SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Business Models and Financing Options for Solar Cooling

This is a report from SHC Task 65: Solar Cooling for the Sunbelt Regions and work performed in Subtask D: Dissemination

Author: Jan W. Bleyl (Energetic Solutions)
Contributors: Uli Jakob (JER) & Paul Kohlenbach (BHT Berlin)
Date 7 May 2024
Report D-D2, DOI

Cover photo credit: World map with Sunbelt regions (marked yellow) and the 18 countries of the participating Task 65 experts (marked green), source: Neyer Brainworks & JER

Solar Heating & Cooling Technology Collaboration Programme (IEA SHC)

The Solar Heating and Cooling Technology Collaboration Programme was founded in 1977 as one of the first multilateral technology initiatives ("Implementing Agreements") of the International Energy Agency.

Our mission is *"Through multi-disciplinary international collaborative research and knowledge exchange, as well as market and policy recommendations, the IEA SHC will work to increase the deployment rate of solar heating and cooling systems by breaking down the technical and non-technical barriers."*

IEA SHC members carry out cooperative research, development, demonstrations, and exchanges of information through Tasks (projects) on solar heating and cooling components and systems and their application to advance the deployment and research and development activities in the field of solar heating and cooling.

Our focus areas, with the associated Tasks in parenthesis, include:

- Solar Space Heating and Water Heating (Tasks 14, 19, 26, 44, 54, 69)
- Solar Cooling (Tasks 25, 38, 48, 53, 65)
- Solar Heat for Industrial and Agricultural Processes (Tasks 29, 33, 49, 62, 64, 72)
- Solar District Heating (Tasks 7, 45, 55, 68)
- Solar Buildings/Architecture/Urban Planning (Tasks 8, 11, 12, 13, 20, 22, 23, 28, 37, 40, 41, 47, 51, 52, 56, 59, 63, 66)
- Solar Thermal & PV (Tasks 16, 35, 60)
- Daylighting/Lighting (Tasks 21, 31, 50, 61, 70)
- Materials/Components for Solar Heating and Cooling (Tasks 2, 3, 6, 10, 18, 27, 39)
- Standards, Certification, and Test Methods (Tasks 14, 24, 34, 43, 57)
- Resource Assessment (Tasks 1, 4, 5, 9, 17, 36, 46, 71)
- Storage of Solar Heat (Tasks 7, 32, 42, 58, 67)

In addition to our Task work, other activities of the IEA SHC include our:

- SHC Solar Academy
- *Solar Heat Worldwide*, annual statistics report
- SHC International Conference

Our members

Australia	European Commission	SACREEE
Austria	France	SICREEE
Belgium	Germany	Slovakia
Canada	International Solar Energy Society	South Africa
CCREEE	Italy	Spain
China	Netherlands	Sweden
Denmark	Norway	Switzerland
EACREEE	Portugal	Türkiye
ECREEE	REEECH	United Kingdom

1 Executive Summary

The goal of the IEA SHC Task 65 “Solar Cooling for the Sunbelt regions” is to focus on innovations for affordable, safe, and reliable Solar Cooling systems for the Sunbelt regions worldwide. Countries located between the 20th and 40th degree latitudes in the Northern and Southern Hemispheres, placed in the Sunbelt, face increasing cooling needs on the one hand and higher solar irradiation on the other a compelling solution.

This document is the final report on activity D2 “Policy advise & financing models”. Activity D2b on financing models provides relevant information about new financing schemes suitable for solar cooling. As solar cooling solutions typically require high upfront capital expenditures. They may also be perceived as risky by potential clients due to their complexity or unfamiliarity with solar cooling technologies. These and other non-technical barriers underscore the importance of developing client- and service-oriented solar cooling solutions for greater market penetration – in particular in the Sunbelt regions. However, a common language in this interdisciplinary developmental area is missing, which limits effective communication and collaboration among stakeholders.

The aim of the Activity D2 results is to establish a common understanding of technical terms and core concepts in economics and financing that are necessary for the development of successful business and financing models for solar cooling. The following topics are covered:

1. Business Models vs. (Third Party) Financing.
2. Basic Financing Options for Solar Cooling Investments.
3. Business Models including Third Party Financing for solar cooling investments and services.
4. Life-Cycle Cost-Benefit Analyses (LCCBA) to support Business Model development and financing solutions.

