Sustainable Energy Future

ECREEE Towards Sustainable Energy

SACREEE SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

EELA ENERGY EFFICIENCY FOR SUSTAINABLE LIVELIHOODS IN AFRICA

Sweden Sverige

Swedish Energy Agency

12 September 2025
V1.0

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Agenda

1. Introductions
2. Energy Efficiency Perspective
3. Applicable Funding Models
4. Selected Case Studies (EELA)
5. Lessons Learned

Section 1

Introductions

AREF ABOUZAHR MBA, P. Eng, PMP, CEM, CMVP, PCF

Chief Executive Officer

Canadian

Energy, Water and Utilities expert with 26 years of North American and GCC experience in management and project development consulting, strategic program design and PMO implementation within renewable and conventional energy, Demand Side Management and Energy Efficiency sectors. At Ark Energy, Aref is focused on Energy Transition program design and implementation, Energy Efficiency and distributed Solar projects development and financing, Energy Transition policy design, and digitalization of energy management information systems (EMIS). He heads Ark's business globally and leads its customer solutions and strategy practice

HIGHLIGHTS

Founder and Executive Director of TAQATI, the dedicated Program Management Office of Dubai's Demand Side Management Strategy (DSM2030), mandated by the Supreme Council of Energy (DSCE) to implement and attain DSM energy efficiency targets (Dubai, UAE)

Principal at Ernst and Young – Power and Utilities Advisory Services (Dubai, UAE)

Head of Infrastructure and Utilities at General Secretariat of the Executive Council (Abu Dhabi, UAE)

Global Market Program Leader of Alternative Energy at General Electric - Power and Water (NY, USA)

Key executive management and senior advisory roles within the public and private sectors at General Electric (Power and Water), A.T Kearney, ITT (Water and Wastewater)

EDUCATION

MBA, *University of Texas, USA*

Post-MBA, *McGill University, Canada*

Bachelor of Engineering (ME),
American University of Beirut (AUB)

LANGUAGES *(Spoken & Written)*

English (fluent), Arabic (native) and French (advanced)

RELEVANT PROJECTS	UNIDO	EMICOOL	three60		Emirates REIT	SHERATON	المجلس الأعلى للطاقة Supreme Council of Energy	SOL PROPERTIES
Project	*EELA Energy Eff. Project Consulting*	*DCPs (1, 3, 4, 5, 6 and 11)*	*Index Tower*	*Al Seef Tower*	*EREIT building portfolio in Dubai*	*Sheraton Jumeirah Beach Hotel*	*Demand Side Mgmt Strategy 2023 (design and PMO)*	*Sol Star Building*
Typical Project Role	**Project Partner**: Identify, qualify and create project opportunities, support clients to get the buy-in for, develop, fund and execute building retrofits, delta-t rehabilitation and solar projects, manage the relationship with the C-level client with project oversight, QA/QC and complex technical, commercial and legal consulting							

Our Value Proposition and Support Model

Ark Energy have developed unique value proposition, proprietary approach and battle-tested tools to enable our clients to cut energy costs and digitalization their energy and carbon management

Energy Efficiency, Transition and Digitalization Services

Acting as an Independent Owner's Consultant, Ark Energy deploys Energy Management consulting expertise and Digitalization to decarbonize operations (scope 1 & 2), reduce energy spend and improve standards of comfort in buildings

Core Services

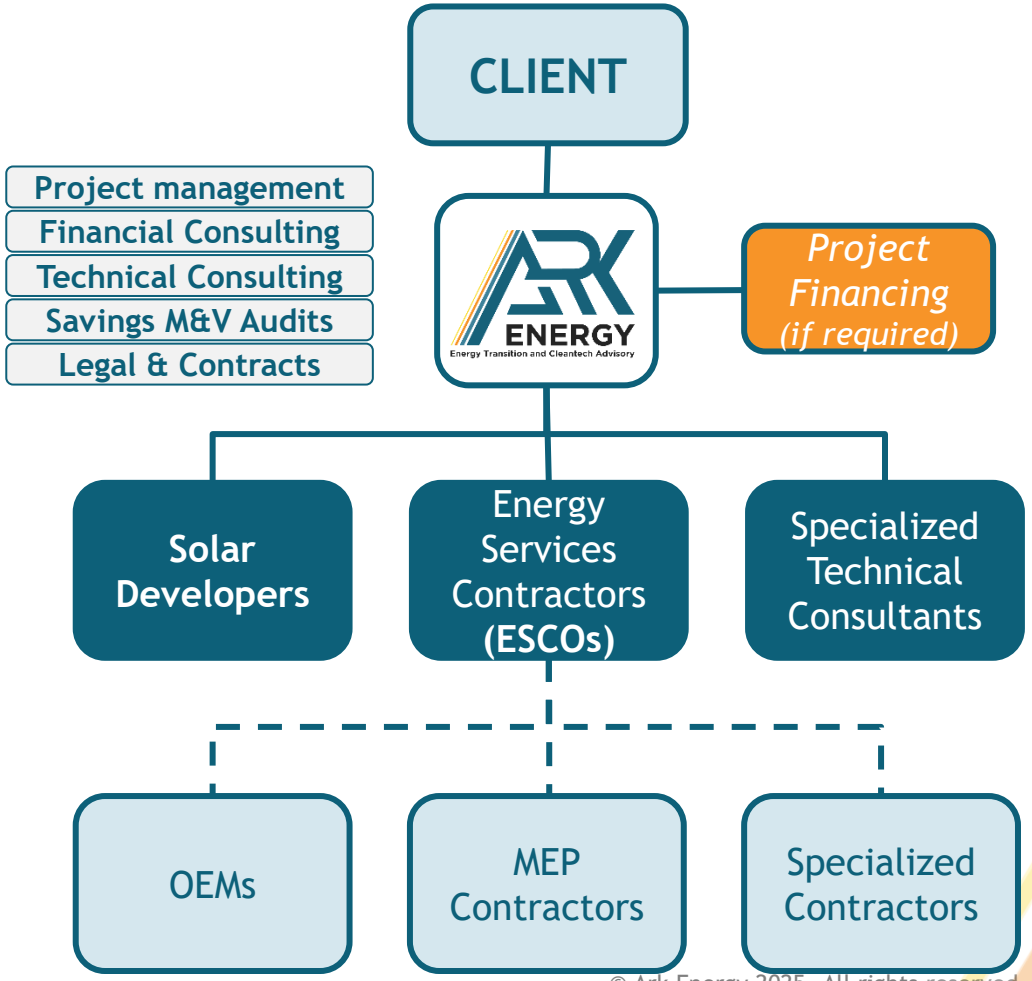
1. Energy Transition Strategy development and implementation PMO
2. Energy Efficiency (Retrofit) Project Development Consulting
3. Solar & Cleantech Project Development Consulting
4. Digitalization of Energy Management and M&V of Savings

Specialized Technical Services

5. Low Delta-T Rehabilitation Assessment and Execution Management
6. Thermal Cooling Load Assessment
7. Building Recommissioning
8. BTU-Submetering Feasibility and Rollout Support
9. Designing for High-Performing Buildings

Energy Projects Development Consulting Business Model

We take the headache away from our clients by providing turn-key project development advisory services as Owner's Consultant using proprietary methodologies to develop, source financing, and execute energy projects



