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Mobilising low-cost institutional investment in renewable energy

Structuring the Clean Energy Investment Trust

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August 2017

The ROCKEFELLER FOUNDATION

A CPI Report

Acknowledgements

We would like to thank the investment industry professionals and other specialists for their valuable contribution to this study.

We thank CPI staff members Felicity Carus, Andrew Goggins, Gaia Stigliani, Muhammed Anwar and Will Steggals for their editorial and analytic contributions to this study.

The Rockefeller Foundation's Zero Gap Initiative provided the financial support for the analysis carried out in this project. The findings of the report are those of the authors, and do not necessarily reflect the views of the Rockefeller Foundation.

Descriptors

Sector	Renewables, electricity
Region	North America, European Union
Keywords	Renewables, institutional investors, pension funds, insurance
Related CPI reports	Beyond YieldCos Mobilising low-cost institutional investment in renewable energy: Major barriers and solutions to overcome them The challenge of institutional investment in renewable energy
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About CPI

Climate Policy Initiative is a team of analysts and advisors that works to improve the most important energy and land use policies around the world, with a particular focus on finance. An independent organization supported in part by a grant from the Open Society Foundations, CPI works in places that provide the most potential for policy impact including Brazil, China, Europe, India, Indonesia and the United States.

Our work helps nations grow while addressing increasingly scarce resources and climate risk. This is a complex challenge in which policy plays a critical role.

Executive summary

Large-scale wind and solar energy projects are completely different businesses from coal- or gas-fired generation. There are no fuel costs, operating costs are lower and more predictable, the initial investment represents a far larger share of the total cost of the energy, and prices for output are often fixed for much of a project's life. In recent years, close to half of all new electricity generation investment has gone into renewable energy in many electricity markets. Gradually, financial markets have started to adapt their approaches to the differences between renewable energy and conventional generation.

However, these adjustments have mainly been incremental based on the common investor-owned utility (IOU), independent power producer (IPP) and project finance models that have served the conventional generation businesses so well. As discussed in a companion paper, *Beyond YieldCos*, the creation – often by the IOUs or IPPs themselves - of so-called YieldCos has turned out to be neither as novel or successful as once thought.

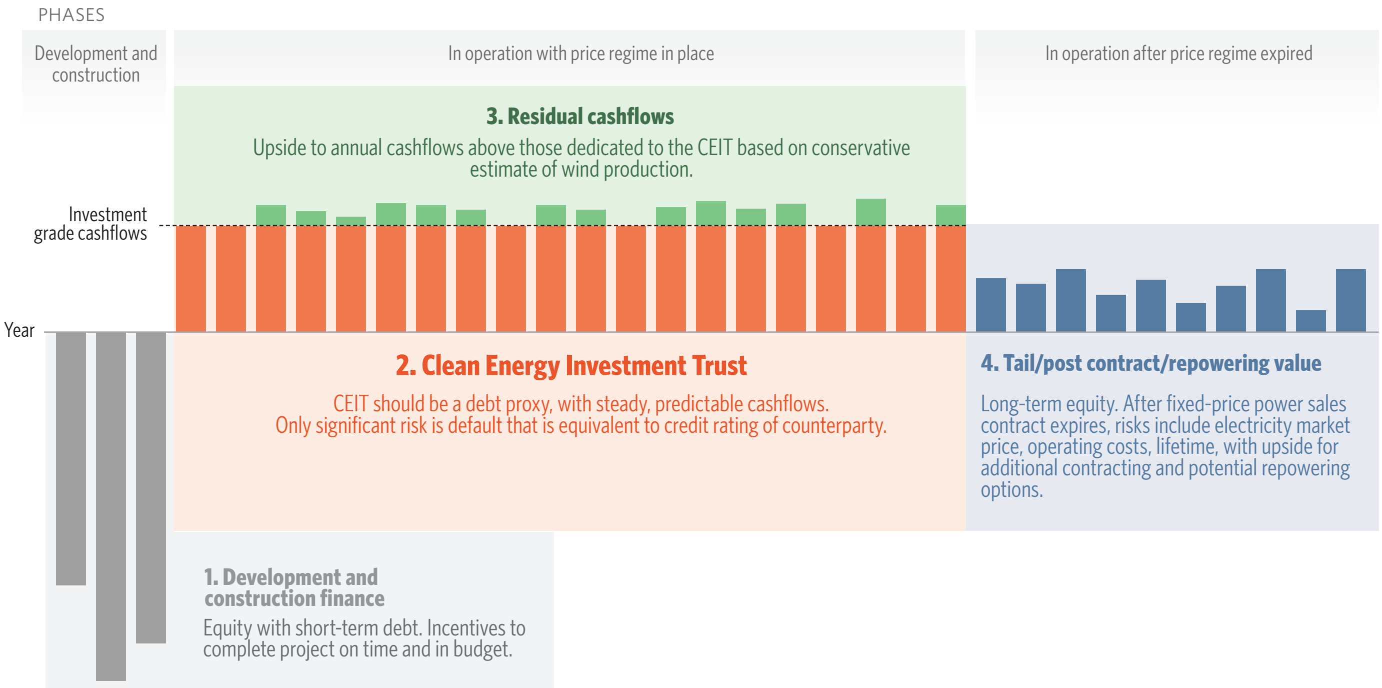
Climate Policy Initiative (CPI), with the support of the Rockefeller Foundation, has taken a different approach. Starting with the investment fundamentals, and working with a wide range of financial investors CPI has sought to develop new finance and business models with the aim of reducing finance costs and, therefore, the cost of energy from wind or solar. The model we present here, based on those fundamentals, could reduce the cost of renewable energy 15-17% from existing practices.

The fundamentals

Wind and solar projects have four distinct cashflows:

1. **Asset development and construction** – Developers and investors spend time and cash developing, building and commissioning the renewable energy project.
2. **Predictable cashflows during operation under a fixed-price regime** - The projects generate predictable cashflows when operating under a long-term, fixed-price tariff or contract.
3. **Less predictable "surplus" cashflows during a fixed-price regime** – The projects also generate less predictable cashflows, even when the energy price is fixed. These occur if, for instance, there is more wind or sunshine than investors deem "predictable", or if plant performance is higher or costs lower than expected.
4. **Tail-end cashflows after the fixed-price regime expires** – When the fixed-price period expires the projects can continue to generate electricity but revenues are less certain because prices may depend on volatile wholesale energy prices or regulation that is 20 years in the future. Operating costs are likely to rise and become less predictable after the original contracting period is finished.

Figure ES1: Four distinct project cash flows have corresponding investment products and attract different types of investors
New mechanism unbundles cashflows that have historically been financed by a single investor type.



As in figure ES1, these sets of cashflows lead to four distinct investment products. Of these four, construction finance is well developed. While there may be room for further financial innovation, this paper focuses on the last three, their structuring, their costs, and how the three interact to create the lowest overall finance costs for renewable energy.