This work shall serve as a basis for better informed discussions among technical and non-technical stakeholders from various disciplines, which are crucial for advancing client-oriented financing and business models to achieve greater market penetration of solar cooling solutions.

2 Scope of Activity D2

The scope of activity D2 is to investigate new financing schemes suitable for solar cooling considering the LCOE/LCC results of Subtask C to establish a sustainable market after accomplishing the technical barriers. Also, other business models like ESCo, CaaS (Cooling as a Service), leasing, World Bank soft loans and country specific models are considered.

3 Introduction

Technical solutions for efficient solar cooling systems have made significant advancements and have been successfully demonstrated (Jakob et. al, 2021; Beccali et. al, 2022; Neyer and Jakob, 2022; Jakob and Calderoni, 2023; Jakob et. al, 2023; Gurtner et. al, 2024; Jakob et. al, 2024). Despite these achievements, substantial non-technical barriers and risks frequently limit a widespread adoption of solar cooling systems in Sunbelt countries (and elsewhere).

A primary obstacle is the substantial upfront capital expenditure (CAPEX) required for solar cooling systems compared to conventional (mostly fossil fuel) alternatives (with high OPEX), which renders financing critical or unfeasible in certain instances. Also, potential clients' perception of risk due to complexity or unfamiliarity with solar cooling technologies further hinders the adoption process. These and other non-technical challenges underscore the importance of developing client- and service-oriented solutions to overcome financial and risk perception barriers. Addressing these challenges is crucial for expediting the adoption and implementation of solar cooling technologies.

Quite some hopes are placed on Third Party Financing (TPF) and energy service business models (BM), also known as ESCo models, to overcome these barriers. ESCo's shall serve as a 'delivery mechanism' for solar cooling solutions on the way to higher implementation rates. Developing suitable financing options and BMs necessitates collaborative discussions and joint efforts involving solar cooling engineers, researchers, investor and financing communities, potential clients and off course policy support.

The aim of this report is to establish a common foundation of technical terms and core concepts for the development of successful business and financing models for solar cooling. Specifically, in interdisciplinary exchanges, comprehension and accurate use of technical terms are essential for mutual understanding and driving innovation processes. Experience has shown that technical stakeholders and engineers typically need to understand some fundamental economic and financial business language. This understanding is crucial for gaining attention for their innovative solutions and engaging in meaningful discussions with decision-makers from economic backgrounds or with financing institutions.

Methodologically, this work is based on long standing experiences from other energy service sectors as well as IEA DSM Task 16[1], desktop studies, presentations and discussions with Task 65 experts. A case study application of the innovative solar thermal cooling technology 'SunBeltChiller' (Gurtner et. al, 2023) with a focus on Life-Cycle Cost-Benefit Analyses (LCCBA) was conducted in close collaboration with Task 65 participant ZAE Bayern from Germany. More case studies are planned for a potential follow up Task on 'Solar Cooling for the Global South'.

The following topics are covered:

1. Business Models vs. (Third Party) Financing: Definition and delimitation.
2. Basic financing options for solar cooling investments.
3. Business Models including Third Party Financing for solar cooling investments and services.
4. Life-Cycle Cost-Benefit Analyses to support Business Model development and financing solutions.

This work shall serve as a basis for discussions and further developments to advance solar cooling implementation in Sunbelt regions.

[1] IEA DSM Task 16: https://userstcp.org/task/task-16-competitive-energy-services/.

4 Business Models vs. (Third Party) Financing: Conceptualization and Delimitation

The goal of this section is to conceptualize the term ‘Business Model’ (BM). Moreover, we seek to delimitate the terms 'Financing’ in general, and ‘Third Party Financing’ (TPF) in particular, against BMs (which are sometimes confused or used interchangeably).

„We should make a clear distinction between business models and third-party financing – both terms are often mixed up.” Third party financing (TPF) can be part of a business model, but the latter goes well beyond financing (Epp, 2023).

In short: “A business model describes the rationale of how an organization creates, delivers and captures value” (Osterwalder and Pigneur, 2010). In other words, it encompasses the strategy and approach that a company takes to generate revenue and sustain itself. Besides the value creation and its sustainability within the company, a key focus is on the value proposition to the customer: What are ‘gain creators‘ and ‘pain relievers’ for the customers perspective?