Digitalization of Energy Management

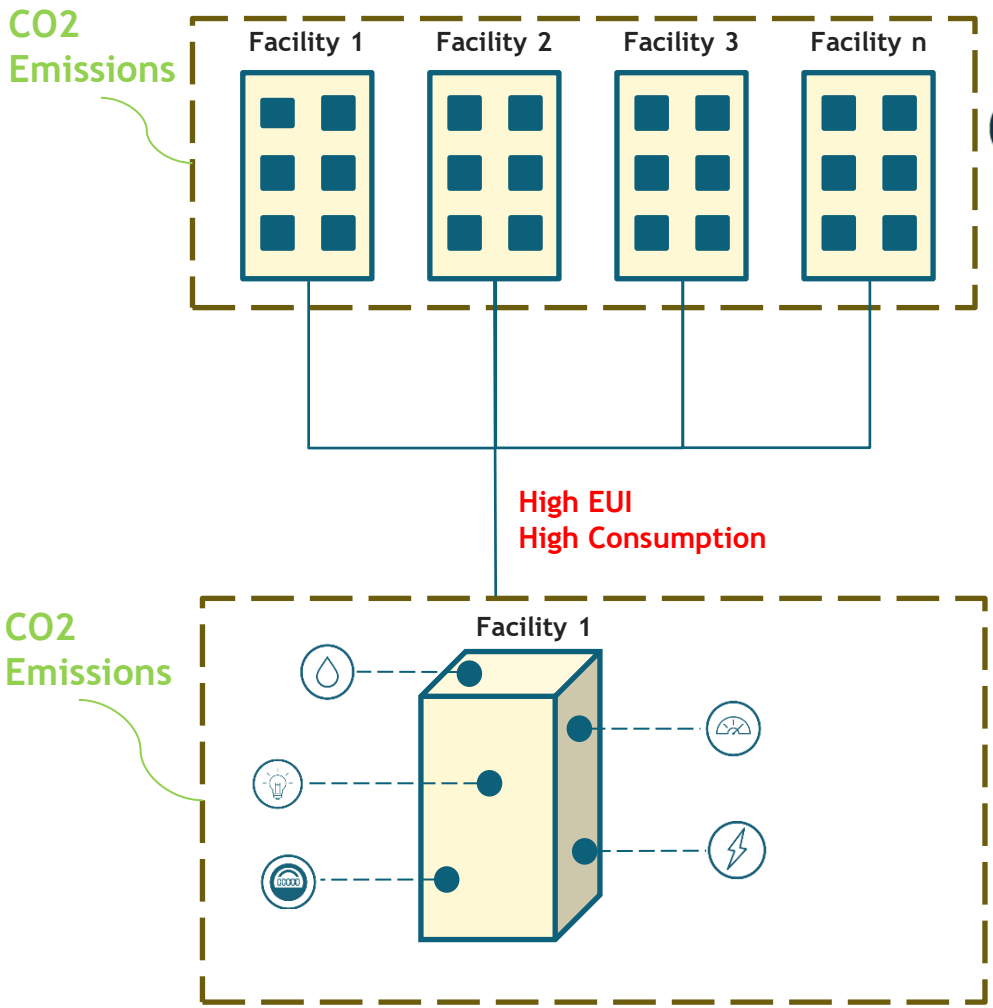
Ark Energy has a suite of advanced digitalization solutions that can provide portfolio-wide energy management and reporting, AI-enabled data analytics, M&V, Carbon accounting and ESG reporting

(CLICK to intro video)

CARBON2HUB

Financial-grade greenhouse gas accounting

- Holistic view of financial-grade scope 1, 2, and 3 carbon emissions data across entire portfolio
- Automated ESG reporting using all protocols and standards
- Market-based emission factors
- Progress tracking towards goals



(CLICK to intro video)

UtilityManagement™

Portfolio-level energy & sustainability reporting

- Automatically capture, manage and analyze utility bills
- Establish and manage complex customer billing and back-charging (sub-metering)
- See details of each building's use and demand
- Manage utility budget against actual spend

(CLICK to arkEMIS video)

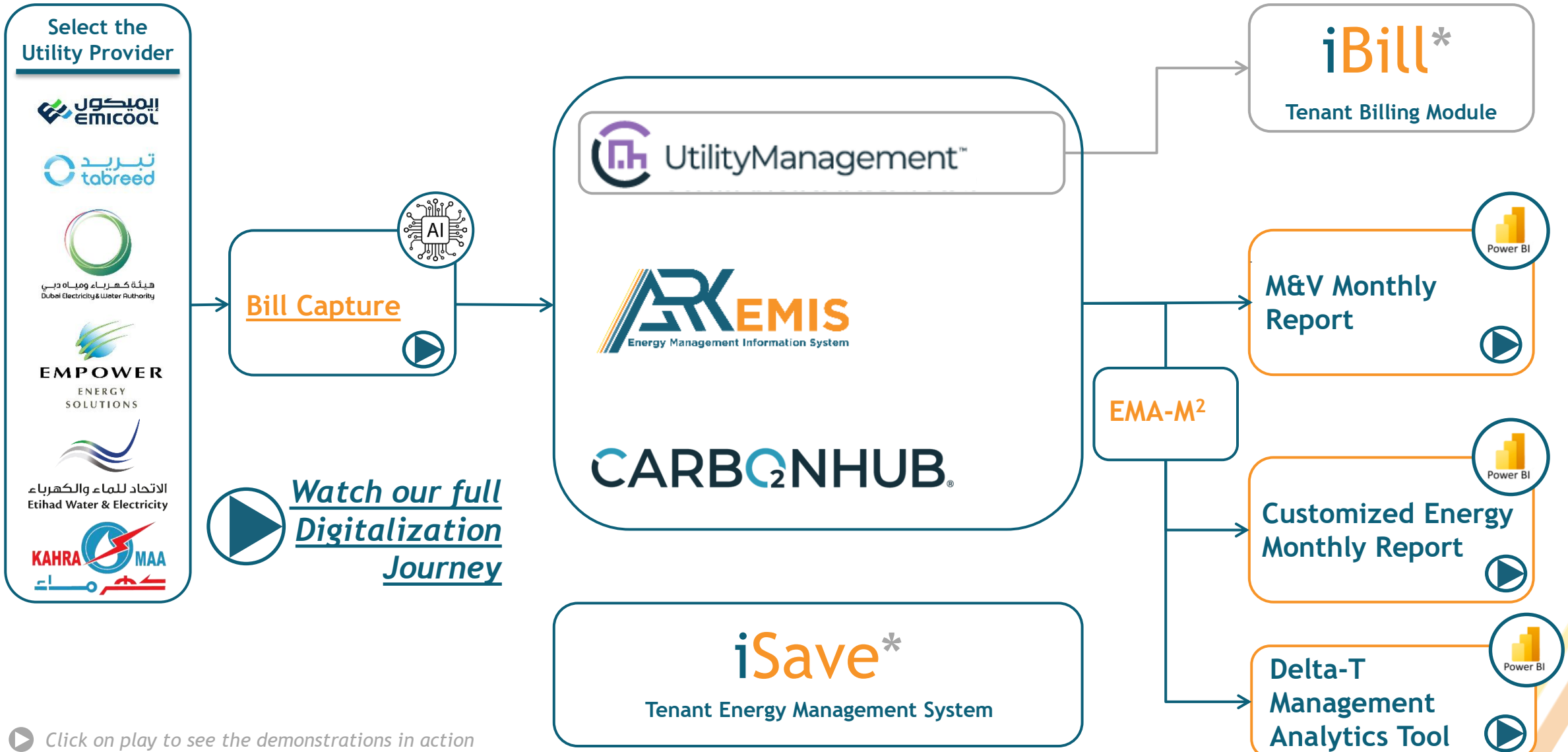
ARKEMIS Energy Management Information System