The Clean Energy Investment Trust: a new type of investment vehicle at the core of a new financing structure

The Clean Energy Investment Trust (CEIT) is an investment vehicle targeted at long-term, "liability-hedging" investors. Liability-hedging investors are those who seek investments that can help guarantee future cashflows to cover their future financial obligations, for example, life insurance payments, annuities or pensions. These investors have the lowest cost finance for assets with the steady cashflows of a wind or solar project, but only if these cashflows can be delivered with a high degree of certainty. The objective of the CEIT is to find ways of delivering this certainty to as large a proportion of the cashflows at the lowest cost. **Whereas typical project finance uses a buffer of project equity to protect debt investors, we have found that there are cheaper ways to deliver more of the cashflows to these investors, thus lowering overall finance costs.**

Based on our discussions with investors as set out in *Mobilising low-cost institutional investment in renewable energy: Major barriers and solutions to overcome them* (*Barriers*), we have found that such an investment vehicle should have the following core characteristics:

1. **Lower cost of capital by maximising the low-risk cashflows available to CEIT investors.** The central objective of the CEIT will be to reduce energy prices through lower finance costs. Lower costs will make renewable energy more competitive and encourage greater deployment, and will also make the CEIT competitive in acquiring assets for its portfolio.
2. **Deliver an attractive risk-adjusted return.** Investors will need to get a return that is high enough to compensate for their risks. For the first CEITs, uncertainty around the concept might amplify risk perceptions and therefore force returns slightly higher than investments with comparable risk profiles. However, once investors are convinced that the level of risk in a CEIT is equivalent to that of an investment-grade bond, required returns – and thus, capital costs – should fall.
3. **Resilience and liquidity.** Investors with a liability-hedging strategy will need to be convinced that the CEIT can be useful for matching long-term liabilities. Our interviews with investors suggest that there are two essential elements:
    a. **Investment-grade risk profile.** The vehicle will need to emulate the liability-matching benefits of an investment-grade bond, ie, the cash returns for a CEIT will need to be as resilient to downside risks as a high-grade debt instrument.
    b. **Liquid/publicly tradeable.** Regulations and policies keep institutional investors from making direct investments in renewables. To reach this target group, the CEIT will almost certainly need to be traded and listed on an exchange.

The CEIT has crucial differences to YieldCos. The most important difference is that the CEIT will not be allowed to buy or sell any projects once the portfolio is set. As we discuss in *Beyond YieldCos*, the ability to buy and sell assets creates a growth premium for the YieldCo, but this growth premium adds significant risks around whether new assets will be available, what price the CEIT will have to pay, the effectiveness of the management in deciding which assets to buy and how much to pay. Each of these risks is equivalent to the risks faced by an IPP or an IOU in the course of their business. In other words, by adding the growth premium and risks, YieldCos begin to look more like the IOU or IPP equity they replace, rather than the bond-like characteristics that liability-hedging investors seek.

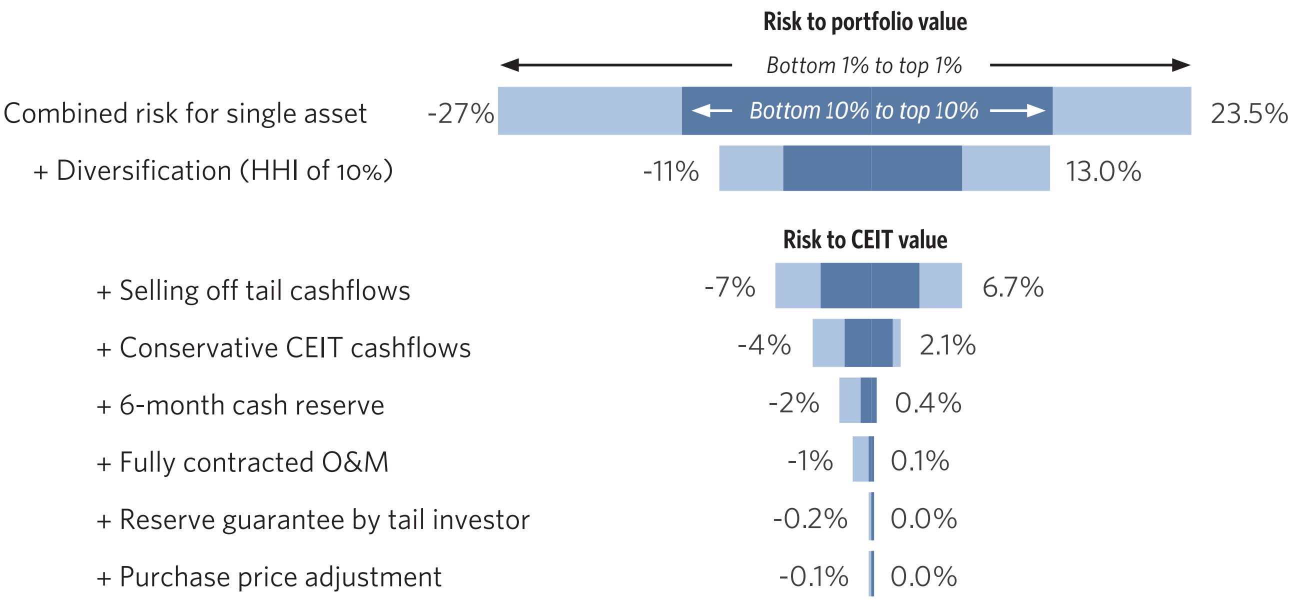
The key to the CEIT is that the equivalent of investment-grade bond certainty can be put in place without the need for project equity. The challenge to achieving this certainty – as our analysis of historic data for onshore with assets in the US showed – is that one in 100 wind farms could generate 20% less energy than expected over its lifetime or spend 15% more for maintenance capex. We found that the most cost-effective package of tools to create an investment-grade CEIT that can manage these risks includes the following:

- An intention to pay investors precisely a "base case" set of returns every six months based on a conservative estimate of future net cashflows. The CEIT works best using estimates for annual generation that site specific wind testing, forecasting data, and project design, suggest would be exceeded in 75-95% of years (ie, P75-P95 - see box 4, page 20).

- A diversified portfolio of wind and/or solar projects with a level of diversification akin to five to 10 equally sized, uncorrelated projects of a similar size.
- Long-term, full-service O&M contract(s), fixing O&M costs for the life of the assets and transfering away from the CEIT responsibility for unexpected maintenance costs.
- A purchase price adjustment facility that will reduce the price paid by CEIT investors after a period of 24 months, in the case that the data show that long-term production will be materially lower than originally forecast.
- A cash reserve facility funded up-front and sized to cover at least the semi-annual expected distribution to investors. This reserve will provide liquidity support in the case of unexpected events or lower-than-expected net cashflows from the portfolio.
- A sharing of some up-front structuring costs between the CEIT and investors acquiring the right to "surplus" cashflows as well as investors acquiring the "tail-end" cashflows
- Return of the full value of the reserve facility cash to the CEIT and its investors at the end of the fixed-price regime. The value of the tail cashflows will grow as their realization nears. Thus, by the time the fixed-price regime ends, the value of the tail will easily cover the reserve cash. The tail investor will guarantee the restoration of any reserve shortfall or forfeit access to the tail revenues.

These risk mitigation tools work in concert to reach an investment grade level of risk, as shown in figure ES2 below.

Figure ES2: A portfolio of risk reduction tools allows CEIT investors to receive their expected return in 99% of scenarios



The 'surplus' investor: getting value out of the uncertain upside

Conservative (P75-P90) estimates of cashflows during the fixed-price regime is an essential component of reaching investment grade equivalence. With this conservatism in place, we would expect that cashflows will exceed those going into the CEIT much of the time (ie, 75%-95% of the time). The CEIT investors will view these cashflows as being too uncertain to use in liability hedging. But less risk-averse investors with different investment goals will undoubtedly see the value and take the risk, albeit at a higher return.