According to Osterwalder and Pigneur, a business model typically consists of the following key building blocks:

- **Customers:** Segments, relationships, channels.
- **Value proposition to customers** (incl. ‚gain creators‘ and ‚pain relievers‘).
- **Value chain:** Key Activities, Resources and Partners.
- **Profitability**: Revenue streams and Cost structure (e.g. profit and loss account.)

Now where does financing come into the picture? As part of the value proposition to the customer, a BM may include ‘Third Party Financing’ arrangements for the customer’s investment. This may be the case in energy service models as follows: An energy service company (ESCo) pays for installations at a customer’s premise. In return it receives performance-based payments for energy services delivered in the framework of a long-term contractual agreement. Other potentially relevant forms of TPF include Integrated Utility Services (IUS) models, operate and financing leases or vendor credits (see Chapter 0).

In summary, TPF can be distinguished from the broader BM framework in the following ways: TPF may serve as a vital component of a business model's value proposition to customers, offering access to necessary capital without high upfront financial burden. However, TPF is just one aspect among several in the value proposition. Other customer benefits typically include long-term performance and price guarantees, as well as risk outsourcing to an ESCo and sustainability improvements. Therefore, a BM encompasses various elements beyond TPF to provide customer benefits. By distinguishing between the broader BM and specific financing methods, stakeholders can better comprehend and assess the strategic and financial aspects of a business model and its value proposition.

Furthermore, regarding financing, it should be noted that a BM typically does not answer the question where financing of investments or operational expenses is sourced from and how it is being securitized.

The next section provides a general overview of financing options for solar cooling investments.

5 Overview of Basic Financing Options for Solar Cooling Investments

Financing is a prerequisite to facilitate (most) economic activities. It involves providing the necessary capital or funds to individuals, businesses, or organizations, allowing them to invest in assets and to undertake projects. In simple terms: How the necessary capital is obtained, allocated, and repaid.

Financing is primarily concerned with the sourcing of funding, structuring of debt and equity, utilization of financial resources and the management of financial risks. Unlike financing, funding doesn't necessarily imply a repayment obligation (e.g. in crowd funding arrangements).

Another important conceptual delimitation: The term 'Financing' should be clearly distinguished from the terms 'economics' and 'profitability'. In the context of solar cooling projects or programs, economic assessments are typically concerned with evaluating economic (pre-) feasibility and investment-grade viability. These are based on revenue or saving cash flows, costs (capital expenditure CapEx, fixed and variable operating expenditure OpEx, replacement investments), assessments of profitability and other benefits (e.g. 'Multiple Benefits of EE'), risks and risk mitigation measures, or overall economic impacts. However, economic calculations do not answer the question where financing of investments or operational expenses can be sourced from.

By way of **overview**, the following **six general financing schemes** for solar cooling endeavours in the Sunbelt regions can been distinguished (more details on next pages) => *followed by a short solar cooling applicability assessment*:

1. **Self-financing**: **Standard hybrid funding model** consisting of
   x% **grant** + y% **debt** (commercial or soft loans) + z% **equity.**
   => *most common form of commercial financing. Requires availability of credits as well as creditworthiness of the debtor and the necessary equity portion (typically 20%-30%)*.

2. **Crowdfunding platforms** & **Community Financing:**
   => *typically for individual smaller-scale projects (not qualified for traditional financing options). Often fostering local/regional, community involvement.*

3. **Public finance**: **Grants | Soft loans | Guarantees** (securities)
   => *limited to market entry / transition period; Mostly co-financing or guarantees only.*

4. **Development aid** (e.g. by ADA, GIZ, KfW, AfD, DANIDA, EBRD, EIB ...):

   - **Technical development aid** typically focuses on policy framework, (pre-)feasibility studies, capacity building or
     => *individual demonstration projects only.*

   - **Financial development aid: Concessional / soft loans + technical assistance**
     => *Requires program volumes of 10-50 Mio EUR and local counterpart for program execution.*

   In quite a few countries and aid institutions, technical and financial aid programs are combined.

5. **Third Party Financing** (TPF), typically as part of a **supplier business model**:

   - **Vendor credits** => *short-term only, equipment only, no services*

   - **Leasing** (operate or finance) => *‚fungible' (= re-usable) assets only*

   - **Energy Services** ("ESCo", "Contracting"): => *comprehensive, long-term and site-specific contractual service agreement, e.g. ‚Cooling as a Service'.*

   - **Integrated Utility Services** (IUS) => *‚on-bill' re-financing, mid-term, e.g. demonstrated in US or Caribbean.* (for more details, please refer to section 0).