Real-time energy and sustainability analytics

- Cloud-Based SaaS
- Real-time performance data of all equipment in buildings
- Granular data analytics using machine learning
- Automated M&V and energy reporting
- Drift alerts and simulations to identify and test energy conservation measures

Digitalization Journey

We shall integrate our AI-Agentic Services with web-based reporting to ensure seamless, easy-to-understand and navigate, energy monitoring and management



Click on play to see the demonstrations in action

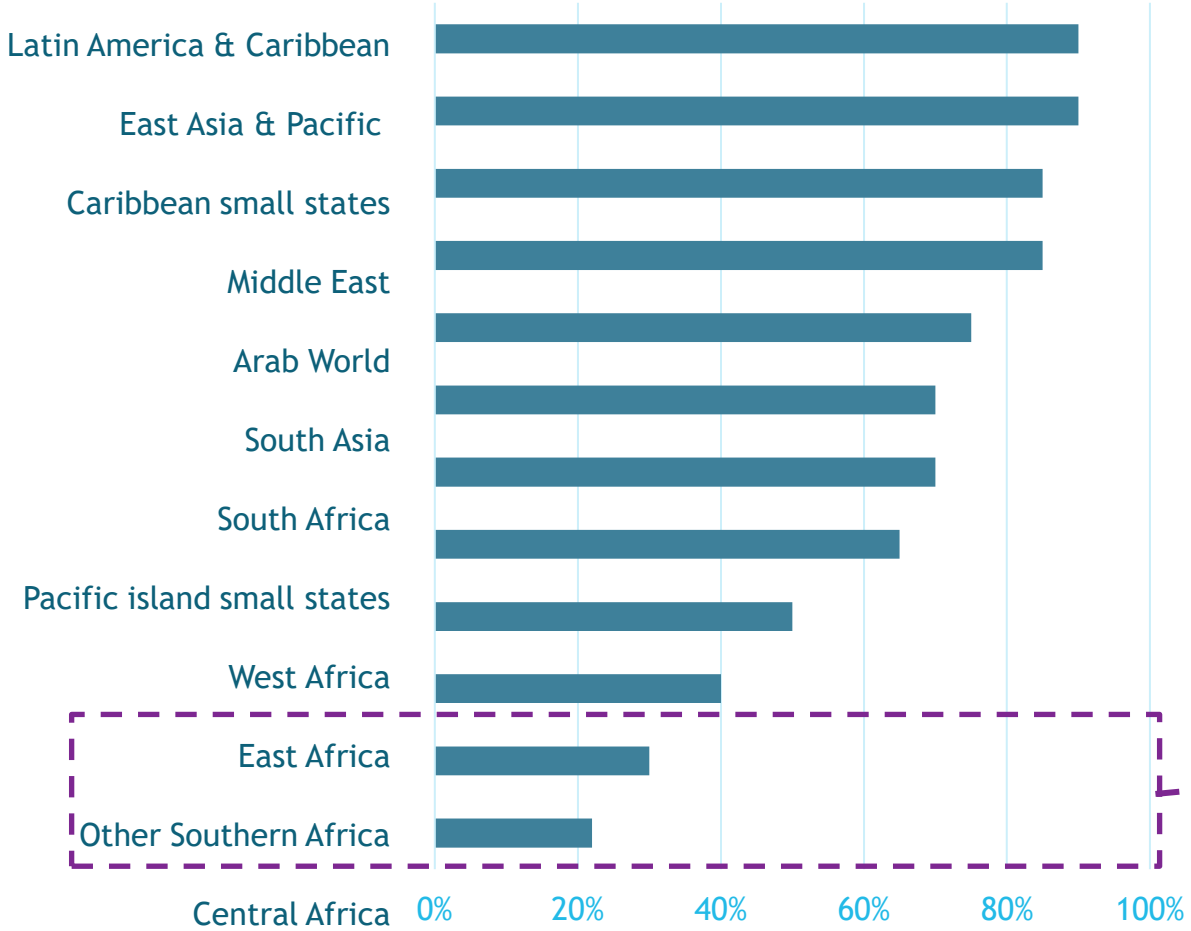
Note that the following applications are currently in development

Section 2

Energy Efficiency Perspective

Over a billion people do not have access to quality electricity or stable grid, drawing most of their energy from Diesel gensets and other “dirty” fuel resources

Business Global Access to Electricity *(% of population)*



Key Challenges Facing the Electricity Sector

- Unstable Grid
- Power outages
- High tariff rates from (often) a monopoly of micro-generators
- Expensive liquid fuel to run existing power plants
- .. And often insecure supply of liquid fuel
- Remote areas with no connection to the power Grid
- Out-dated and unreliable baseload turbines
- Energy dependence
- Unreliable grid

Source: World Bank Enterprise Surveys

Energy Efficiency Retrofit cuts down utility costs, enhances asset lifecycle, improves standards of comfort and reduces your carbon footprint with a 2 to 3-year average payback time

Lowers utility costs and enhances equipment lifecycle with sustainable and integrated energy conservation measures

20 - 50%
Lower Utility Bill

Translates to
3 to 6%
net benefit on P&L

- Efficient and Smart Lighting — LED
- Upgrade of HVAC Systems and Reduction of Cooling Load Requirements
- Power Quality and Harmonics Improvement, and Enhanced Equipment Lifecycle
- Upgrade of Building Envelope
- Digitalization of Energy Operations and Building Automation Systems — arkEMIS
- Efficient Indoor and Outdoor Water Systems
- Delta-T Rehabilitation

… and improves standards of comfort across different key areas of the building

- Humidity
- Temperature
- Air Flow
- Indoor Air Quality (lower particulates of formaldehyde and CO_2)
- Light efficacy

… and decarbonizes your operations

1 MWh

438 kg CO_2

Notes: CO2 – MWh conversion is based on Dubai Energy Efficiency Strategy (2019). Number may change based on the energy mix

Data has emerged as the most important resource for this Digital Age

LAND
Was the resource of the
AGRICULTURAL AGE

OIL
was the resource of the
INDUSTRIAL AGE

DATA
is the resource of the
DIGITAL AGE

Market Challenges

Based on lessons learned from EELA projects in EAC & SADC region and international experience, we identified 4 overarching market challenges preventing Energy Eff. project adoption

Challenges

Data are based on market study conducted in 2018-2019 covering 1,900 respondents in Dubai, UAE from government, industrial, commercial and residential sectors

	Challenges	Energy Users	Energy Services Providers	Financiers
72%	***Limited funding or available capital*** *for energy efficiency interventions*	✓		✓
60%	***Lack of experience, relevant technical or legal knowledge*** *in energy performance contracting or execution of energy efficiency projects (incl. audits, energy/financial simulation, detailed design and integration, tech.)*	✓	✓	✓
52%	***Constrained resource bandwidth*** or ***capacity***, and ***lack of focused*** project ownership (energy users)	✓	✓	
38%	***Low client awareness***, or ***trust / confidence*** in energy efficiency and optimization projects	✓		✓