Our analysis investigated different structures for this investment product and identified several potential investors, including:

- Long-term equity-type investors looking for high-risk, high-return investments,
- Speculators,
- Investors looking to hedge risks that are offset by renewable energy performance such as power price or weather risk that could be related to renewable energy performance. For example, an investor that is exposed to power prices that would fall if there is a large amount of wind energy produced might like to have a hedge by taking exposure to higher levels of wind production, or
- Developers, equipment manufacturers or O&M contract providers in the project that can either influence the value or benefit from a small continued stake in a part of the project.

We find that despite the much higher return requirements of these investors, this vehicle will be worth 1-2% of the value of the CEIT. More significantly, this vehicle helps offset the cost of other risk coverage for the CEIT in exchange for an interest in the upside potential of the portfolio. Unlike project equity, which can represent 20-40% of a project's value, the risk passed on to the surplus investor is small and very targeted.

The 'tail' investor: finding the right investor for energy and operations risk 20 years in the future

As much as one-third or more of the energy produced by a wind or solar project will be generated after the fixed term expires. But cashflows from this output are both less predictable, and far into the future. After discounting for time and risk, these cashflows represent closer to 5% of the total value of a typical renewable project.

The tail may have other sources of value as well. Once the fixed-price regime is over, investors may consider whether there is value in repowering – replacing the equipment with newer, more powerful and efficient equipment. Grid connections, planning permission, infrastructure, among other items, could make development, approval and construction cheaper and faster than for a greenfield facility. In some regulatory regimes, the repowering could make the project eligible for a renewed period of fixed pricing. This possibility creates an option value that owners of the asset will be able to use. The owners will evaluate the likely future cashflows from generation and decide whether repowering or selling the repowering option is worth more than keeping the same plant operating. At some point repowering is likely to create additional upside.

As with the surplus revenues, liability-hedging CEIT investors are likely to ascribe close to zero value to the tail, as these cashflows are not predictable. However, other types of investors might have a greater interest, including:

- Investors seeking a very long-term hedge against energy market prices. The tail investment could be a relatively inexpensive way to build this hedge.
- This investment could interest investors seeking the steady, high returns that would come from this source of value coming one year nearer each year.
- As with the surplus investment, the O&M contractor, developer or equipment manufacturer might wish to take on this investment stream either because they have a higher confidence in the value or because they can invest to make it more valuable.
- The surplus investors may be interested in this cashflow alongside the other investment flow.
- Finally, later in the project life, developers might be interested as a way to build a pipeline for future development.

Investment in the tail has an interesting characteristic in that during the early years, little new information about future power prices or maintenance costs will emerge. Thus, the tail value will initially increase at the discount rate for these cashflows. Given the risk, we believe that the value will increase 12-15% per year.

Another useful characteristic is that the value will grow from a relatively small level, to one that is worth many times the cash reserve. Thus, the tail can easily cover or guarantee the cash reserve. Since tail investors have a discount rate of roughly 12% and CEIT investors a rate between 4-5%, the tail investor can cover the risk of a reserve shortfall in the final year at close to one-seventh of the cost in today's terms.

Putting the pieces together: optimising the entire post-construction investment

Designing the new structuring requires careful design of each of the pieces with special attention paid to the intersection between the pieces – for instance, tradeoffs between conservative forecasts and reserve size required, or between the reserve and the tail valuation.

In a generic sense, the relative valuation of each of the pieces and the practical financial mechanisms involved in putting these pieces together are illustrated in figures ES3 and ES4.

We have evaluated a range of options and found out that there is a range of potential outcomes that satisfy lowering cost, but the optimum design will vary depending upon both the specifics of the component projects and the desires of investors or other participants. Figure ES5 shows the results of our analyses to identify CEIT designs that can address the needs of all its investors. **We find that a range of feasible CEIT structures can deliver 15-17% savings in the cost of wind-generated electricity.**

Figure ES3: The allocation of value and mechanics of a CEIT structure

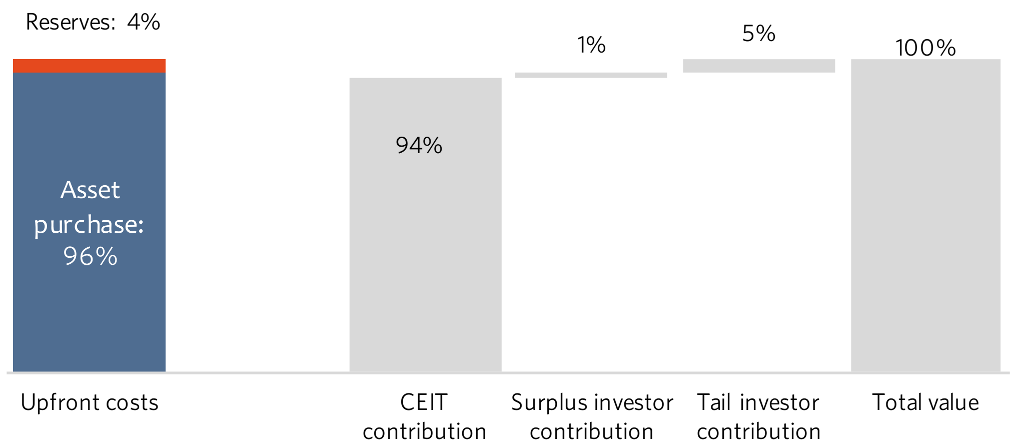
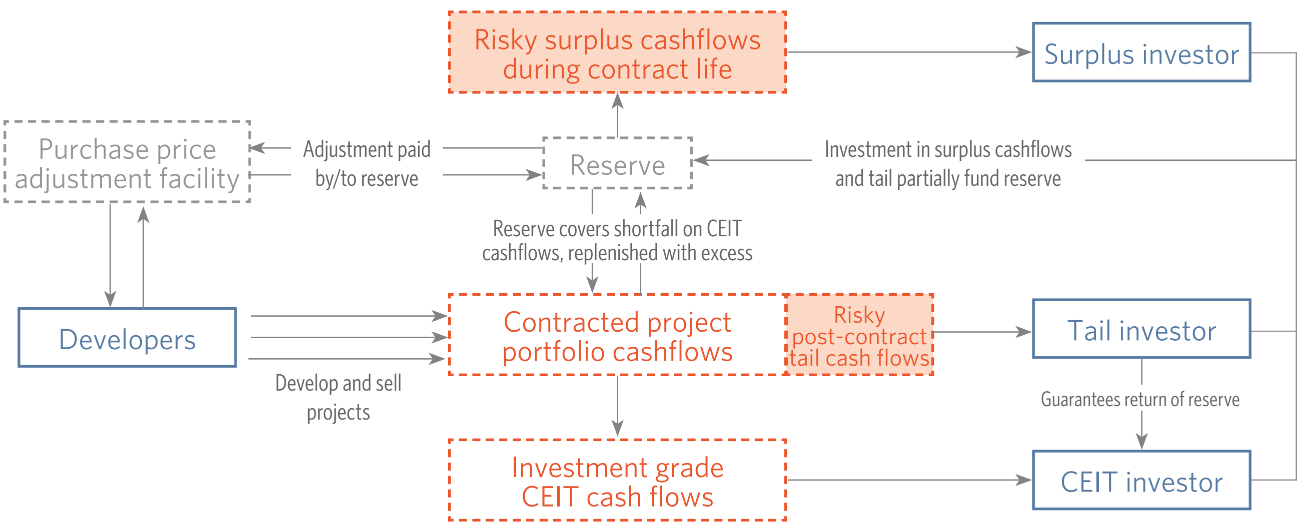