   Special Purpose Vehicle (SPV):
   => *restricted to large scale and profitable projects or programs (>10-20 Mio EUR investment volume).*
   For more details, please refer to Chapter 0.

A few more detailed explanations regarding some of the above general financing schemes:

re. 1.: ***A standard self-financing hybrid funding model*** consist of a mixture of grant money (if available), debt (commercial or soft loans) and equity capital, which can be put into a simple formular: x% **grant** + y% **debt** + z% **equity**.

Depending on their risk assessment, financing institutions will typically require a 20%-30% equity portion in a funding arrangement.

Here's a breakdown of each component:

a. **Grants** are non-repayable funds provided by governments, foundations, or other organizations to support specific projects, programs, or activities.
Grants do not require repayment and are typically awarded based on criteria such as 'additionality' to business as usual, project feasibility, impact, and alignment with the grant provider's objectives.
Grants can cover various expenses, including research and development, infrastructure, capacity building, and community development.

b. **Debt financing** involves borrowing funds from lenders, such as banks or other financial institutions, or bondholders, with the obligation to repay the principal amount plus interest over time.
Debt can take various forms, including bank loans, lines of credit, bonds, or other debt instruments.
Debt financing provides access to capital to finance projects or operations while allowing the borrower to retain ownership and control of the business or project.

c. **Equity** in a simple sense refers to an investor's own funds in a project.
In the context of companies, **equity financing** involves raising capital by selling ownership stakes in the business or project to investors, such as venture capitalists, angel investors, or private equity firms.
Equity investors provide funds in exchange for shares or ownership interests in the business, entitling them to a portion of the company's (hopefully future) profits and voting rights.
Equity financing does not require repayment like debt but involves sharing ownership and potentially relinquishing some control over the business.

A standard hybrid funding model combines these funding sources in a strategic and balanced manner to optimize capital structure, mitigate risk, and maximize financial resources for the project or business. By leveraging grants, debt, and equity financing, organizations can access a diverse range of funding options tailored to their specific needs, objectives, and risk tolerance.

re. 5.: **Third Party Financing** (TPF) as part of **supplier business models**:

a. **Vendor credits** for solar cooling equipment => Short-term only, typically no services included.

Vendor credit refers to a financing arrangement in which a vendor or supplier extends credit terms to a buyer for purchasing goods. Instead of requiring immediate payment at the time of purchase, the vendor allows the buyer to defer payment to a later date, typically within a specified period, such as 30, 60, or 90 days. This form of credit facilitates transactions between businesses by providing flexibility in managing cash flow and working capital. Vendor credit arrangements may also include discounts for early payment or interest charges for late payments, depending on the terms negotiated between the buyer and the vendor.

b. **Operate leasing** *=>: ‚Fungible' (= re-usable) assets only, short- to mid-term, recorded on the lessor's books.*

A lessee (the individual or entity leasing the asset) obtains the right to use the asset for a specified period without assuming the risks and rewards of ownership. The lessor (the owner of the asset) retains ownership of the leased asset and is responsible for maintenance, repairs, and other operating expenses associated with the asset.

Operating leases are typically short- to mid-term agreements. At the end of the lease term, the lessee has the option to return the asset to the lessor, renew the lease, or purchase the asset at fair market value. Operating leases are often used for equipment, machinery, vehicles, and other assets that have a relatively short useful life or are subject to frequent technological advancements.

c. **Finance** (or captial) **lease**: => *Mid- to long-term, recorded on the lessee's books.*

Here the lessee assumes most of the risks and rewards of ownership associated with the leased asset. The lessee must treat the leased asset as if it were purchased with borrowed funds and records the asset and corresponding liability on its balance sheet. Unlike operating leases, finance leases typically cover the majority of the asset's useful life, and the lessee is responsible for maintenance, repairs, and other operating expenses associated with the asset. At the end of the lease term, the lessee may have the option to purchase the asset at a nominal price or return it to the lessor.

