Exploring the Potential of the Seychelles Pension Fund to Finance the Renewable Energy Transition

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1 Introduction

The preceding *SRJ* article *A Strategic Approach towards 100% Renewable Energy in Seychelles* assesses impacts, barriers and required activities for implementing an energy supply system based on 100% renewable energies until 2035 (named SeyRES 100, see Wehner, Dransfeld and Köhler, 2020). It concludes that the mobilization of sufficient capital for covering the investment needs for renewable power capacity, transmission and distribution grids as well as storage facilities represents potentially the most crucial challenge in the context of the SeyRES 100 realization. While those investments will strongly depend on the applied regulatory framework and related incentive mechanisms, it is likely that large shares of the overall volume have to be mobilized from public or private investors with institutional scale. As outlined in Wehner et al. (2020), an approach of shifting the full responsibility for SeyRES 100 investments to the parastatal Public Utility Company (PUC) or the public budget will not be feasible as Seychelles is recovering from a severe balance of payments and debt crisis that hit the country in 2008. Due to consecutive IMF programs, Seychelles has only limited public resources to support climate-related projects. The country is therefore dependent on mobilizing further, adequate financing. Among the solutions suggested by the IMF are an effective use of Public Private Partnerships, finding external debt sources and creating further fiscal space over the medium-term through shifting resources from other sectors such as social welfare (see International Monetary Fund, 2017, pp.52–56). To conclude, investments for the energy transition will either lead to reduced public services or rely on the mobilization of significant amounts of international or domestic private capital.

In order to reflect an economically sound option that is beneficial for a majority of the Seychelles' population and in line with the Government's debt reduction strategy, this article explores the potential of leveraging domestic pension capital to finance elements of the energy transformation. It builds on the draft assessment by Köhler (2020, pp.178-224) that analyses the suitability of Sustainable Infrastructure Pension (SIP) systems for financing energy transition investment needs. In the Seychelles context, it is explored whether and how the public Seychelles Pension Fund (SPF) can invest domestically in sustainable energy infrastructure.

2 Methodology

This article discusses SPF's potential role in SeyRES 100 and demonstrates advantages and disadvantages for the Seychellois population associated with such an innovative financing approach. The key objectives are to explore:

- whether the SPF is eligible and suitable for investments in SeyRES 100 assets;
- what volume of SeyRES 100 investment needs could be matched by SPF resources over the energy transition implementation period;
- what benefits and drawbacks can be expected by increased investments of private pension capital in sustainable energy assets.

For exploring those elements, the following four step methodology is applied (see Köhler, 2020, p.28ff).

First, the suitability and eligibility of the institutional structure and management procedures, including the investment guidelines, are analysed based on a literature review. Gaps and limitations are highlighted and solutions to address those are derived.

Second, a spread-sheet model simulates quantitatively the long-term potential for SeyRES 100 engagement. For assessing financial in- and outflows of the assessed pension schemes in the context of this thesis, a combined approach of available demographic and macroeconomic data assumptions and cash-flow analysis stemming from financial statements is interpreted as suitable, particularly due to its focus on viability and liquidity. In general, the cash-flow statement provides information about the cash efficiency of operating, investing and financing activities as well as liquidity and solvency of the institution itself (see Brycz and Pauka, 2012, p.5). From the perspective of energy transition investments, the application of non-levelized cash flows for any given point of time in the future is also deemed appropriate by several long-term energy scenario developers (see e.g. OECD/IEA, 2017, p.62: Singer et al., 2011, p.193ff). Taking these findings into account, the quantification model applied in the context of this article depends on several in- and outflow parameters. Most important elements are the demographic development of the population as well as cash inflows and outflows of the fund (see Figure 1). An analysis of SPF inflows can be separated by mandatory or voluntary contributions on the one hand and investment income on the other hand. The latter can be separately expressed by interest on typical assets such as government bonds, bills and bank accounts, dividends from stock equity or rental income from real estate values. Additionally, capital redemptions from debt investments with maturity frequently flow back on SPF's virtual balance sheet and require reinvestment. Cash outflows from the SPF can be distinguished by benefit payments for retirees and potentially other benefits as well as capital allocation to new investments. Further, the SPF system

operations inherit transaction costs for administrative purposes or asset management expenses.

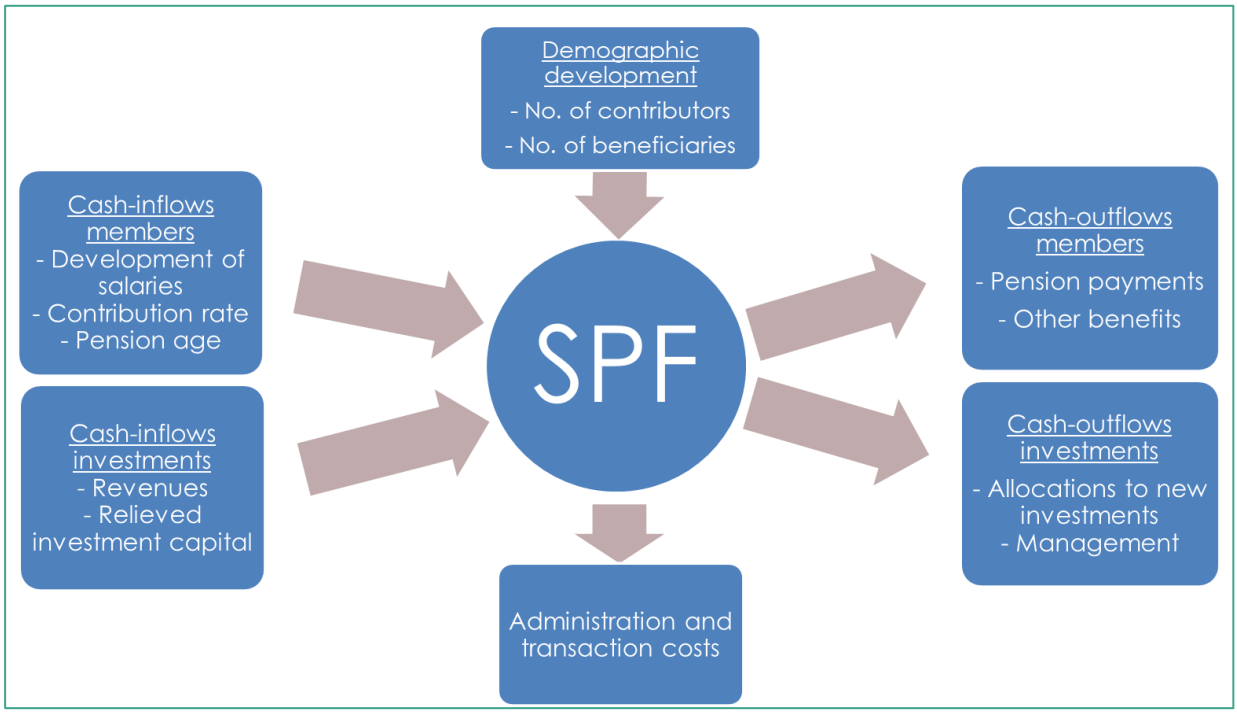

Figure 1: Elements influencing SIP systems' future cash flow as considered in the simulation models of the case studies
Source: Own illustration based on Köhler (2020, p.30)