Key Market Players *(impacted)*

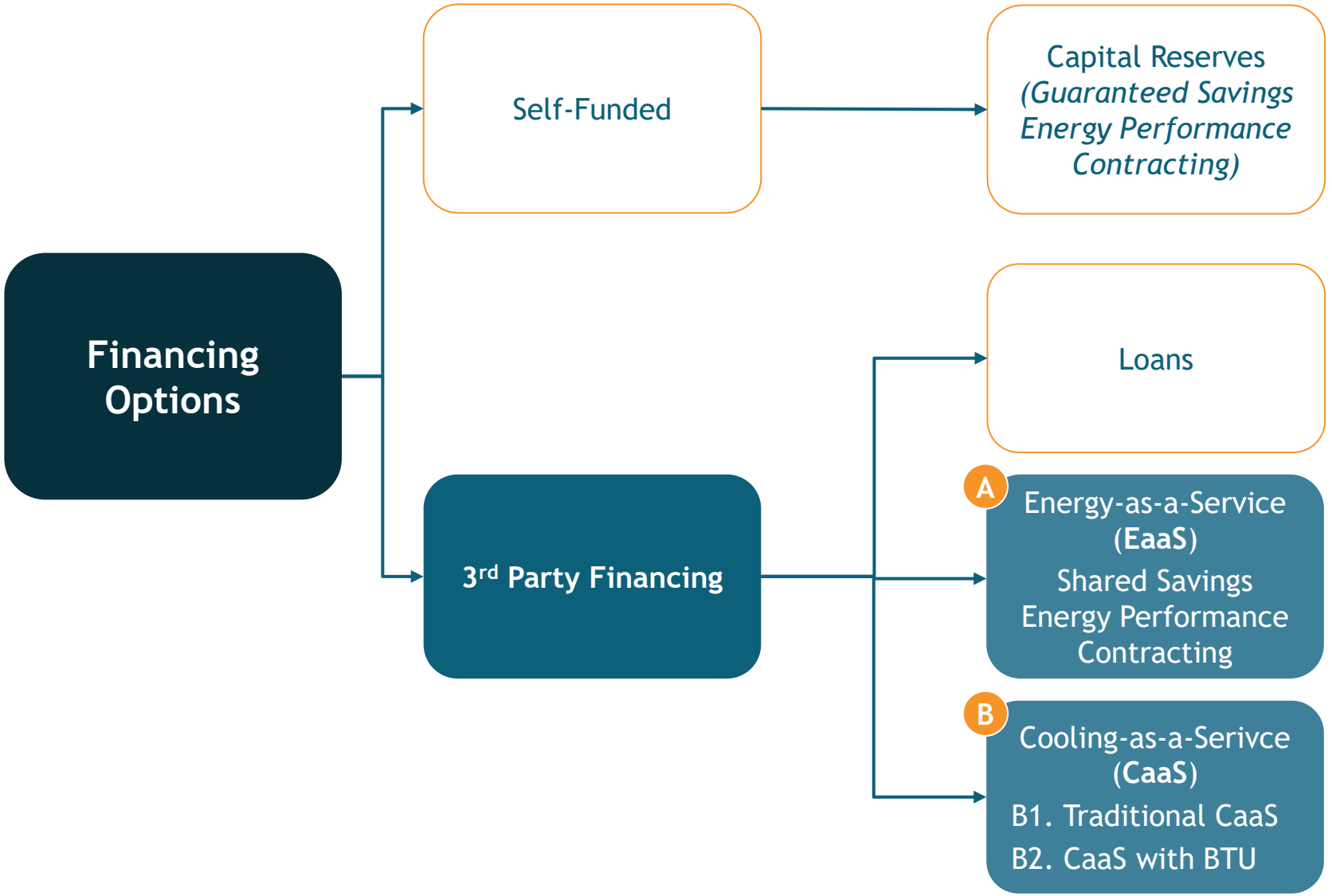
Source: Ark Energy Market Assessment (2019, Dubai UAE)

Section 3

Applicable Funding Models (EELA)

Funding Options

Capital allocation and risk appetite drive decision-making to select the most suitable funding mechanism for the ESCO and energy-users alike



Highlights

- Working capital depletion
- NPV and IRR driven selection process
- Board decision

- Bonds
- Collateral
- Corporate guarantees
- On Balance sheet

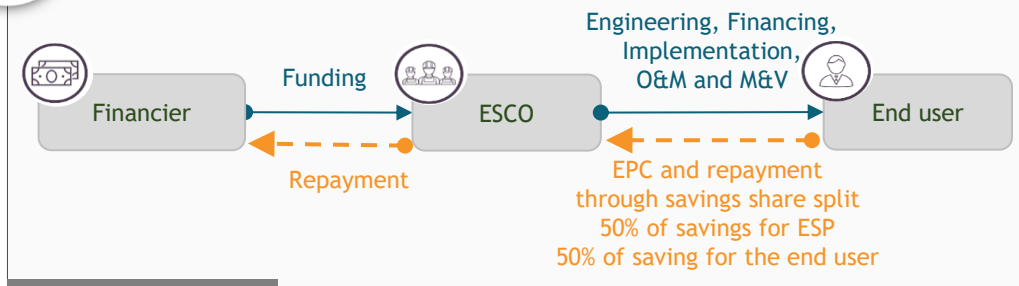
- 3rd party investor
- Off Balance sheet
- OpEx, not CapEx
- Savings guarantee

- 3rd party investor
- Payments are agreed upon as a function of actual usage
- OpEx, not CapEx

Applicable Funding Options (EELA)

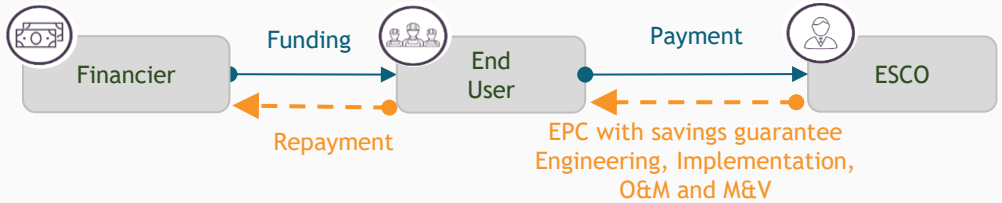
Energy service business models received and supported by the EELA Facility

A Energy Performance Contracting (Shared Savings Model)



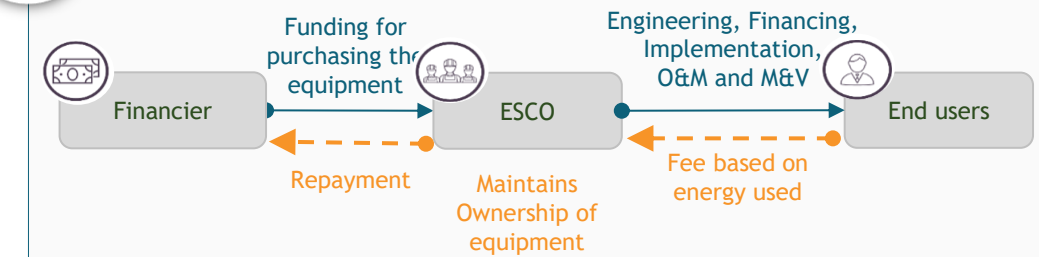
2 projects

B Energy Performance Contracting (Guaranteed Savings Model)