Finance leases are often used when the lessee intends to use the asset for a significant portion of its useful life and wants to benefit from ownership rights, such as depreciation deductions and potential tax benefits. In summary, finance leases involve long-term agreements where the lessee assumes ownership-like responsibilities and treats the asset as if it were purchased.

re. 5.: **Crowdfunding platforms & Community Financing:**

Soliciting small contributions (either as non-repayable grant or (typically unsecured) loan) from a larger number of individuals and local communities to pool resources to finance energy projects. This approach fosters community involvement and can provide access to capital for smaller-scale projects that may not qualify for traditional financing options.

It is important to note, that in any financing scheme, **lenders prioritize ensuring repayment of their funds**. And they will analyze KPIs like 'Cashflow available for Debt Service' (CFADS) and 'Debt Service Cover Ratio' (DSCR). Lenders will also consider factors such as collateral, securitization, and risk-sharing, while also emphasizing the importance of borrowers having a financial stake in the investment ("skin in the game"). This approach helps mitigate risks and fosters a more secure lending environment.

For further reading, a publication titled "Financing Options for Energy-Contracting Projects – Comparison and Evaluation; A Manual for ESCos, ESCo Customers and ESCo Project Developers including Good Practice Examples and Calculation Tool' is recommended. The conference paper suggests a structured customer demand profile to systematically describe a lenders financing requirement (in 6 categories). This customer demand profile is then compared to the standard properties of different financing options (credits, operate and finance lease and forfaiting) and advantages and disadvantages are discussed. (Bleyl and Suer 2010).

6 Business models including Third Party Financing for Solar Cooling Investments and Services

A BM's value proposition including TPF revolves around offering a turnkey solution for solar cooling without the need for high upfront investment or operational responsibilities by the customer. Other key customer benefits should be performance and price guarantees, outsourcing of technical and economic risks and sustainability improvements. If designed well, an ESCo model should align the interests of both partners and encourages collaboration towards shared environmental and financial goals.

The following basic BMs including TPF for Solar Cooling Services can be distinguished *=> followed by a short core product to clients and solar cooling applicability:*

1. **Energy services** ('ESCo', 'Energy-Contracting' models), *e.g. ‚Cooling as a Service',*
   => Two basic BMs: a. Supply of cooling energy or b. Savings of final energy for cooling:
   a. **Energy Performance Contracting** (EPC): => Guaranteed s*avings against a (fossil) fuel and/or electricity cost baseline [**N**Wh_{Saved}]*[2] (Lovins, 1990).
   b. **Energy Supply Contracting** (ESC): => Metered *supply of cooling energy [**M**Wh_{Cool}]*
   c. **Integrated Energy Contracting:** Following the 'Savings First' principle, this ESCo model is an innovative combination of the above EPC and the ESC models (Bleyl-Androschin et. al, 2009).
2. **Integrated Utility Service (IUS)**: A utility-based ESCo-type program approach, where a utility's investments (typically behind the meter) are re-financed through ‚on-bill' re-payments (a separate line item on the utility bill).

   => *Applicable in particular for EE or RE program role outs for smaller customer investments in the household, SME and public sector markets.*
3. **Special Purpose Vehicle (SPV)**: A dedicated legal entity (project company), created solely for the purpose of executing a specific energy project, often used to ring-fence risks and liabilities associated with the project from the sponsoring company.

   => *Restricted to large scale and profitable projects or programs >10-20 Mio EUR investment volume.*

A basic set up of a solar cooling BM incorporating TPF and its value adds for customers ('gain creators' and 'pain relivers') may look like this: An ESCo's value proposition is to install and operate a solar cooling system at a customer's production facility (e.g. for food processing or for district cooling) at its own expense. The ESCo's remuneration can be based either on metered Megawatt hours (MWh) of cooling energy delivered (Energy Supply Contracting (ESC) model) or on energy savings delivered against an electricity consumption baseline (Energy Performance Contracting (EPC) model). In both cases, a long-term contractual agreement is required to repay the ESCo's investments, typically in the range of 10 to 15 years. Depending on the risk assessment and other circumstances, a building cost contribution for the initial investment may be required form the client. Shorter contract terms are possible but will require higher upfront CapEx contributions by the customer. A shared financing approach between ESCo and customer is often leads to the best solution for all parties involved.

Based on the above basic service offering, ESCo models should and can be adapted flexibly to the customers (and ESCos) needs.[3]

[2] 'Negawatthours'.