As a third methodological step, the advantages and disadvantages of a SPF engagement in financing SeyRES are discussed qualitatively. This assessment builds on IPCC's (2014, p.235ff) suggestion of policy objective categories for evaluating climate-related policies. They are clustered according to an economic objective including efficiency, effectiveness and transaction costs, distributional objectives including acceptance, fairness and equity, as well as the institutional and political feasibility.

Finally, conclusions and recommendations suggest how a SPF engagement can be realized, what limitations are given, and what actions would be required from the SPF and the Government.

3 Results and discussion

3.1 Assessment of the SPF's structure and operation

The SPF is a publicly controlled institution providing payments to pensioners, their widows, widowers and orphans as well as disabled persons, thus representing a key

cornerstone of the Seychellois social system. It is financed by contributions from employers, employees including self-employed, and investment returns. In order to explore whether it can play a key role in financing SeyRES 100 assets, it is necessary to understand its objectives as well as its operational and management procedures.

3.1.1 Elements of the Seychelles pension system

The Seychelles retirement system in the year 2019 is based on two elements. Representing the first pillar of basic and universal non-contributory protection, an income-tax financed 'old age pension' of USD 370 (SCR 5,050)[1] per month is provided to all citizens above 63 years (see Seychelles Legal Information Institute, 2010). The second element is based on a defined-benefits scheme managed by the SPF. It is financed by contributions from employers and employees as well as the self-employed. Surplus contributions are invested to yield maximum returns in order to strengthen the financial position of the SPF and build capital stocks for future retirees. Permitted investments include government bonds, equity shares of companies, direct lending to governmental entities and, in particular, real estate property development.

3.1.2 Contributions and pension payments

The SPF is mainly financed by member contributions and revenues from its investments. Currently the SPF has about 44,000 active members contributing to the system. Legislation in 2018 requires employees to transfer 3% of their monthly gross salary to the SPF. Employers additionally contribute 3% of the employees' gross earnings (SPF, 2017b). There are further plans for gradually increasing the combined contributions of employees and employers to 10.5 % by 2035, translating into 1-2% increases all five years (see Seychelles News Agency, 2017a). Total contributions amounted to about USD 25 million (SCR 350 million) in 2018 (SPF, 2019, p.10). As a direct-benefit scheme, the long-term benefits of its members are pre-calculated, depending on the members' gross salary for the last five years before retirement. The SPF maintains an account for each member, tracking compulsory and voluntary contributions as well as interest accumulated.

At the age of 63, with the option of early retirement at the age of 60, the individual pension payment is calculated based on a transparent formula and the disbursement starts. It is infinite until death and frequently adjusted to inflation which was between -1% and 4% during the last five years (Central Bank of Seychelles, 2019, p.21). The Government announced plans for increasing pensionable ages to 63 and 65 respectively by 2023 (see Seychelles News Agency, 2017b). In 2018, about USD 16 million (SCR 223 million) have been disbursed as

[1] all values given in Seychelles Rupees (SCR) are translated with the average 2018 SCR/USD currency exchange rate provided by the Seychelles Central Bank (2019, p.52)

pension payments, additional USD 4.5 million (SCR 63 million) as other benefits (see SPF, 2019, p.10).

3.1.3 SPF's investment guidelines and portfolio

Regulated by the Pension Fund Act from 2005, the SPF has defined investment objectives and permissions. Its investments have to aim for capital preservation, earn highest yields with minimal risks, diversify its portfolio, consider sufficient liquidity and guarantee cautious and prudent fund management. The investment strategy published in 2018 adds investment portfolio targets for the years 2022 and 2027. Permitted investment options and their respective targets include (SPF, 2018b, 2017a, p.3ff) the following.

- Bank deposits (target of 5% of portfolio assets by 2027).
- Fixed income mainly related to bills and bonds issued by the Seychelles Government (up to 30% by 2027).
- Equity investments in companies with five or more years of good profitability and stability. Investments in new companies are subject to independent due diligence analysis. Generally, equity investments in one company shall not exceed 20% of the total shares (up to 30% by 2027).
- Real estate development, including freehold and leasehold properties (target of 35% by 2027).
- Direct debt lending to the Seychelles Government or Governmental entities, depending on sufficient securities (no specific range given).
- Investments with social impact (0% to 5%).

SPF can jointly invest with partners, subject to due diligence analysis. The minimum average rate of return is 7%. Further, the SPF shall act as a conservative investor that considers typical risks for institutional investors. Among these are the risk for solvency and mismatch, liquidity risks, long-term underperformance, credit risks, market risks as well as interest rate and foreign exchange risks. By the end of 2018, SPF's investment portfolio relies mainly on domestic real estate assets, representing about 50% of the portfolio. The remaining shares are distributed across different domestic investments, particularly listed equity in Seychelles Breweries and the insurer SACOS, Government Bonds and Bank Deposits. This portfolio generated about USD 12.5 million of revenues in 2017, the average rate of return was at 9% (see SPF, 2019, p.35ff).