Figure ES4: Representative deal structure for a CEIT

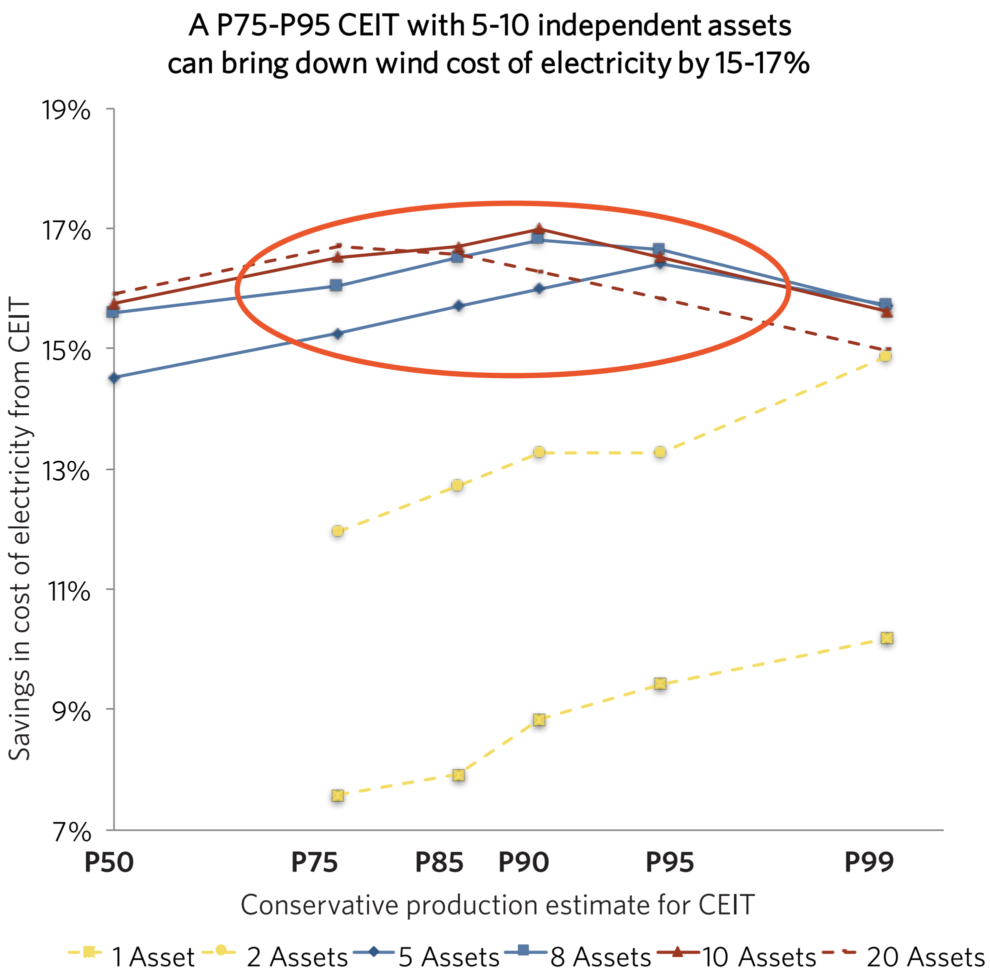


Conclusion: moving to a lower cost renewable energy industry

The renewable energy example presented here shows how developing financial structures based on the fundamentals of the underlying projects, rather than historical market practices, can significantly reduce costs. Reduced costs can smooth a transition and encourage more clean energy build.

Another important lesson is that many of the most important costs of the clean energy transition are merely a function of historical accident, rather than intrinsic differences in cost or attractiveness. Addressing these standard financing practices head on can be one of the most cost-effective and impactful mechanisms for accelerating a successful energy transition.

Figure ES5: With some diversification (5-10 independent assets) and moderately conservative CEIT cashflows (P75-P95) a CEIT can balance the needs of all its investors to reduce the cost of electricity 15-17% relative to traditional utility financing



Contents

1. Introduction

Conventional wisdom holds that an efficient financial system will always find the most attractive way to finance a viable investment. But most attractive for whom? Since it is the investor that puts in the most effort and has the greatest incentive to fine-tune the financial structure, the answer is likely to be the investor. Aligning investment outcomes with the needs of consumers, taxpayers, voters and the economy and the government may require policy, incentives and creative thinking. New financial structures can help expand and diversify the investor universe in ways that create an investment pool with investment criteria that are more consistent with policy objectives.

Renewable energy presents an interesting example. Financing patterns for renewable energy have developed within the framework of existing energy companies, financing mechanisms and investors. These patterns evolved over decades in response to very different energy sources and industry needs, such as rising energy demand met predominantly by fossil fuel-fired generation. Fitting renewable energy investment into these legacy structures is inefficient. Our analysis suggests that more cost-effective financial structuring could yield a 15-17% reduction in the cost of renewable energy after financing and could increase the potential institutional capital available for renewable energy investment by a factor of 13 (see *Mobilising low-cost institutional investment in renewable energy: Major barriers and solutions to overcome them*).

A typical renewable energy project has four distinct sets of cashflow profiles with different risks. Different investors are best suited for each profile, and in an ideal world the investment would be structured to optimise the match between investor and cashflow and risk profile. That is the objective of the financial structure proposed in this paper.

The four cashflow profiles include:

1. **Asset development and construction.** Investors, including project developers, invest cash to develop and build new projects. Uncertainty about construction costs and timing can create high levels of risk. During this phase there are almost no revenues until project commissioning.
2. **Expected long-term contracted, fixed-price cashflows.** Once a project is operational it will return relatively steady cashflows that depend on the energy price, output and costs. The energy price is often fixed by contract or feed-in-tariff, output is reasonably predictable, and costs can be made reasonably predictable, for instance through long-term contracts. Thus, overall risks are low.
3. **Volatile cashflows during the contracted phase.** Uncertainty around wind or solar resources and operating and maintenance costs result in significant cashflow volatility during the contracted fixed-price phase. We find that treating this risk and the associated potential cashflow separately is important in achieving a good match with investors and, therefore, lower overall costs.
4. **Tail or post-contract residual value and repowering option.** Once a contract or fixed-price regime has expired, prices become uncertain. At the same time operating costs can rise, while opportunities can develop to replace the equipment with new equipment at the end of the project life. These cashflows are relatively risky and far into the future, but could be attractive to a distinct set of investors.

The key to effective structuring is to create an appropriate balance of risks and costs among all four cashflow streams. Privileging one stream will in turn lessen the quality of one or more of the others, potentially to the point that they are unattractive to any investors. In addition to balancing one stream versus another, additional mechanisms such as insurance policies or maintenance contracts can reduce the risk of any one of these streams, at a cost.

The value of risk segmentation has not been completely lost on current renewable energy investment markets. Notably,

- Construction finance is used to cover the earlier and riskiest investment activities;
- Developers typically sell part or all of their equity in projects that are successful enough to reach commercial operations; and
- Most renewable energy projects are "project financed", separating cashflows into hierarchical streams to attract both debt and equity investors.