[3] Further reading on the two basic ESCo business models can be found here for example: Bleyl-Androschin, Jan W. und Ungerböck, Reinhard. 2009: *What is Energy Contracting (ESCo services)? Concept, Definition, Two Basic Business Models,* IEA DSM Task 16 Discussion Paper.

A few more detailed explanations regarding some of the above basic BM schemes:

re. 2.: **Integrated utility services: Investments for solar cooling are repaid on utility bill**

A utility-based on-bill repayment model may be particularly suitable for Sunbelt countries with weaker economies. “You will rarely find technology companies for example in the Caribbean islands apart from the electricity suppliers that can conclude an energy service or leasing contract over 10 years for a household solar cooling unit” (Epp 2023).

On-bill repayment is widely used in the United States for energy saving measures or heating upgrades in the residential sector. Here the asset including the re-financing agreement can be sold with the house if the owners have to move. Bleyl has already accompanied the implementation of efficiency measures in four Caribbean countries using the business model of integrated utility services. Bleyl added: “Utilities stand for long-term relationships, so they are a brilliant partner for the dissemination of demand-side energy efficiency and renewable technologies.”

re. 3.: **Special purpose vehicles help mitigating risks**

Special purpose vehicles (SPV) are widespread e.g. in the wind farm or large-scale PV sectors. A dedicated outsourced legal project entity is established, which plans, builds, finances and operates the energy production units and signs all the relevant documents like EPC contracts, O&M agreements or loans contracts. “The advantage is that you can separate the risks of large investment volumes from the core company. However, transaction costs are high, and this business model is therefore only suitable for investment volumes of typically at least 10 to 20 million EUR.” (Epp, 2023)

While BM including TPF may offer a number of advantages, it's important to note that the successful implementation requires careful planning, a customer-centric approach, and often a cultural shift (towards outsourcing) within the organization.

To avoid misunderstandings: Any outsourcing strategy to an ESCo or any other BM should be seen as a ‘delivery mechanism’ to support the achievement of a companies or an institutions’ goals. Implementing a project with in-house resources is just as good – as long as it is being done (reasonably well). However, waiting or not implementing EE and RE opportunities should not be a viable option in the light of the energy and climate crises. If in-house resources are limited or too scarce, an outsourcing model should be evaluated (if available). For the purpose of comparison plans for a self-implemented and -financed solar cooling system may serve as a reference case for comparison to outsourced options.

7 Life-Cycle Cost-Benefit Analyses (LCCBA) to Support Business Model Development and Financing Solutions

The development and implementation of BM and financing solutions for solar cooling requires sufficiently detailed economic and financial modeling tools and capacities. Basically, assessments based on dynamic cash flow models are needed. Profit and loss accounting or 'engineering economics'-type assessments (such as economic comparison of investment alternatives based on VDI 2067 (VDI, 2012) or Ö-Norm 7140 (AS, 2021) or the like) are not suitable or sufficient to satisfy 'financial engineering' or due diligence process or requirements.

As an important part of the Task 65 activities, an investment, and Life-Cycle Cost-Benefit Analyses (LCCBA) tool has been adapted to facilitate modeling of solar cooling solutions. For further details, please refer to Task 65 Activity C3 report.

The following offers a high-level overview of possible applications and tasks in the realm of solar cooling systems that dynamic LCCBA models can support:

1. Develop a tailored **solar cooling strategy** focusing on economic, financial, and environmental targets and measures specific to a company or country.
    a. Conduct **pre-feasibility and feasibility assessments for projects**:
    b. Evaluate **economic viability** using key performance indicators (KPIs) such as IRR, NPV, and dynamic payback period.
    c. Assess **financial viability** using KPIs like CFADS and DSCR, and implement financial engineering strategies for feasible financing and optimization.
    d. Calculate the **generation cost** of solar cooling facilities and determine Levelized Cost of Cooling (LCoC) or savings (LCoS) in EUR/MWh produced or saved.
    e. Evaluate different variants, scenarios, and sensitivities to optimize project outcomes.
2. Develop **business models and value propositions for Energy Service Companies** (ESCOs) and perform cost and price calculations for service offerings.
3. Provide support for **financial due diligence processes** during project evaluation.
4. Perform **risk assessments** including scenario analysis, 'What-if' scenarios, and quantification of risks.
5. Offer **management and planning support** for solar cooling projects or programs.
6. Assist in **contract negotiations** with clients and suppliers, including calculation of negotiation targets and scope.
7. Prepare **project documentation** for decision-makers, financial institutions, and other stakeholders to demonstrate project bankability and achievements.
8. Conduct **policy assessments** related to solar cooling initiatives and projects.