3.1.4 Development benefits of the SPF investments

By regulation, the primary objective of the SPF is to provide attractive and sustainable returns on investment for the benefit of its members. However, since the investments of the Social Security Fund in real estate construction and

parastatal entities at the beginning of the 1980s, the Seychelles social protection system has also been linked to the economic and social development of the country. The SPF continues this tradition by investing about 50% of all inflows into real estate since its inception in 2005. As SPF representatives highlight, "these projects are aimed at providing office accommodation, trade outlets and business and commercial accommodation, which are in great demand. Hence, they help to develop the capital city of Victoria, bringing forth further improvement in the country's economy and providing, among other national benefits, business and employment opportunities" (Seychelles Nation, 2011). In its 2017 Annual Report the SPF Investment Committee explicitly highlights the need to diversify the investment portfolio and shift the focus towards long-term opportunities. Further it is posited that impact investments, especially in the environmental and renewable energy sector, will be seriously considered as they "generate beneficial social or environmental impact alongside good financial returns" (see SPF, 2018a, p.84). According to SPF staff, the Board has already signalled general eligibility of renewable energy investments (SPF Staff, 2018).

3.1.5 Barriers and solutions for energy infrastructure investments

To date, SPF has not engaged in energy infrastructure investments. The underlying reason is that such potential SPF engagement faces significant entry barriers.

First, there is no SPF internal experience yet with investments in energy infrastructure such as renewable capacity, transmission grids or storage facilities. Internal expertise on the characteristics as well as regulatory, business, administrative and technical risks is required to take comprehensive due diligence and eventual investment decisions. There is the need to learn from practical examples while blueprint and pilot renewable energy projects hardly exist in Seychelles.

Second, the underlying legal, regulatory and economic incentive framework for large-scale investments in renewable energy does not yet exist. With envisaged international support, the Seychelles Government attempts to develop required enabling framework elements for the energy transition (see the preceding article by Wehner, Dransfeld and Köhler, 2020).

If the SPF intends to engage in energy transition investments, the development of an internal investment strategy will be required to address the identified barriers and gaps. Such a strategy would have to include a prioritization of particularly suitable elements from SeyRES 100 that match SPF's requirements in the best way. Furthermore, a SPF internal strategy could support the formulation of regulatory and financial incentive mechanisms by the Ministry of Environment,

Energy and Climate Change (MEECC), and the Ministry of Finance. A suitable regulatory framework would guarantee macroeconomic benefits to the Seychellois population through renewable power access for reasonable prices while taking into account the specific characteristics of the SPF, including for instance a suitable risk-revenue ratio, reflection of liquidity or the limitations regarding financial instruments such as direct lending. Training of existing staff, knowledge transfer from experienced institutions abroad and potentially hiring new experienced employees will be possible solutions to address these capacity constraints.

3.2 SPF's long-term potential for SeyRES 100 investments

So far it is unclear what SPF capital volumes could be leveraged for potential investments in the energy transformation until 2035. From a macroeconomic perspective it is highly relevant to understand the investment potential of available domestic and international funding sources. Since the MEECC, potentially supported by a SeyRES 100 Steering Committee, would have to manage and streamline the transformational process, it is of key importance that these institutions are provided with sufficient information on available domestic funding sources. Thus, this second part of the article explores the potential for SPF investments in SeyRES 100 elements. Hereby the methodology as presented in Section 2 has been applied to develop a spread-sheet based simulation model to quantitatively project the maximal available capital provisions for SeyRES investments until 2035 under current conditions. Furthermore, a sensitivity analysis reveals key parameters that significantly increase or decrease the available funding volume.

3.2.1 Assumed development of SPF parameters until 2035

The simulated scenario includes basic SPF parameters and developments that are discussed in Sections 2 and 3.1 above. The most important elements are the demographic development of the population as well as cash inflows and outflows. An analysis of SPF inflows can be separated by contributions on the one hand and investment income on the other hand. The latter depends on the underlying short-, mid- and long-term assets with specific characteristics. Additionally, capital redemptions from debt investments with maturity frequently flow back on SPF's balance sheet and require reinvestment. Cash-outflows from SPF can be distinguished by benefit payments for retirees and payments for permanent incapacity as well as capital allocation to new investments. Further, SPF operations inherit transaction costs for administrative purposes, property management and minor other expenses. Concerning new investments, the model allocates investments according to the internal Investment Policy and Strategy that represent the guiding documents for the SPF operational management. Predefined asset class ranges and targets, based on the value of the portfolio, determine possible investment decisions. As SeyRES 100 investments would fall under long-term activities comparable to real estate, it is grouped accordingly. As the objective of the simulation is to reveal the maximum capital available for

SeyRES 100 investments, the model decreases the allocation for new short- and mid-term investments over time to achieve the above defined target range. Within three years the short-term investments are linearly reduced from ~20% to 10% and the mid-term investments from ~30% to 20%, while real estate allocation remains exactly on the level of the year 2019. This implies that no new real estate activities are realized. Thus, all additional available investment capital can be theoretically allocated for SeyRES 100 elements. Table 1 summarizes all discussed key parameters, lists the references and explains the assumptions that have been used for the simulation.

Table 1: Applied data for SIP simulations
Source: Compilation of research results

Parameter	Applied data/assumptions	Data source
Demographic & socio-economic development of population	Work force grows from 62,500 in 2020 to 65,500 by 2035 Population in retirement age grows from 10,000 in 2020 to 17,000 in 2035 Pension age increases to 65 years by 2023 Average gross salary grows from USD 9,500 in 2020 to USD 12,500 in 2035 (assumption based on historic growth rates)	(National Bureau of Statistics Seychelles, 2018, 2014)
SPF membership information	SPF contributors increase from 43,000 in 2020 to 46,000 in 2035 (assumption based on historic growth rates and demographic development) Number of SPF pensioners grows from 5,500 in 2020 to 11,500 in 2035 (assumption based on historic growth rates and demographic development) SPF contributions grow from USD 28 million in 2020 to USD 57.5 million in 2035 (assumption based on demographic development and contribution rate adjustments every 5 years: Contribution rate 2019: 6%; 2025: 8%; 2030: 9%; 2035: 10%) Benefit payments grow from USD 26.5 million in 2020 to USD 83 million in 2035 (assumption based on pension payment formula, inflation rate and demographic development)	SPF Annual Reports, 2014 - 2018
SPF investment information	Asset classes and shares of SPF according to SPF Investment Policy and Strategy Assumed rate of return of 9.9% for traditional investments (average value from 2013-2017) Assumed administrative expenses increase from USD 4 million in 2020 to USD 8.5 million in 2035 (assumption based on average increase rate of 10% between 2013 and 2017)	(SPF, 2018b, 2017a) SPF Annual Reports 2014 - 2018

3.2.2 Quantitative results: SPF's capital mobilization potential

The simulation describes an optimization of SeyRES 100 engagement through the fund. While real estate is fixed on the 2018 value and short- and mid-term investments are reduced to their minimum eligible allocation levels, all remaining capital is allocated to SeyRES 100 investments. Hereby the model applies a prioritization of different asset classes according to associated risks, revenue expectations, liquidity needs and the investment horizon. In the following, the SeyRES investment options are briefly discussed according to their likelihood for prioritization under SPF engagement. Hereby many assumptions depend on the future regulatory and economic incentive framework Seychelles envisages implementing in subsequent years.