Section 2 of this report describes the four cashflow streams in greater detail, highlighting the different risk-reward patterns and how these could meet the needs of different types of investors. We also touch upon why structuring has been only partially successful to date.

Section 3 explores the design of a Clean Energy Investment Trust (CEIT) – a new investment vehicle designed to offer certainty, duration and liquidity to institutional seekers of stable returns – and its potential to reduce the financing costs. This vehicle lies at the centre of our structuring proposal and is a new style of investment vehicle with risks equivalent to investment grade bonds.

Section 4 assesses the value and packaging of the surplus cashflows and residual risk that could arise once the CEIT has been structured.

Section 5 focuses on valuation and structuring of an investment product for the cashflows that a project may earn after a fixed-price contract or price regime has expired.

Section 6 integrates the prior chapters, evaluating various structuring scenarios that combine to deliver debt-like CEIT cashflows as well as higher yield residual risk and tail investments.

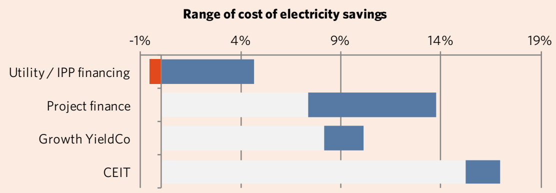
2. Renewable energy investment: in search of a better allocation of risk

Standard project finance models allocate risk to a single investor or group of investors at the pre-revenue stage of development. This is the riskiest stage of the project.

But once a renewable project begins to operate, risks (and returns) are much lower than for operating fossil fuel-fired power plants.

However, financing structures that dominate today's utility industry increase the cost of capital unnecessarily, and therefore the cost of energy from those projects.

By unbundling project finance into four distinct cashflows as we will discuss in the following section, our modelling indicates that we can reduce the cost of energy from those projects by between 15% and 17% relative to 'traditional' utility financing.



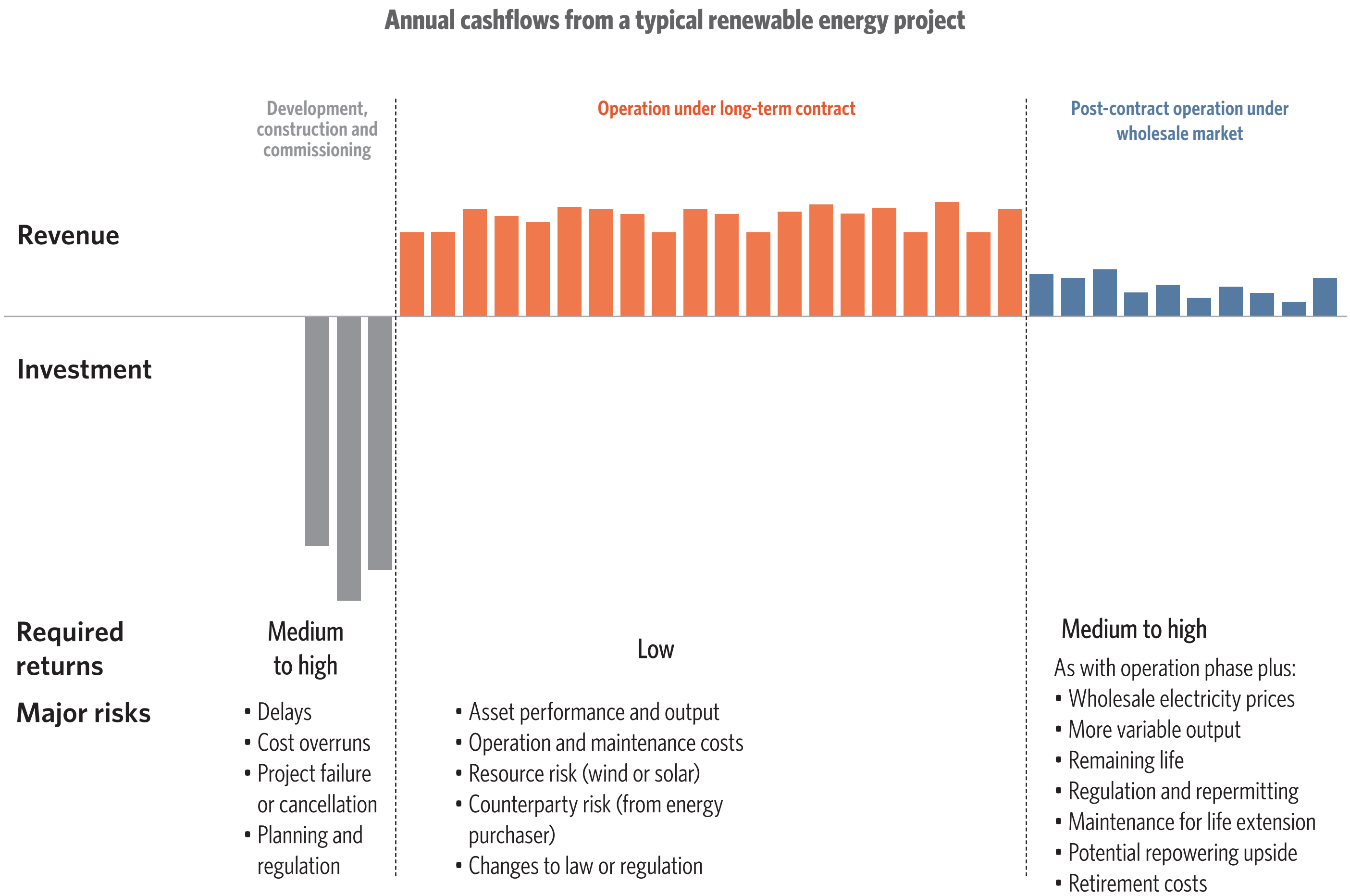
2.1. Typical renewable cashflows

There are three distinct time phases in the life of most renewable energy projects:

- Asset development and construction;
- Operation under long-term contract; and
- Post-contract operation under wholesale market conditions.

These time phases differ markedly with regard to cashflows, return requirements and major risks, as illustrated in figure 4.

Figure 4: The cashflows, risks and return requirements for the three distinct time phases in the life of a renewable energy project



2.1.1 ASSET DEVELOPMENT AND CONSTRUCTION

A renewable energy project begins with a developer identifying a site, planning a project, securing permissions, buying equipment, hiring contractors and then construction. During this phase, the project will have no revenue, while costs and duration will both be uncertain. Developers or utilities invest in the project in expectation of future value and cashflows once operation begins. With uncertainty about costs, timing and even whether the project will be completed successfully, investors face high levels of risk. As compensation for this risk, investors demand, and receive, higher returns.

During development, an investor/developer has the greatest opportunity to use technical and engineering skills, onsite supervision, and local relationships to manage risks, adding substantial value by ensuring low-cost, timely delivery of the project. Typically, investment in these types of projects is active, either by the developer or by external investors investing in the developer or joining as co-developers.

2.1.2 OPERATION UNDER LONG-TERM CONTRACT

As the project nears completion, costs and timing of revenues become clearer. Once a project is commissioned, risk levels continue to fall during the first two years of operations, as teething issues are resolved and, moreover, forecasts are refined/validated. Concurrently, the developer's ability to actively manage risks is significantly reduced.