Comprehensive LCCBA applications, case studies and further developments are planned for the IEA SHC follow up Task 'Solar Cooling for the Global South'.

8 Bibliography

Austrian Standards (2021). *ÖNORM M 7140: Betriebswirtschaftliche Vergleichsrechnung für Energiesysteme nach dynamischen Rechenmethoden (Comparative business calculation for energy systems using dynamic calculation methods)*. https://www.austrian-standards.at/de/shop/onorm-m-7140-2021-01-15~p2560557

Beccali, M., Vasta, S., Weiss, W., Baby, B.A. and Bonomolo, M. (2022). *Adapted components and showcases on solar cooling systems in sunbelt region countries.* EuroSun 2022, ISES conference proceedings, Kassel, Germany, doi:10.18086/eurosun.2022.06.02

Bleyl-Androschin, J. W., Schinnerl, D. and Ungerböck. R. (2009) *Integrated Energy Contracting (IEC) A New ESCo model to Combine Energy Efficiency and (Renewable) Supply in large Buildings and Industry*. ECEEE Summer Study.

Bleyl, J. W. and Mark S. (2010) *Comparison of Different Finance Options for Energy Services Customer Requirements for Financing Energy Service Projects*. Building Performance Congress 33:1–14. Please feel free to contact the author for a .pdf copy (office@energetic-solutions.eu).

Epp, B. (2023) *Business and financing models – a clear distinction*. IEA SHC Task 65 News, February 27, 2023, https://task65.iea-shc.org/article?NewsID=448

Gurtner, R., Bleyl, J. W., Jakob, U. (2023) *Sunbelt Chiller – An Innovative Solar Cooling Adaption*, IEA SHC solar update, Vol. 78, December 2023, https://task65.iea-shc.org/Data/Sites/1/publications/2023-12-Task65-Sunbelt-Chiller.pdf

Gurtner, R., Schmetzer, T. and Riepl, M. (2024). *The SunbeltChiller – A solarthermal cooling system for the Sunbelt.* ISEC 2024, Conference proceedings, Graz, Austria

Jakob, U., Vasta, S., Weiss, W., Neyer, D. and Kohlenbach, P. (2021). *Solar Cooling for the Sunbelt Regions.* SWC 2021, ISES conference proceedings, virtual, doi:10.18086/swc.2021.30.01

Jakob, U. and Calderoni, M. (2023). *Chapter 5.5. Solar Air Conditioning and Cooling*. In W. Weiss & M. Spörk-Dürr (Ed.), Solar Heat Worldwide – Edition 2023 (pp. 32-35). IEA SHC. doi:10.18777/ieashc-shw-2022-0001

Jakob, U., Vasta, S., Weiss, W., Neyer, D. and Kohlenbach, P. (2023). *Solar Cooling for the Sunbelt Regions – Results from Task 65 activities.* SWC 2023, ISES conference proceedings, New Delhi, India

Jakob, U., Neyer, D. and Ostheimer, M. (2024). *Solar cooling for the Sunbelt regions – Highlights from Task 65 activities.* ISEC 2024, Conference proceedings, Graz, Austria

Lovins, A. B. (1990) *The Negawatt Revolution*. Across the Board XXVII (9):18–23.

Neyer, D. and Jakob, U. (2022). *New IEA SHC Task 65 – Solar cooling for the Sunbelt regions.* ISEC 2022, Conference proceedings, Graz, Austria

Osterwalder, A. and Pigneur Y. (2010) *Business model generation*. Zurich

VDI-Gesellschaft Bauen und Gebäudetechnik (GBG) (2012) *VDI 2067: Wirtschaftlichkeit gebäudetechnischer Anlagen Grundlagen und Kostenberechnung (Economic efficiency of building installations. Fundamentals and economic calculation)*. In Norm (Issue September). https://www.vdi.de/richtlinien/details/vdi-2067-blatt-1-wirtschaftlichkeit-gebaeudetechnischer-anlagen-grundlagen-und-kostenberechnung-1