- Renewable power capacity for electricity supply and e-mobility: This includes investments in solar PV, wind and biomass. According to Hohmeyer (2017, p.172) the most promising incentive model for SIDS is likely a feed-in-tariff. Its implementation would set attractive incentives particularly during the starting period to reward frontrunners and decrease the risk of initial investments. Thus, an average rate of return on equity of 13% and interest rates on debt at 10% seem to be in line with international investor expectations as analysed by e.g. OECD (2017, p.235f). This value is applied across all renewable power sources in the SIP simulation model. Associated technical risks are perceived as comparably low, as first experience has been gathered in Seychelles for wind power and solar PV. Internationally, the technologies are mature and are proven to be of increasing reliability. The aspect that SPF owns a significant share of buildings and related roofs requires special attention when estimating the rooftop PV investment potential. A satellite-based solar radiation mapping conducted for MEECC can hereby help in estimating the related energy potential (see Wehner et al., 2018, p.16). Typical investment periods for renewables are fixed at 20 years, applying across all renewable power sources. This is not an extraordinary long investment horizon compared to the real estate activities by SPF and the potential to liquify the assets is considered as medium due to the likelihood that a market for renewable assets might emerge over time in Seychelles. This has happened in other countries that increased the market share of renewables over time (see e.g. IRENA, 2018, p.37f). Overall, the model assumes that investments in renewable capacity are particularly attractive for the SPF during an initial phase of implementation when incentives are expected to be high while risks are expected to be already low due to international knowledge and experience with a mature technology.

- Extension of the power grid: An increased share of fluctuating renewable capacity requires an extension of both distribution and transmission grids. According to recent studies by the utility PUC, about USD 10 millions are

required for upgrading the low voltage grid in order to allow for electricity absorption from mainly PV plants (PUC, 2018). As PUC builds and operates the entire national grid in Seychelles, there exists currently no financing mechanism for grid investments that allows other investors to pose fees on power consumers. Assuming that such an incentive mechanism is implemented in the context of SeyRES 100, an expected return on equity of 10% and interest rates on debt of 8% are assumed, representing a lower value compared to the other traditional and SeyRES 100 assets (see also discussion in Section 0). Associated risks are considered being low as grid extension is a mature procedure and the grid operator, PUC, is familiar with the business. While the investment horizon is very long, lifetimes of more than 50 years are usual for electricity grids, the potential for liquifying the assets is considered as very low. There is no grid operator other than PUC that could purchase the assets and there exists no market of institutional investors interested in such assets in Seychelles. Also, international investors are not active in that field. Thus, investments in the power grid can be seen as a long-term option with very low risk and stable cashflows while market-access and liquification options are highly limited under the current market conditions.

- Electricity storage: As identified by Hohmeyer (2016, p.18), the most effective and efficient solution is a hydro pump storage plant. International experience shows that hydropower facilities inherit various potential risks, among these are social, environmental, static and economic risks (Moran et al., 2018, p.3f). The specific associated risks highly depend on the local conditions. Feasibility studies for Seychelles have not been elaborated yet thus making predictions about specific risks not possible. Thus, under conservative assumptions risks are ranked rather high. This is also reflected in an assumption of comparably higher rates of return on equity of 15% and interest rates on debt of 10%. While the investment horizon is considered as long, liquidity potential is comparably low as neither domestic investors nor international investors interested in such assets currently exist in Seychelles.

- E-mobility: The final stage of SeyRES 100 aims to transform the transport sector through the roll-out of e-mobility. This will require additional renewable capacity and some flanking infrastructure investments. Consistent to the other renewable energy investments, an average rate of return on equity 13% are assumed, interest rates on debt are simulated at 10% over an investment period of 20 years.

Based on these considerations the potential core investment elements for SPF will be renewable capacity during the initial five years of SeyRES 100 and a substantial investment volume for the storage facility during the main implementation phase

in the years 2025 to 2030, subject to the regulatory and economic framework as well as the outcome of respective risk feasibility studies. The model further distinguishes between equity and debt investments to reflect its different characteristics including varying revenues and transaction costs. Equity investments are depreciated over the asset lifetime while debt allocation is flowing back to the Fund at the respective maturity date. Generated revenues from the different SeyRES 100 assets also flow back to the Fund's balance sheet and can be reinvested in the following year.

The simulation for the first ten years of SeyRES 100 implementation (see Figure *2*) shows a constant volume of real estate assets (black line), a decline of short-term assets (red line) and medium-term assets (orange line) and a steep and rapid increase of the cumulated SeyRES 100 assets (green line). This growth path flattens towards the year 2030 and is interrupted between the years 2022 and 2024 due to increased benefit payments while contributions remain constant. In 2025 the contribution rate increases and allows for higher investments. By 2030, the total assets of the fund have reached about USD 250 million. The maximum SeyRES 100 share will be 23% of the total portfolio or about USD 60 million in cumulated, nominal values in the year 2028.