Most renewable energy projects have either feed-in tariffs or power purchase contracts that guarantee the price for each unit of energy produced. However, total revenues also depend on production volume, which is usually not fixed by the contract and can depend on weather, equipment performance, energy demand or regulation. Many projects enter into long-term O&M contracts that reduce operating risks and provide liquidated damages if minimum availability metrics are not met. Lower risks and reduced scope for onsite risk management facilitate the participation of passive investors. These lower-risk, long-dated cashflows align well with the needs of institutional investors seeking to hedge their long-term liabilities (eg, pension obligations or insurance claims).

2.1.3 VOLATILE CASHFLOWS DURING THE CONTRACT PHASE

The operating phase is not entirely without risk. There is uncertainty about how much the wind will blow or sun will shine in a given year (resource risk), around O&M costs, and asset availability and output (performance risk). Various contracting, insurance, and investment structuring options can be employed to address these downside risks.

In addition to downside risks that must be covered to build a CEIT, there is a risk that the wind will blow more than predicted, the plant will be available more of the year, or that costs will be lower than expected. These upside cashflows are highly uncertain, and therefore would add almost no value to a liability-hedging low-risk investor. However, other investors with different needs might find these speculative cashflows interesting.

2.1.4 POST-CONTRACT OPERATION UNDER WHOLESALE MARKET

The fixed-price contract usually expires before the end of the project's design life. The owner/ operator can then sell energy at market prices, sign a new contract, or rebuild or repower the facility. O&M costs are likely to be less certain due to the ageing of the plant. Key valuation risks include uncertainty around the remaining life of the equipment as well as the potential upside from project repowering. Understandably, investment in these tail cashflows requires a higher return. Once again, a skilled owner/investor should be able to navigate these risks more effectively than a passive investor. In conventional financing, these cashflows are often ignored as the discount rate is high and the flows are far into the future. However, they can provide value for an investor with very long time horizons.

Figure 5: Separating the cashflows of a typical renewable project into four cashflow streams

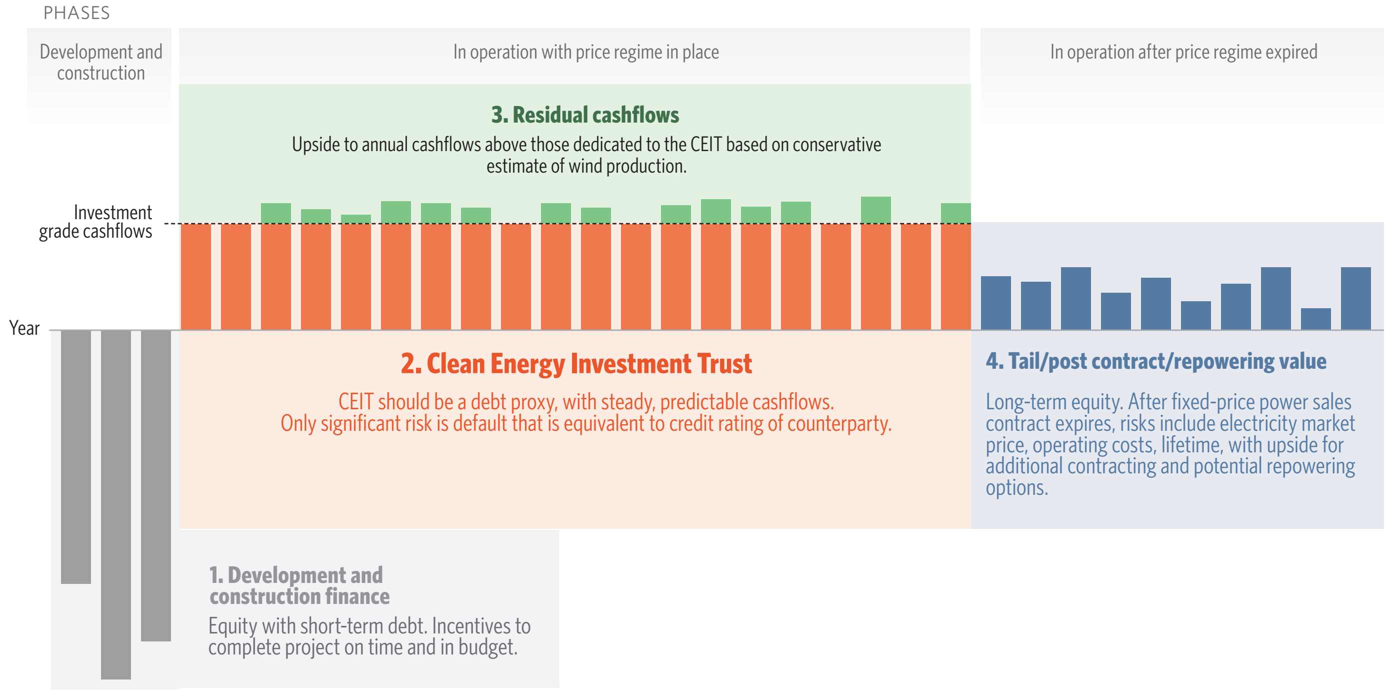
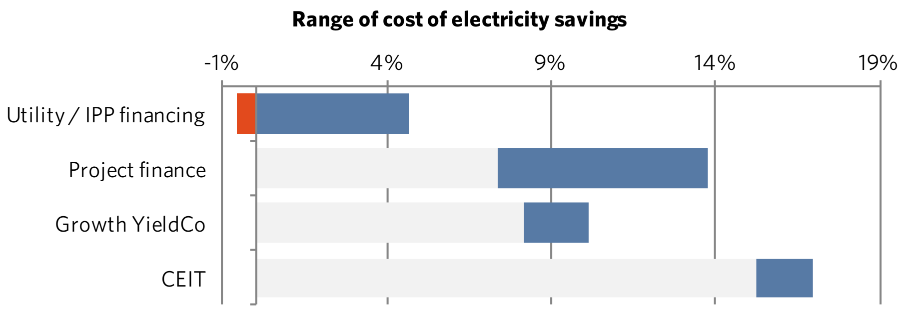


Figure 5 shows how the cashflows of a typical renewable energy project can be separated into four different streams and investment vehicles.

2.2. Experience in structuring to date

Thirty years ago, most electricity generation was financed by large integrated utilities, which were either state owned or fully regulated. Large integrated utilities continue to play a significant role in financing utility-scale generation projects, but renewable energy projects, like many fossil fuel generation projects, are increasingly financed outside of the integrated utility. These new structures enable financial innovation, including bringing in new types of investors, such as lenders, bondholders, equity investors, private equity and infrastructure investors.

Figure 6: CEIT cost savings relative to existing financing structures could be material



As we will show in greater detail, the CEIT could deliver between 15% and 17% in savings relative to traditional utility financing (see figure 6).

In the dominant financing model, utilities typically use corporate finance (eg, a mix of corporate equity and debt) to fund a renewable project such as an onshore wind farm. Utilities rely on an investment-grade credit rating, so there is a relatively low limit on the amount of debt they can take on. A relatively high amount of higher-cost equity means the cost of capital for a utility-owned renewables project can be relatively expensive.

Project finance structures use a much higher amount of debt than utilities and add a buffer of private equity. Project finance lenders or bondholders also target an investment-grade rating, but have access to more (lower-cost) debt than utilities. This structure reduces the overall cost of financing but is only possible if shareholders are willing to accept restrictions in return for the high proportion of debt financing.