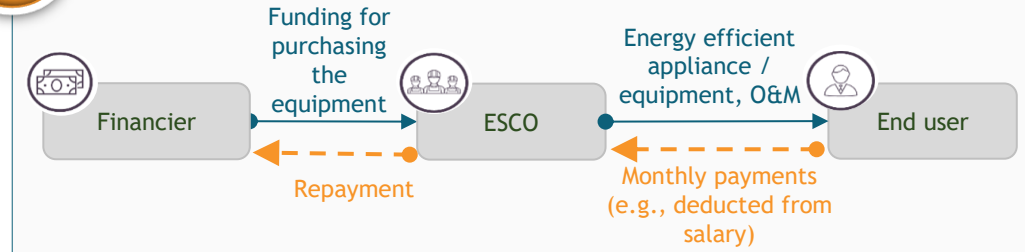
1 project

C Energy-as-a-Service



1 project

D Energy Efficient Appliance/Equipment Leasing



2 projects

A1 **Financing with On-Bill Payment Business Model**

A funding mechanism with On-Bill payment and Repayment Guarantees can significantly reduce cashflow risk for the investor, and increase adoption by eliminating Capital constraints of end-users

Either one of 2 parties can be funded:
- ESCO
- Energy-users

Guarantor *(e.g., SIDA, GCF, …)*

Securing repayment of invested capital by private investors / banks (guaranteeing scheme of 70-75% of the initial invested capital)

Energy-Users

On-Bill Payment thru Utility Bill Or Municipality taxes / fees

- Energy Eff Retrofit
- Savings Guarantee
- Delta T elimination
- Retro/Recomm.

Repayments

Financing

ESCO/ Solar EPC

Payments pass-through

Utility / Municipality *(leverage)*

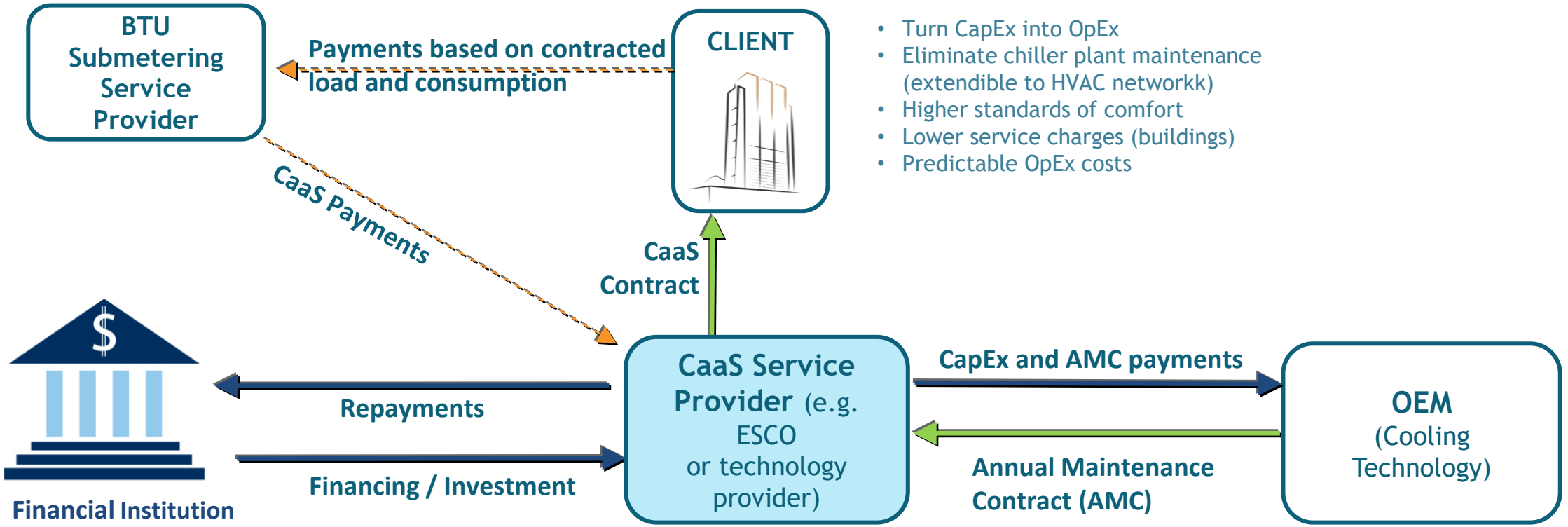
Participating Financial Institutions ("PFI's")

- *Audit / site survey*
- *Detailed engineering and design*
- *Integration of ECMs (energy retrofit)*
- *Solar installations*
- *O&M and savings Guarantees (if ESPC or EaaS contract)*
- *M&V of Savings*

- *1st line of defense: collect payments from energy-users (in a EPC funding models, debt financing, convertible grants, Leasing agreements etc.)*
- *Payment pass-thru either to the ESCO (if ESCO is funded), or directly to PFI (if the End-User is the party being funded)*

B2 Cooling-as-a-Service (CaaS) – BTU Submetering

With BTU Submetering model integrated with CaaS, Client off-loads CaaS payments onto the BTU SSP, and chiller plant / HVAC network upkeep onto the CaaS service provider



- Turn CapEx into OpEx
- Eliminate chiller plant maintenance (extendible to HVAC networkk)
- Higher standards of comfort
- Lower service charges (buildings)
- Predictable OpEx costs

- Take over aging cooling equipment from the client
- Provide optimum maintenance through their service contracts (AMC) with OEM
- Install metering infrastructure to measure electricity consumption on the chiller plant

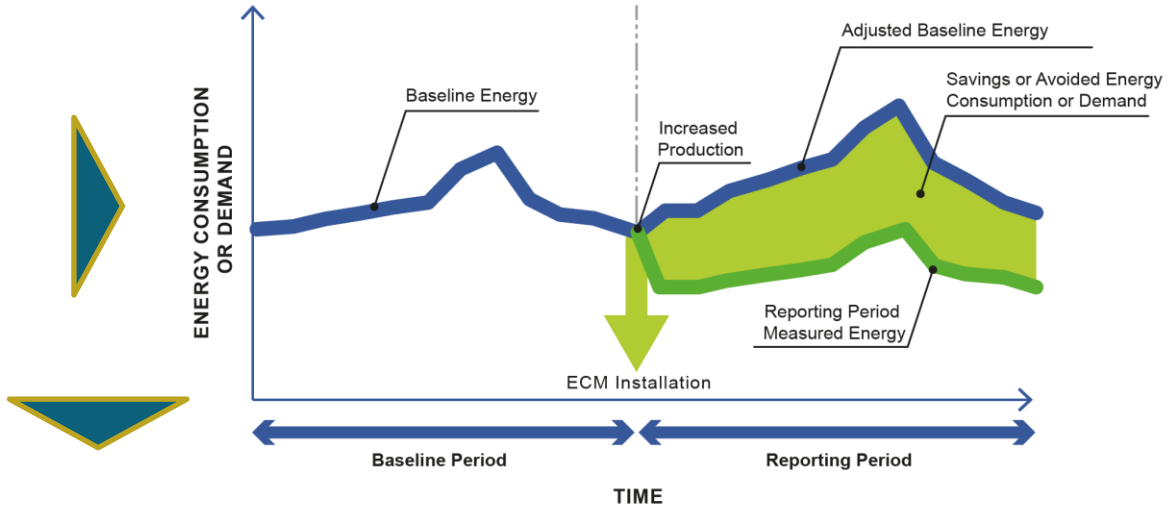
Measurement & Verification Audit of Savings