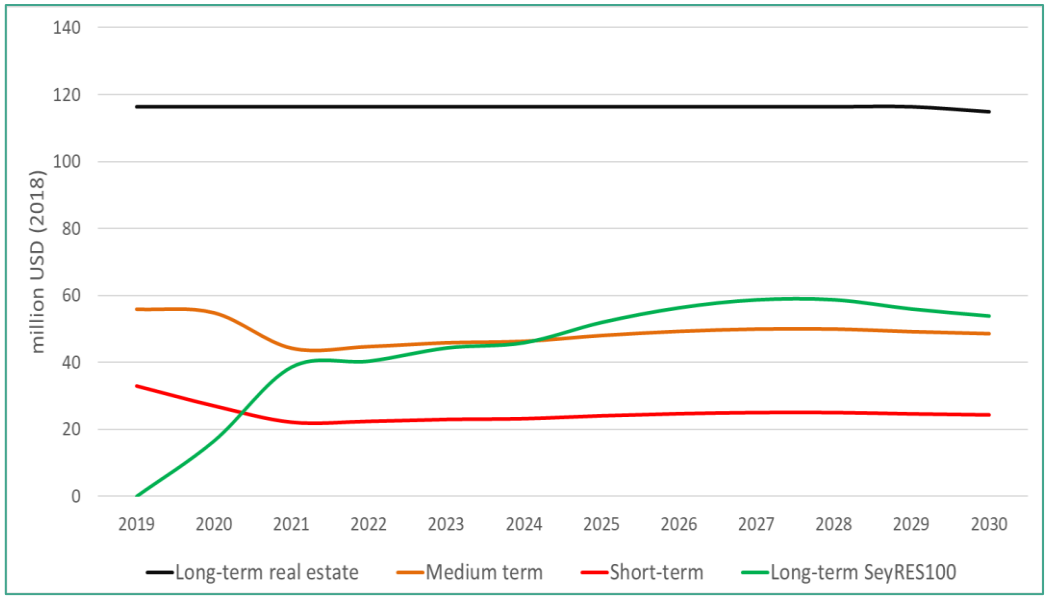

Figure 2: Simulated development of SPF asset classes for the first 10 years of SeyRES 100 implementation until 2030, in million USD$_{2018}$
Source: Own illustration based on Köhler (2020)

Beyond 2030, the simulated cash-flow predicts a decreasing potential for SeyRES 100 investments (see Figure 3). Due to demographic developments, the number of SPF retirees will increase faster than the number of active contributors leading to a negative contribution/benefit payment ratio under consideration of envisaged

pension levels and contribution rates. Despite increasing revenues from traditional and simulated SeyRES 100 investments, this negative ratio cannot be fully outbalanced, thus the fund will have limited investment options from 2029 onwards.

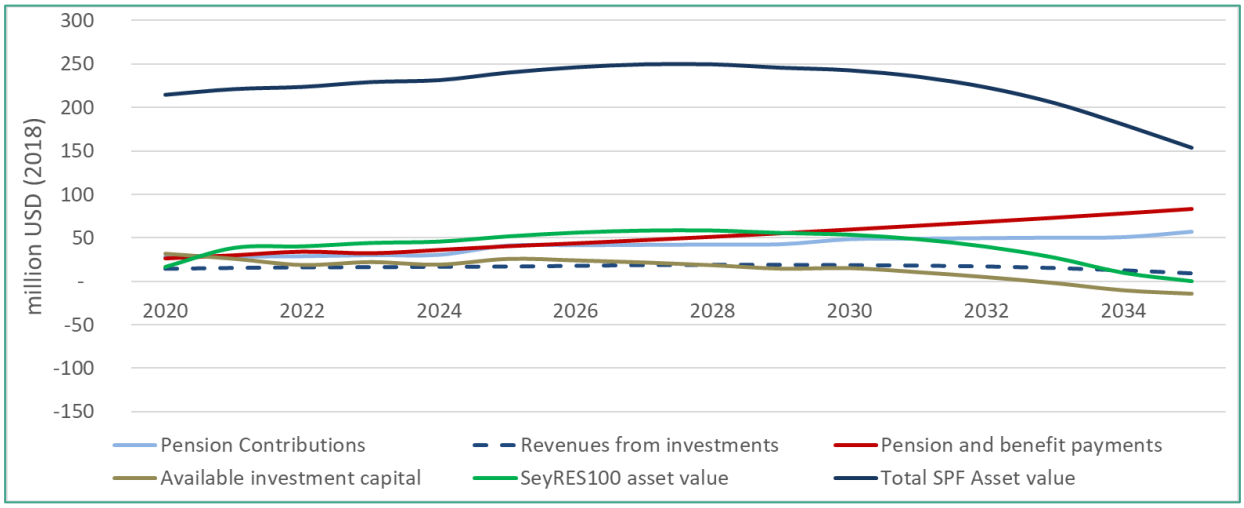

Figure 3: Simulated development of SPF cash-flows and asset portfolio until 2035, in USD$_{2018}$; SeyRES 100 scenario
Source: Own illustration based on Köhler (2020)

This trend is not caused by the SeyRES 100 investments. Contrary, their assumed average revenues are slightly above the ones from traditional investments thus they rather sustain the operation.

3.2.3 Sensitivity analysis for the SeyRES 100 scenario

The model also includes a sensitivity analysis that assesses key factors influencing the maximum volume of available capital for SeyRES 100 investments. It reflects varying investment revenues, particularly the equity related ones as well as an increase or decrease of the asset class ranges that influence the maximum SeyRES 100 investment volume. Furthermore the sensitivity analysis considers a deviated contribution rate, since the member contributions remain the key source of cash inflows over the whole assessed time period. Contribution rates in other countries, particularly developed ones, are significantly higher than in Seychelles. Many of those are between 15% and 25% of the gross salary (see Pallares-Miralles et al., 2012, p.44f). Finally, also an adjustment of the benefit payment level as major outflow of the SPF is considered.

The sensitivity analysis demonstrates the deviation of the maximum SeyRES 100 investment potential by the year 2028. This year has both the highest total asset portfolio value and, with about USD 60 million, the highest investment value for SeyRES 100 elements. As demonstrated in Figure 4, it is mainly the level of

payments and contribution rate that can increase or decrease the maximum capital for SeyRES 100 investments while the rate of return on investments and an adjustment of long-term asset allocation targets in favour of SeyRES 100 have minor influence.