The rate of return (or "hurdle rate") sought by private equity investors in wind farms is rarely informed by a detailed analysis of the risks, but by the returns promised to investors in any given private equity fund (see *Barriers* paper). **YieldCos sought savings by tapping public (rather than private equity) investors** who prioritised predictability of cash dividends rather than share price growth. Switching high-cost equity for lower-cost equity initially resulted in significant cost savings. Aggressive portfolio growth targets made the business model riskier than investors had thought.

While the integrated utility finance model serves as a baseline, the most common new structures – financing by independent power producers/utilities, project finance, and growth YieldCos – are described in Table 1.

As we will discuss in greater detail in the next section, the CEIT is similar to the YieldCo concept – in that it is a liquid, exchange-traded, diversified portfolio of renewable energy assets, but has important differences:

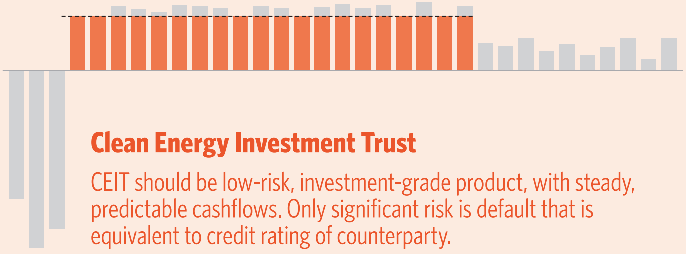
1. The CEIT is a fixed set of assets with nearly 100% payout of free cashflows, with no option to buy new assets or sell assets from the existing portfolio. As such, the CEIT avoids market and management risks and avoids questions and risk associated with the valuation of an undeveloped project pipeline;
2. The CEIT incorporates risk mitigants to achieve the equivalent risk of an investment grade bond;
3. The overall structuring creates additional investment opportunities in the residual cashflows and tail end revenues that flow to investors more appropriate to these riskier cashflows.

Table 1: The most common structures beyond integrated utility financing used in the power sector

Structure	Description	Structuring benefits	Potential issues
Independent power producers (including integrated utilities investing outside of their home market) **...with sell down at start of operation**	Competitive generation companies that develop, build and operate power plants either under contract or as merchant plants competing in electricity wholesale markets Developers can further sell projects partially or completely to outside investors once the operational phase begins	• Creates competitive incentives that encourage financial innovation • Can bring in new sources of capital – including equity and debt in the IPP or project finance – to invest in higher risk development • To maintain high returns, developers seek to recycle cash from asset sales into new projects.	• Risks can be higher than for regulated utilities, leading to higher debt and equity costs that can more than offset the benefits of financial structuring • The higher equity and debt costs in particular have an impact on lower risk investments like renewable energy • Timing of investments and sales is unpredictable and lumpy, leading to more volatile quarterly/annual earnings
Project finance **...with construction financing**	Independent developers and utilities seeking to finance projects whose risk-return profiles are different from those of the firm as a whole Developers may refinance after construction to broaden their access to potential lenders, including those averse to taking on construction risk (eg, many institutional investors)	• Non-recourse financing allows leverage levels consistent with the risk of the project • Post-construction refinancing can lower Levelised Cost of Electricity (LCOE) and Weighted Average Cost of Capital (WACC)	• Debt is relatively expensive, precisely because non-recourse structure isolates project from other assets in case of default • Project bonds are relatively illiquid, reflecting small volume of issuances • Refinancing risk due to adverse events or interest rate increases between the start of construction and the start of operations; two sets of fees
Growth YieldCo (partial unbundling)	Listed equity product enabling public market access to equity in diversified, operational renewable portfolios	• Attractive to investors unwilling or unable to make illiquid, single-asset direct investments with the associated due diligence costs, concentration risk and inflexibility in terms of investment size.	• 45% of the average valuation of a US YieldCo at launch was for growth expectation rather than the yield from payouts; this added an estimated 200bps to the unlevered cost of equity compared to a no-growth YieldCo

3. Designing a Clean Energy Investment Trust (CEIT)

Fixed-price contracts such as power purchase agreements offer an opportunity to create an instrument with low-risk bond-like returns that appeal to those looking to match their long-term liabilities, such as pension funds and insurers. A CEIT would be a closed but diversified portfolio of between five and 10 assets. In the long-term we would expect CEITs could reach market caps in the range of $1bn or more – large enough for them to be exchange-traded equity vehicles. At scale, this financial innovation could expand the potential for institutional investment by a factor of 13, to nearly $4trn.



Clean Energy Investment Trust

CEIT should be low-risk, investment-grade product, with steady, predictable cashflows. Only significant risk is default that is equivalent to credit rating of counterparty.

Type of investor:	**Pension funds; insurance companies**
Rate of return:	**Based on BBB+ bond rating plus 50bps**
Period:	**10-20 years**

3.1. Essential characteristics

The CEIT is at the core of our proposal to restructure renewable energy project investment. The CEIT would be the lowest-risk and hence lowest-cost element of the investment structure.

The key to lowering total finance costs is to allocate as many of the project's cashflows as possible to the CEIT, which will have by far the lowest cost of capital of the investment vehicles introduced in Section 2 (see figure 5).

The CEIT, structured as a long-duration, low-risk, listed investment could be attractive for pension funds and insurance companies as a means of "liability hedging". If successful, it could expand potential for investment by OECD institutions in renewable energy countries by a factor of 13 to nearly $4 trillion (see *Barriers* paper).

Box 1: Liability-hedging investment

Investors such as pension funds and insurance companies will seek to make investments that provide predictable cashflows that match against their liabilities, such as payments to pensioneers, life insurance policy holders, or annuity holders. For these investors, internal guidelines and metrics or regulators will specify risk criteria for different types of investment that, when taken together, protect pensioneers and shareholders from the risk that their provider will fall short of cash in any period.

Like the YieldCo, the CEIT is an investment vehicle designed for liability-hedging investors who are unable or unwilling to take on illiquid assets. However, the CEIT has crucial differences, the most important one being that it will not be allowed to buy or sell any projects once the portfolio is set.

As we discussed in *Beyond YieldCo*, the ability to buy and sell assets created a growth premium for the YieldCo, but this growth premium adds significant risks around whether new assets will be available, what price the CEIT will have to pay, the effectiveness of management in deciding which assets to buy. Each of these risks is equivalent to the risks faced by an IPP or an IOU in the course of their business. In other words, by adding the growth premium and risks, the YieldCos began to look more like the IOU or IPP equity they were designed to replace, rather than the bond-like instruments that liability-hedging investors seek.

Our analysis has shown that the CEIT, an investment which avoids those growth risks, is the best-suited and lowest-cost means of financing the predictable portion of renewable energy asset cashflows.

The CEIT must have the following essential characteristics:

1. **Lower cost of capital by maximising the low-risk cashflows available to CEIT investors.** The central objective of the CEIT will be lower effective energy prices through lower finance costs. Lower costs will make renewable energy more competitive and encourage greater deployment, and will also make the CEIT competitive in acquiring assets.