M&V Audits using IPMVP standards are critical to safe-guard investments in energy efficiency and solar projects for both the energy-users and financiers

Key Drivers for M&V Reporting Period Issues

- **Lack of technical knowledge** of the M&V formulas and energy modeling methodology used to create them
- **Lack of ownership** of the M&V reports
- Lack of experience in assessing the **adjusted baseline** *(core of the IPMVP protocol)*, static factors, routine or non-routine adjustments
- Lack of capability to **identify discrepancies** or engage the ESCO in a rational dispute on energy savings

(at times) Lack of proper M&V reporting (incomplete dashboard)



Business Case | *Pre-Tendering (Ark's WTA)* | *Tendering* | *Detailed Energy Audit + M&V Plan* | *Implementation* | *M&V reporting*

Mitigating Risks during the M&V Plan

- **Select the right M&V Option** depending on the retrofit plan
- **Utilize our proprietary M&V model** to develop adjusted baseline regressions
- **Identify and validate independent variables** to minimize model uncertainty
- Capture independent variables datasets from **trusted market sources**
- **Back-test** the M&V model using historical data
- Assess static factors and quantify their impact

Mitigating Risks during M&V Reporting Period

- Monthly Energy Savings report evaluation
- Quarterly Energy Savings Audit
- Annual Energy Savings Audit
- **Digitalized Measurement and Verification of savings with automated reporting through (arkEMIS, arkUM, and arkBI)**

ARKEMIS Energy Management Information System + ARKBI Energy Transition and CleanTech Advisory + ARKUM Utility Management

Section 4

Selected Case Studies - EELA

Case Study 1: Agricultural Application in Kenya (Shared Savings Energy Performance Contracting - SSEPC)

Energy Efficiency Retrofit including Pump VFD Retrofit, RTU Optimization, Power Quality optimization and Lighting Retrofit partially funded by UNIDO under a 5-year SSEPC[1]

Project Background

Hatchery Facility

Baseline Energy Consumption: 2.8 million kWh

Energy Costs *(pre-retrofit)*

Total Annual Utility Costs: EUR 237,821

Client Challenges

- Voltage and Power quality issues (fluctuations)
- Equipment and instrumentation in bad conditions with high harmonic issues
- Energy costs much higher than benchmarked peers
- O&M costs increasing constantly

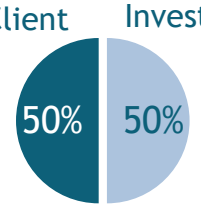
High-level Approach

1. Business Case
2. Tendering
3. Contracts
4. Energy Audit
5. Implementation
6. M&V Reporting

Project Financing

5-year Shared Savings Energy Performance Contract

... savings split of



Project Outcome

EUR 47,359
Annual Savings

8% reduction
in Energy Consumption

1.8 years
Project payback time

37 Tons/yr.
Avoided CO_2 emissions

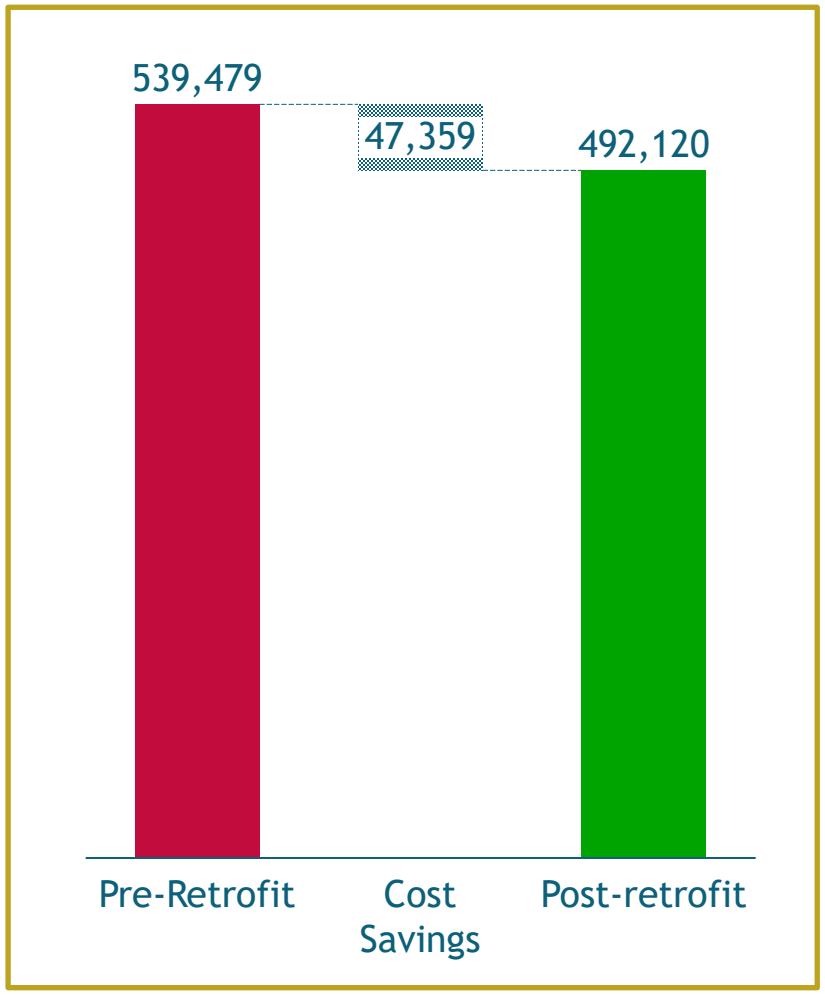
Digitalization of energy management (arkEMIS) with AI-enabled asset management

Electricity access beneficiaries: 50 people
Jobs created: 5

Case Study 1: Agricultural Application in Kenya (Shared Savings Energy Performance Contracting - SSEPC)

Energy Efficiency Retrofit including Pump VFD Retrofit, RTU Optimization, Power Quality optimization and Lighting Retrofit partially funded by UNIDO under a 5-year SSEPC[1]

Annual Utility Cost Savings
(EUROS)



Summary Project Outcome

CapEx
89,038
Initial Capital Investment

Savings
EUR 47,359
Annual Reduction in energy (kWh) consumption versus baseline

Carbon Reductions
37 tons CO_2 Eqv.
Annual Reduction in carbon footprint (Tons CO_2 equivalent) versus baseline