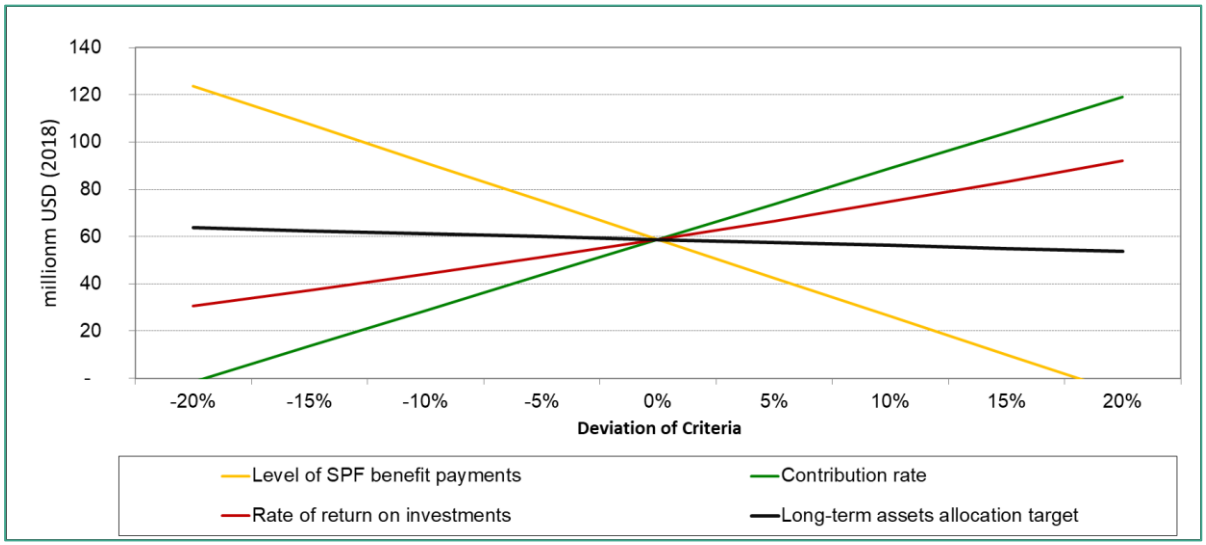

Figure 4: Sensitivity analysis of key parameters influencing the maximum SeyRES 100 investment potential by 2028, in USD_{2018}
Source: Own illustration based on Köhler (2020)

To sustain the potential for SeyRES 100 investments beyond 2030, either the level of payments could be reduced by up to 15 percent or the contribution rate could be increased by about 20 percent of its currently envisaged value. This would equalize a nominal contribution share of 12% instead of the currently envisaged 10% on the gross salaries. Such an approach in turn would lead to additional capital availability for SeyRES 100. Hereby the cumulated maximum volume increases from USD 60 million up to USD 170 million by 2035.

3.2.4 Matching available SPF resources with SeyRES 100 investment needs

While the total estimated SeyRES 100 investment needs including a transformed transport sector cumulate to about USD 390 million until 2035 (see previous *SRJ* article by Wehner, Dransfeld,and Köhler, 2020), SPF can mobilize its own resources of ~USD 60 million under existing conditions and eligibility ranges. This indicates that a full match of all required funds is not possible. However, if one assumes ongoing investment potential of the SPF beyond 2035 with adjusted contribution rates or benefit payments, the potential coverage of SPF investments increases significantly. Under the scenario with increased contribution rates, the Fund is able to cover more than 40% of the required SeyRES 100 investments with its own resources during the timeframe 2020 to 2035. For covering the full SeyRES 100 investment needs of USD 390 million, SPF would theoretically

require an increase of the contribution rates by 45 percent until 2035, translating into contribution shares of the gross salary of about 15%, instead of the currently envisaged 10%.

Finally, the applied funding instrument by SPF, equity or debt, has significant impact on both the Fund's risk and revenue expectation as well as the potential to leverage co-funding for larger SeyRES 100 investment coverage. Generally, it is assumed that SPF would mainly consider unlisted, direct project financing as this is regular procedure with real estate investments. The option of listed investments through stock purchase or traded bond investments are currently unlikely as no market or enterprise offering such opportunities exists. Also, indirect funding through e.g. balance sheet financing of PUC is rather unlikely and limited by SPF's Investment Policy. For direct project financing, two eligible financing instruments are applicable for SeyRES investments under SPF's investment policy: equity and/or debt with guarantees.

Equity includes direct capital investments in specific project activities or bundles of projects. As discussed by Sawant (2010), Underhill (2010) or Nelson and Pierpont (2013), the rate of return on equity is likely higher than on debt. But equity also comes with higher risks, higher fluctuation of cash-flows and higher transaction costs. Depending on the legal and institutional structure, supervision rights and management responsibilities might also be included, requiring additional effort from SPF's side. From a paramount perspective of SeyRES oversight by MEECC, the theoretical potential to leverage co-financing from domestic or international banks is tremendous. Since international assessments show that equity accounts average about 20% of an infrastructure investment (see e.g. Saha et al., 2018, p.14), the SPF capital could theoretically mobilize an additional 80% of debt from other sources. Following this assumption, even under the current SPF conditions the existing mobilization potential of about USD 60 million could leverage an additional USD 100 to 200 million. Considering an adjusted contribution rate, theoretically the entire investment needs of SeyRES 100 could be covered by SPF equity combined with leveraged co-finance debt.

With regards to debt investments from SPF's side, either bonds issued by the project investment vehicle or loans could be applied as direct project debt financing. The main advantage for SPF would be low transaction costs, low responsibility and management requirements and a high stability of pre-defined cash-flows. Also, risks are lower than with equity investments, particularly if the condition of the current investment policy applies that requires guarantees, e.g. by the Government of Seychelles. In this case, the default risk would be close to zero. The drawbacks are a slightly lower revenue expectation compared to equity and a lack of control and oversight rights. From the MEECC perspective, debt from SPF

would be rather unattractive compared to equity as it inherits low or no leverage potential for mobilizing co-finance. Thus, MEECC might include an assessment of incentivizing equity or debt investments through e.g. issuance of guarantees or specific design of the economic and regulatory framework.

3.3 Impact of SPF SeyRES 100 engagement

As discussed by Köhler (2020), a SPF engagement would have additional impacts on society, the sustainability of the pension schemes and the energy transition beyond mobilization of private capital at scale. The following section summarizes benefits and challenges created through an increased allocation of SPF resources towards SeyRES 100 assets, following IPCC's categorisation of policy intervention impacts (2014, p.235ff).

3.3.1 Investment revenues and distributional impacts

Whether an increased SPF engagement in energy infrastructure generates higher rates of return than investment alternatives is subject to the economic mechanisms incentivizing SeyRES 100 investments. The expected revenues do not differ significantly from the revenues SPF achieves with its traditional investments. A potential distributional challenge of balancing efficiency gains between electricity users and SPF members depends on the future economic framework. With regards to a potential crowding-out of resources in other sectors, the volume of funds flowing into Seychelles government bonds and domestic and international stocks is expected to continue on a similar level, determined by the respective ranges of the investment guidelines. However, a strong engagement of SPF in energy infrastructure would create a conflict with investments in real estate. As SPF historically contributed significantly to the development of commercial and residential room space, this characteristic can lead to a societal conflict of interest.

3.3.2 Investment risks

One important risk of energy infrastructure investments in Seychelles is a lack of any regulatory and legal framework as well as the absence of functional economic incentive mechanisms that allow market-entries of institutions like the SPF. Considering a future, robust framework, the risk associated with SeyRES 100 investments in power capacity, grids and e-mobility infrastructure is likely comparable to e.g. real estate. It would be considerably lower, in case the government or international organizations provide guarantees. The unclear setting, technical parameters and environmental impacts of the envisaged pump storage would need further consideration as it could jeopardize the investment portfolio. In this context, SPF's internal capabilities might also play a key role. As discussed, the existing risks associated with infrastructure implementation can only be adequately addressed if the relevant institutions inherit sufficient experience, know-how and capacity. This requires either SPF to build up such capacity internally or external support, providing the required expertise.

As a small economy, Seychelles is prone to inflation rate fluctuations or devaluations of the currency. SeyRES assets represent strong, domestic assets that are able to generate revenues as long as demand exists. Thus, SPF cash-flows could be adapted to macroeconomic fluctuations and impacts, as for instance electricity tariffs can be readjusted to inflation.

With regards to the protection of critical infrastructure from foreign control, a small country like Seychelles would, particularly, benefit politically from sustained ownership and control of its energy assets. Also, since the utility PUC maintained its status of a parastatal entity for decades, an alternative funding structure comprising of foreign investments and shareholders would potentially create resistance. Thus, financing SeyRES through SPF member's capital could contribute to the protection of Seychelles' infrastructure while providing comparably safe assets, likely to withstand larger macroeconomic turbulences.

3.3.3 Acceptance

Experience with acceptance of energy transition activities is low, as only a few renewable power generators have been installed so far. However, the construction of five wind turbines in the symbolic, central, and highly visible location of the harbour did not lead to resistance. According to the government officials, the peoples' interest regarding the installation of household roof top PV is also perceivable. This has been confirmed at a public stakeholder meeting conducted in May 2018. Reactions by the audience and media indicated public support and broad acceptance (PUC, 2018; Seychelles News Agency, 2018; SPF Staff, 2018). The macro-economic benefit of oil imports independence is the most convincing argument.

However, some stakeholders also raised concerns regarding environmental integrity and impacts of larger-scale renewable energy implementation, particularly potential offshore and onshore wind power as well as the envisaged pump storage facility (see stakeholder interaction Wehner et al., 2018, p.52f). Overall, there exists broad public backing of the SeyRES 100 plans and acceptance problems are not conceivable yet, regardless of a potential SPF involvement.

3.3.4 Democratization

So far, the provision of basic services like electricity is predominantly a state responsibility. Some autoproducers with significant energy demands, mainly active in the context of the tourism sector, complement this characteristic. As discussed in the context of acceptance, there is an explicit interest of the Seychellois population to personally engage in the generation of electricity. Some people might be able to realize such democratization of power generation through installation of their own PV capacity on e.g. their roofs. The majority however

will not have such possibilities, due either to not owning their housing property or to the lack of capital. Thus, SeyRES 100 investments through the SPF scheme provide an opportunity for large parts of the population to achieve ownership in energy transition assets. The associated potential economic and environmental benefits can further increase ownership and motivation for energy transition infrastructure deployment among the population.

3.3.5 Energy justice and energy finance

According to Hall et al.'s energy justice principles (2018, p.773ff) the SPF engagement in SeyRES activities lead to diverse outcomes. With regards to the principle governance, the Seychellois state institutions and frameworks do not provide a reliable framework for investments yet, while the investors' institutional set up and unique position in the Seychelles' retirement system is a strong base for potential internal capacity enhancement. Related processes and transparency standards are well established and have been proven over the last 15 years. As analysed by Hall, the intergenerational conflict, that the energy transition poses upon the population can be resolved by economic participation. SPF engagement in SeyRES 100 would offer broad economic participation of the working generation through enhanced pension payments, the benefits of the transformation would be shared more equally.

3.3.6 Political feasibility

The political feasibility is mainly dependent on the legal framework and economic mechanism the government establishes for SeyRES 100. If SPF deems such conditions as an attractive environment for investments, it will voluntarily engage in energy transition assets. Consequently, the government and potentially also international support institutions such as the Green Climate Fund are required to establish a suitable enabling environment for SPF. Direct control of government representatives in the supervising Board of Trustees could also mandate the operational staff of SPF to realize SPF opportunities as long as they are consistent with the institution's investment policies. However, the potential conflict of SeyRES 100 and real estate allocation of resources might also create political tensions that hamper large-scale engagement in energy transition assets. If the public perceives negative impacts from declining investment for residential and commercial buildings, it might request limiting SeyRES 100 investments.

4 Conclusion and recommendations

A successful energy transition towards 100% renewables will require substantial mobilization of private capital and institutional investors will likely have to be involved.

This article reveals several important results with regards to SPF's potential to contribute to and benefit from SeyRES 100.
First, the assessment of the institutional set-up demonstrates that SPF engagement based on the current operational structure is possible, and willingness among the responsible actors exists. However, the operational staff requires more capacity and the Government has to provide a comprehensive enabling environment before substantial investment decisions can be taken.

Second, the qualitative discussion of impacts suggests that SPF investments will positively address potential conflicts around the energy transition. A broad economic participation and a democratization of infrastructure assets could increase acceptance among the population and resolve the intergenerational issue of burden and benefit sharing. Further, stable and more attractive revenues that can be adjusted in the future reduce investment risks and sustain SPF's operation. Lower revenue expectations than other investor groups, including international ones, benefit the consumers of electricity. However, a conflict of interest between pension members and non-members could also create conflicts that might need mitigation. Also, future governments might advantage SPF members and retirees through increasing power tariffs or grid operation fees in favour of SPF's inflows but negatively impacting other interest groups of the society.

Third, a quantitative modelling of SPF's capital potential for SeyRES 100 investments demonstrates that the SPF could mobilize temporarily up to USD 60 million of cumulated energy transition investments by 2028. A sensitivity analysis revealed that, in particular, the level of benefit payments and the level of the contribution rate have a key influence on the long-term investment potential of the SPF. To achieve constant investment volumes beyond 2030, benefit payments could be decreased by up to 15% or the contribution rate could be increased by about 20%. This in turn, would boost cumulated SPF capital resources for SeyRES investment to up to USD 170 million until 2035.