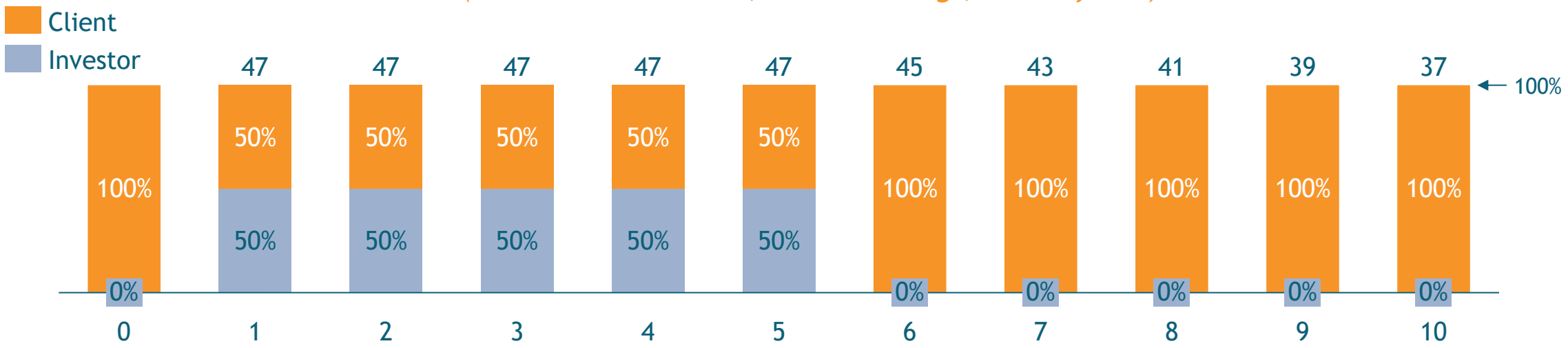
Project Payback Time
1.8 years

Case Study 1: Agricultural Application in Kenya (Shared Savings Energy Performance Contracting - SSEPC)

10-year profit of EUR 322k from savings, along with equipment enhancement and operational modernization, and repayment through sharing the savings that significantly de-risk the project

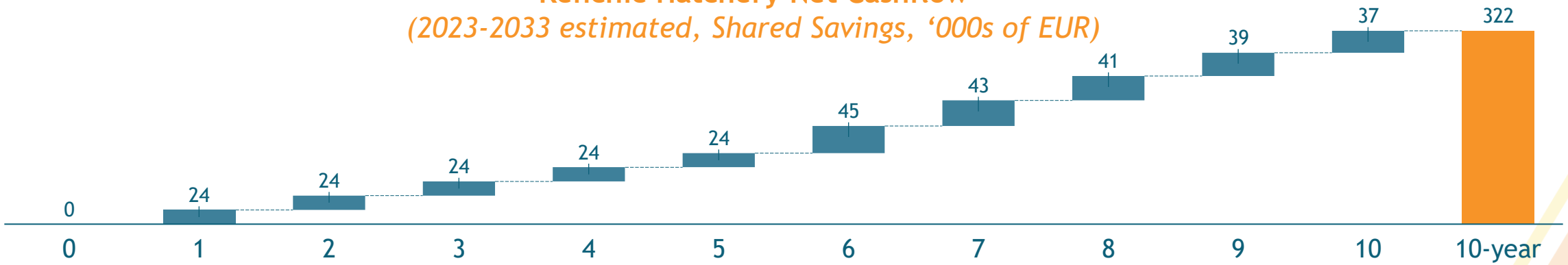
Kenchic Hatchery Gross Energy Cost Savings

(2023-2033 estimated, Shared Savings, '000s of EUR)



Kenchic Hatchery Net Cashflow

(2023-2033 estimated, Shared Savings, '000s of EUR)



ESPC Contract term is 3 years, expected degradation of 5% starting after year 3

Case Study 2: Institutional / Educational Building Retrofit in Kigali, Rwanda

Energy Efficiency Retrofit with **Lighting Retrofit**, partially funded by UNIDO under a 3-year Shared Savings Energy Performance Contract

Project Background

Educational Facility

Baseline Energy Consumption: 1.12 million kWh

Energy Costs *(pre-retrofit)*

Total Annual Utility Costs: EUR 98,411

Client Challenges

- Lighting does not meet ASHRAE Standards
- Equipment and instrumentation in bad conditions
- Energy costs much higher than benchmarked peers
- O&M costs increasing constantly

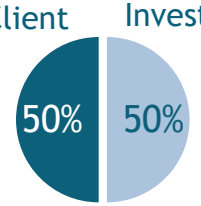
High-level Approach

1. Business Case
2. Tendering
3. Contracts
4. Energy Audit
5. Implementation
6. M&V Reporting

Project Financing

3-year Shared Savings Energy Performance Contract

... savings split of



Project Outcome

EUR 57,806
Annual Savings

59% reduction
in Energy Consumption

3 years
Project payback time

165 Tons/yr.
Avoided CO_2 emissions

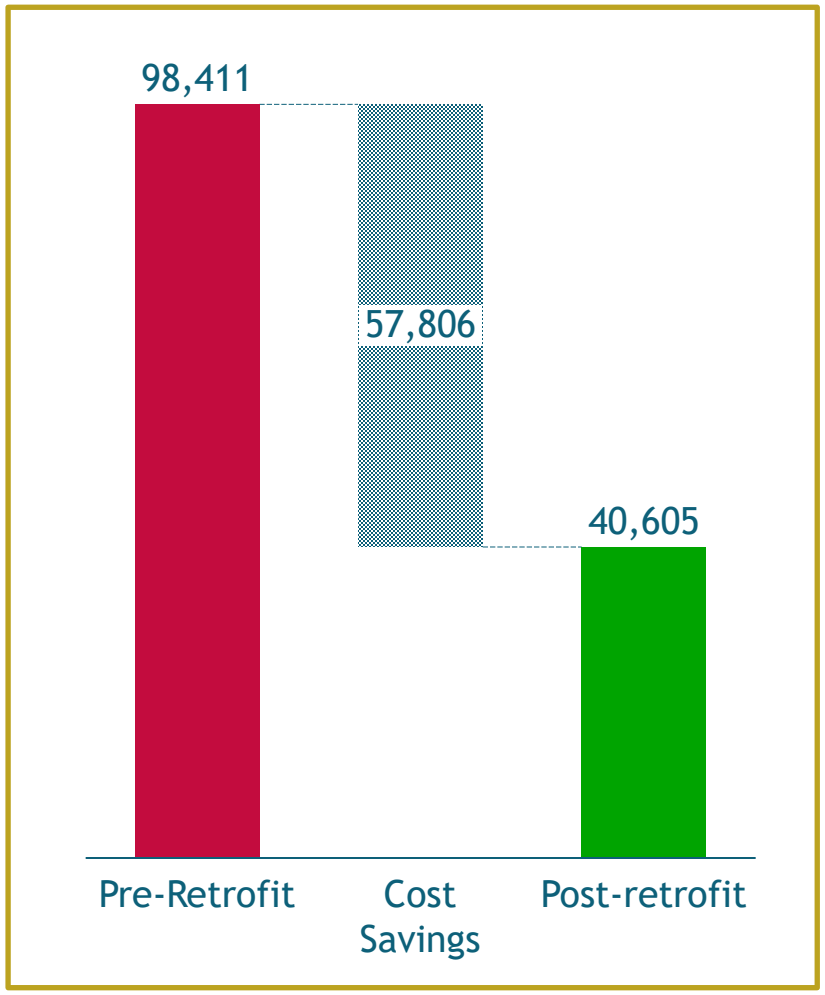
Digitalization of energy management (arkEMIS) with AI-enabled asset management