Finally, a matching of available resources with investment needs shows the potential to cover significant shares of the total required funds in the initial phase of SeyRES 100. Under the scenario with an adjusted contribution rate, a significant share of almost 45% of the total investment needs between 2020 and 2035 can be covered by SPF's own resources. Taking into account the potential to leverage co-financing through application of equity, the Fund could theoretically cover the total SeyRES investment needs. With regards to SPF's potential appetite for different SeyRES investment opportunities, an evaluation based on international experience indicates that renewable capacity investments might be most attractive in the initial phase while financing of the potential pump-storage facility would have the highest benefits during the main implementation phase.

For the Seychelles Government it is recommended to analyze the impacts on and interrelations of policy options for involved actors such as the SPF and the society in order to enable and optimize the envisaged capital flows required for a successful implementation of SeyRES 100. Potential conflicts of interests such as favourable conditions for SPF and its members' capital versus higher electricity costs for all have to be balanced carefully. Also, a decision to favour domestic capital with potentially higher or lower revenue expectations compared to international finance might be important for the overall acceptance and success of the energy transition. It is suggested that MEECC takes into account these considerations when designing the economic and regulatory SeyRES 100 framework and planning the roll-out of technology and related funding.

For the SPF it is recommended to actively tap the investment opportunities that SeyRES 100 offers. Attractive risk-revenue ratios can be expected and, subject to the applied funding instrument, very stable cash-flows and low transaction costs are possible. An engagement continues the long-standing history of SPF and its predecessors in developing the country's infrastructure and housing sector while democratizing key assets of the society through economic participation.

References

Brycz, B., Pauka, M. 2012. Analysis of Statement. *Financial Sciences.* Publishing House of Wrocław University of Economics.

Central Bank of Seychelles, 2019. Annual Report 2018.

Hall, S., Roelich, K.E., Davis, M.E., Holstenkamp, L. 2018. Finance and justice in low-carbon energy transitions. *Applied Energy,* 222, pp.772–780. doi:10.1016/j.apenergy.2018.04.007

Hohmeyer, O. 2017. Economic Analysis to Facilitate the Establishment of a Stable Price for Electricity from Renewable Sources.

Hohmeyer, O. 2016. *A 100 % renewable Seychelles* - Report 1: Mahé, ZNES Discussion Papers.

International Monetary Fund, 2017. IMF Country Report Seychelles.

IPCC, 2014. Climate Change 2014: Mitigation of Climate Change, Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. doi:10.1017/CBO9781107415416

IRENA, 2018. Power Generation Costs in 2017. International Renewable Energy Agency, Abu Dhabi.

Köhler, M. 2020. *The Sustainable Infrastructure Pension* – Draft Version. Europa Universität Flensburg.

Moran, E.F., Claudia, M., Moore, N., Müller, N., Hyndman, D.W. 2018. Sustainable hydropower in the 21st century. *Proc. Natl. Acad. Sci. U. S. A.*, 115. doi:10.1073/pnas.1809426115

National Bureau of Statistics Seychelles, 2018. Statistical Bulletin - Population and Vital Statistics 2017.

National Bureau of Statistics Seychelles, 2014. Seychelles Population Projections 2014-2080.

Nelson, D., Pierpont, B. 2013. The Challenge of Institutional Investment in Renewable Energy. *Climate Policy Initiative,* 1–92.

OECD/IEA, 2017. *Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System*. International Energy Agency.

OECD, 2017. *Investing in Climate, Investing in Growth*. Paris: OECD Publishing.

Pallares-Miralles, M., Romero, C., Whitehouse, E. 2012. International Patterns of Pension Provision II: A Worldwide Overview of Facts and Figures. Soc. Prot. Labor Discuss. Paper. 205.

PUC, 2018. Grid Investment Assessment.

Saha, D., Nair, T., Ho Hong, S. 2018. H1 2018 Private Participation in Infrastructure (PPI).

Sawant, R.J. 2010. *Infrastructure Investing: Managing risks and rewards for pensions, insurance companies and endowments*. John Wiley and Sons, Inc.

Seychelles Legal Information Institute, 2010. Social Security Act 2010 [WWW Document]. URL https://seylii.org/sc/legislation/act/2010/11 [Accessed 26 April 2019].

Seychelles Nation, 2011. *What happens to our monthly pension fund contributions?* [WWW Document]. URL http://www.nation.sc/article.html?id=229231 [Accessed 31 January 2019].

Seychelles News Agency, 2018. *New energy policy is a roadmap to increase Seychelles' renewable energy use to 15 percent* [WWW Document]. URL http://www.seychellesnewsagency.com/articles/9916/New+energy+policy+is+a+roadmap+to+increase+Seychelles%27+renewable+energy+use+to++percent [accessed 27 April 2019].

Seychelles News Agency, 2017a. Mandatory retirement contributions to rise by 1 percent in Seychelles [WWW Document]. URL http://www.seychellesnewsagency.com/articles/7505/Mandatory+retirement+contributions+to+rise+by++percent+in+Seychelles [accessed 31 January 2019].

Seychelles News Agency, 2017b. *Retirement age to rise to 65, no tax increase, Seychelles' president tells National Assembly* [WWW Document]. URL http://www.seychellesnewsagency.com/articles/7633/Retirement+age+to+rise+to+%2C+no+tax+increase%2C+Seychelles%27+president+tells+National+Assembly [Aaccessed 31 January 2019].

Singer, S., Denruyter, J.-P., Jeffries, B., Deng, Y., Cornelissen, S., Klaus, S. 2011. *The Energy Report - 100% Renewable Energy by 2050*.

SPF, 2019. Annual Report 2018.

SPF, 2018a. SPF Annual Report 2017.

SPF, 2018b. Seychelles Pension Fund Investment Strategy.

SPF, 2017a. SPF Investment Policy.

SPF, 2017b. *Increase in mandatory contribution rate* [WWW Document]. URL http://www.pensionfund.sc/increase-in-mandatory-contribution-rate/ [accessed 31 January 2019].

SPF Staff, 2018. Exchange on SPF procedures.

Underhill, M.D. 2010. *The Handbook of Infrastructure Investing*. John Wiley and Sons, Inc.

Wehner, S., Dransfeld, B. and Köhler, M. 2020. A Strategic Approach towards 100% Renewable Energy in the Seychelles. *Seychelles Research Journal,* 2 (1).

Wehner, S., Köhler, M., Dransfeld, B., Nettersheim, C. 2018. Pre-Feasibility Study SeyRES100.

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