Electricity access beneficiaries: 5374 people
Jobs created: 5

Case Study 2: Institutional / Educational Building Retrofit in Kigali, Rwanda

Energy Efficiency Retrofit with **Lighting Retrofit**, partially funded by UNIDO under a 3-year Shared Savings Energy Performance Contract

Annual Utility Cost Savings
(EUROS)



Summary Project Outcome

CapEx
EUR 190,391
Initial Capital Investment

Savings
EUR 57,806
Annual Reduction in energy (kWh) consumption versus baseline

Carbon Reductions
165 tons CO_2 Eqv.
Annual Reduction in carbon footprint (Tons CO_2 equivalent) versus baseline

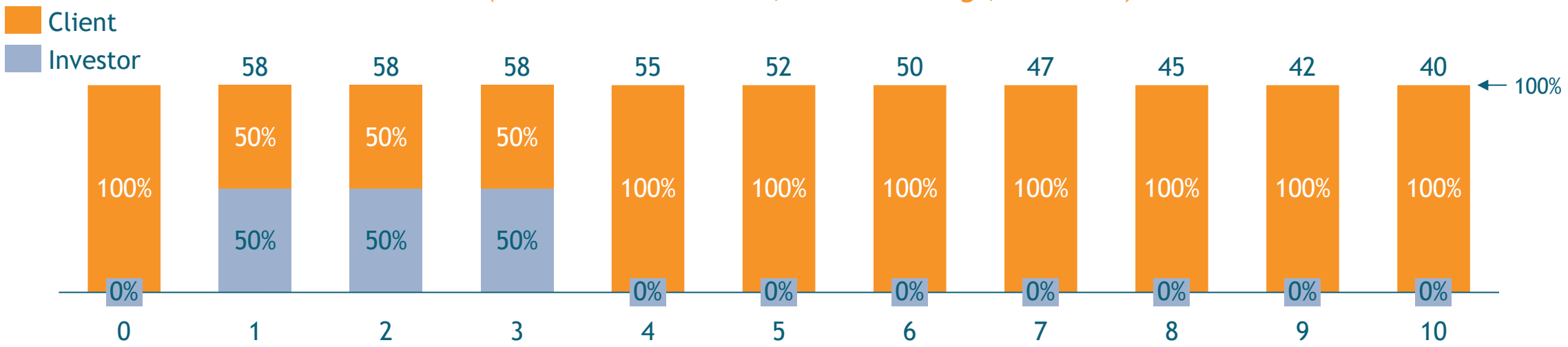
Project Payback Time
3 *years*

Case Study 2: Institutional / Educational Building Retrofit in Kigali, Rwanda

10-year profit of EUR 418k from savings, along with equipment enhancement and operational modernization, and repayment through sharing the savings that significantly de-risk the project

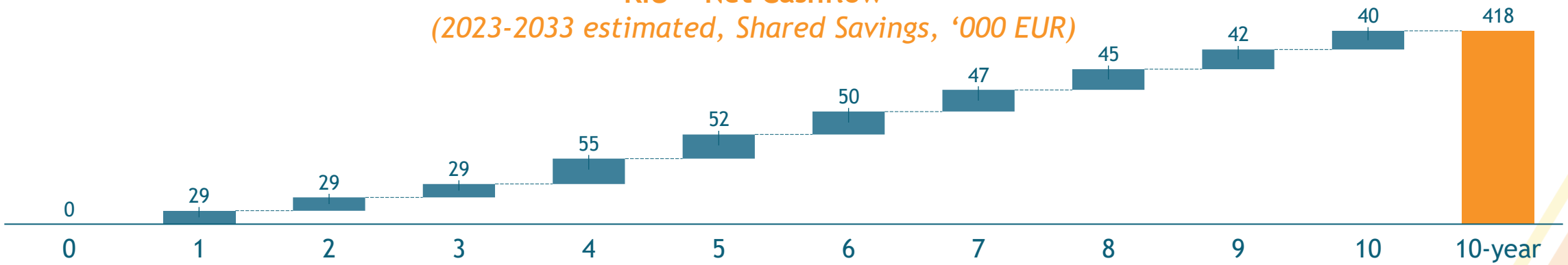
KIU[(1)] Gross Energy Cost Savings

(2023-2033 estimated, Shared Savings, '000 EUR)



KIU[(1)] Net Cashflow

(2023-2033 estimated, Shared Savings, '000 EUR)



[(1)] KIU: Kigali Independent University
ESPC Contract term is 3 years, expected degradation of 5% starting after year 3

Section 5

Lessons Learned

Lessons Learned

Lessons learned from the EELA Facility

Category	Lessons learned	Recommendations
1. Technical capacities of ESCOs	Technical capacity of ESCOs to design and implement energy service projects are relatively low, as this is a new market in EAC and SADC. Technical Assistance had to be provided under Window 2, which was not initially planned	• Provision of consultative support to local ESCOs to compliment their capability from a technical, commercial and contractual aspect, both at the design level but also in the implementation phase, is necessary • Establishing a training programme and restricting the facility to ESCOs who have participated in the training can help reduce reduce risks and transaction costs
2. Awareness of energy users on EELA and energy service business models	• High potential for EELA projects across sectors – Municipality (incl. markets), Health & Education, Commercial (incl. SMEs), Agriculture and Agri-food industries, and Households - and for on and off-grid users. • Although national meetings were conducted to create awareness on the facility and the facility was promoted in international events, applications came from 9 countries only and mostly from ESCOs. • For Window 1 applicants (two hospitals in Tanzania), walk-through energy audits had to be included in the Technical Assistance.	Extensive awareness creation on EELA, monetary savings, energy service business models, and opportunities is needed to reach and create interest among energy users, and channels have to be tailored to the target energy user groups.
3. Financing for EELA projects	• ESCOs in EAC and SADC have limited ability to obtain commercial financing, which involves high interest rates and collateral requirements (even with 75% grant co-financing) • Banks are unfamiliar with EE/EELA projects and ESCO models and perceive that EE/EELA projects carry high risk • Internal approval for grant disbursement at UNIDO is lengthy process	• A loan guarantee fund, with smaller grant component through partnership with a fund manager / bank is better suited for a scale-up of the facility • Awareness and capacities of financing institutions in the region on technical due diligence and project appraisal needs to be built • Low risk projects can be promoted, e.g., standard products with deemed savings, streamline business models, and support ESCOs that have gone through the formal training. Grants can be provided for proof-of-concept projects
4. Regulations for EELA projects	• In countries with regulations for energy audits and implementation, there is higher awareness among energy users and stronger capacity among ESCOs. E.g., Kenya with Energy Management Regulations 2012 and licensing of energy auditors by EPRA.	• Governments can support the creation of enabling environment for ESCOs, e.g., by promoting energy-saving performance contracting in public buildings and facilities, and enforcing energy audit and retrofit directives for large energy users • Suitability of accreditation and certification schemes for energy auditors can be evaluated.

Your Trusted Energy Efficiency Solutions Partner

For clarifications or questions, please contact:

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E: **aref@arkenergy.ae**

Backup

Ark Energy Proprietary Approach to Energy Efficiency Project Development