2. **Deliver an attractive risk-adjusted return.** Investors will need to get a return that is high enough to compensate for their risks. For the first CEITs, uncertainty around the concept might amplify risk perceptions and therefore force returns slightly higher than investments with comparable risk profiles. However, once investors are convinced that the level of risk in a CEIT is equivalent to that of an investment grade bond, required returns – and thus, capital costs – should fall.
3. **Resilience and liquidity.** Investors with a liability-hedging strategy will need to be convinced that the CEIT can be useful for matching long-term liabilities. Our interviews with investors suggest that there are two essential elements:
    a. **Investment grade risk profile.** The vehicle will need to emulate the liability-matching benefits of an investment grade bond, ie, the cash returns for a CEIT will need to be as resilient to downside risks as a high-grade debt instrument.
    b. **Liquid/publicly tradeable.** Regulations and policies keep institutional investors from making direct investments in renewables. To reach this target group, the CEIT will almost certainly need to be traded and listed on an exchange.

The primary structuring challenge we face in designing the CEIT is in achieving all three of these goals simultaneously – and in particular addressing the tension between maximising the size of the vehicle (by distributing nearly all available cash to CEIT investors) and achieving an investment grade risk profile.

Our hypothesis was that a CEIT which distributed nearly all cashflows would be best structured as an "unlevered" equity instrument although the regulatory framework governing the CEIT and the particular requirements of its investors will influence the design in practice.

3.2. Hitting the right risk profile

Institutional investors rarely have the time to evaluate the detailed risk profile of every single investment they have in their portfolio. Thus, they need to evaluate classes of investments, set up their portfolio to manage risks as a balance between the classes, then select the most attractive opportunities – on a risk-reward basis – within each class. For most investors, the lowest-risk group is bonds, in particular, those with the lowest risk of not paying their contractually promised returns (ie, risk of "default"). Those bonds are the ones with "investment grade" credit ratings.

Box 2: What is a credit rating? And what makes it "investment grade" or not?

"Investment grade" ratings are assigned to obligations with a negligible risk of loss over the upcoming five years. Riskier securities have "sub-investment grade" or "speculative grade" ratings. Investment grade ratings have scores ranging from AAA to BBB- (Standard & Poor's and Fitch Ratings) and AAA to Baa3 (Moody's), while speculative grade ratings have scores ranging from Ba1 to C.

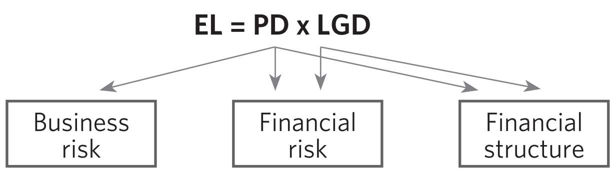
3.2.1 DEFINING INVESTMENT GRADE

Credit ratings are formal opinions provided by independent agencies for the benefit of investors about the risk that an investor might lose money by holding a given bond ("expected loss").

Rating agencies typically monitor ratings once issued and change their opinions ("upgrade" or "downgrade") periodically if they feel the risks have changed. While ratings are typically determined at the discretion of the agency, most tend to follow a basic approach set out in "methodologies" for each major sector.

Whether expressed as a rating symbol or a percentage, the outcome of most credit risk analysis is an assessment of expected loss. As set out in figure 7, this is typically stated as the product of two factors: Probability of Default (PD) and Loss Given Default (LGD).

Figure 7: The primary components of credit risk



Box 3: Learning from existing investment-grade bonds

As renewable project financing has evolved, arrangers for project bonds have taken different approaches to achieving an investment grade rating. Continental Wind is a portfolio of onshore wind assets in the US first rated in 2005, while WindMW is an offshore wind project in Germany first rated in 2015. Both target a similar level of financial risk and have low investment grade (Baa3) ratings. However, while Continental relies heavily on diversification (of wind resource, regulatory framework and turbine technology), WindMW is a single asset operating a less proven technology, but in a stronger regulatory framework and with much stronger (solid investment grade) principal contract counterparties.

Investment grade bonds have a very low level of expected loss[1] because they require a low probability of default, a low loss given default, or both.

Bond arrangers can choose multiple routes to reach their target rating. If the financial risk is high (because debt is used to fund the majority of up-front investment), arrangers must take measures to lower business risk (eg, using contracts and other mechanisms to stabilise cashflows) and to strengthen the financial structure (eg, preventing management from paying dividends when project performance is weak).

A CEIT would – by design – have higher financial risk than most renewable project bonds as it would seek to pay out all free cashflow with very little buffer. This requires more stable cashflows than those of most rated renewable projects and a stronger financial structure.

3.2.2 AN INVESTMENT GRADE CEIT

The greatest challenge with designing the CEIT is convincing investors (and regulators) that a new instrument which may not be a formal debt instrument has a risk profile similar to that of an investment grade bond.

Assigning the CEIT an "investment grade" label would situate it with the appropriate investment class and give investors a familiar basis for evaluation and commitment. A formal opinion from a credit rating agency would be the easiest way to convince investors of the CEIT's risk profile. However, the major rating agencies typically do not rate equity instruments.

We approached this problem from two angles:

1. We used a rating agency methodology – in this case, Moody's Investors Service's *Power Generation Projects* – and an analysis of rated deals as a structuring guide.
2. We also performed detailed scenario analysis to compare the likelihood that CEIT investors do not get their expected returns (CEIT "default") with the probabilities of default that Moody's expects for corporate bonds.

Using the methodology

The rating methodology covers the three principal elements of credit risk in turn:

Business risk

Minimising business risk is all about stabilising cashflows from the CEIT's assets. There are three broad avenues for this: 1) excluding certain assets 2) reducing payment for an asset; and 3) using contracts or other means of passing through project risks to other parties.

Based on our investor interviews and a comparison with rated project bond transactions, we would start by limiting the pool of potential CEIT assets to those that:

- **Are located in countries with low credit, policy and currency risks** – with investment grade sovereign credit ratings, no recent history of retroactive renewable policy changes, and a deep pool of institutional assets in the same currency, thereby avoiding foreign exchange risk.
- **Have little technology risk and strong off-take contracts with creditworthy counterparties** – that is they have long-term, fixed-price off-take contracts with investment-grade principal counterparties, limits to any uncapped market design or regulatory exposure (no uncapped curtailment risk) and proven generation technologies (eg, onshore wind and PV).
- **Are acquired only at or after commencement of operations** – that is, they are not exposed to the particular risks associated with construction, which are better borne by construction

1 Moody's estimates that over a 20-year period, the expected loss for an investment grade bond can range from 0.02% for the lowest risk to just under 8% for the highest risk.

companies. A CEIT manager may also prefer to acquire assets with a little operating history, which can significantly reduce the risk associated with original output forecasts.

- **Are held at least to the end of their lives, cannot be levered or pledged as security** – as discussed in *Beyond YieldCos,* leverage magnifies any market-correlated default risks associated with the asset, while any asset sale necessarily depends on market conditions at the time of sale, adding market-correlated risk to the CEIT.

A portfolio of assets that takes into account the above conditions should be reasonably safe from some of the highest impact risks. [2] However, in order for a CEIT to promise quasi-fixed returns to investors consistent with an "investment grade" rating, the CEIT must more comprehensively address the key risks which could cause revenue to be lower than expected and costs (both operating and capital) to be higher than expected.

We group these risks into a) those related to wind or solar resource; b) those relating to the performance of the assets and c) those relating to other issues, such as physical and market-based constraints that can stop a project from generating energy.

Our analysis of historical data for onshore wind assets in the USA shows that the most material are those relating to long-term resource estimation error and maintenance capex.[3]

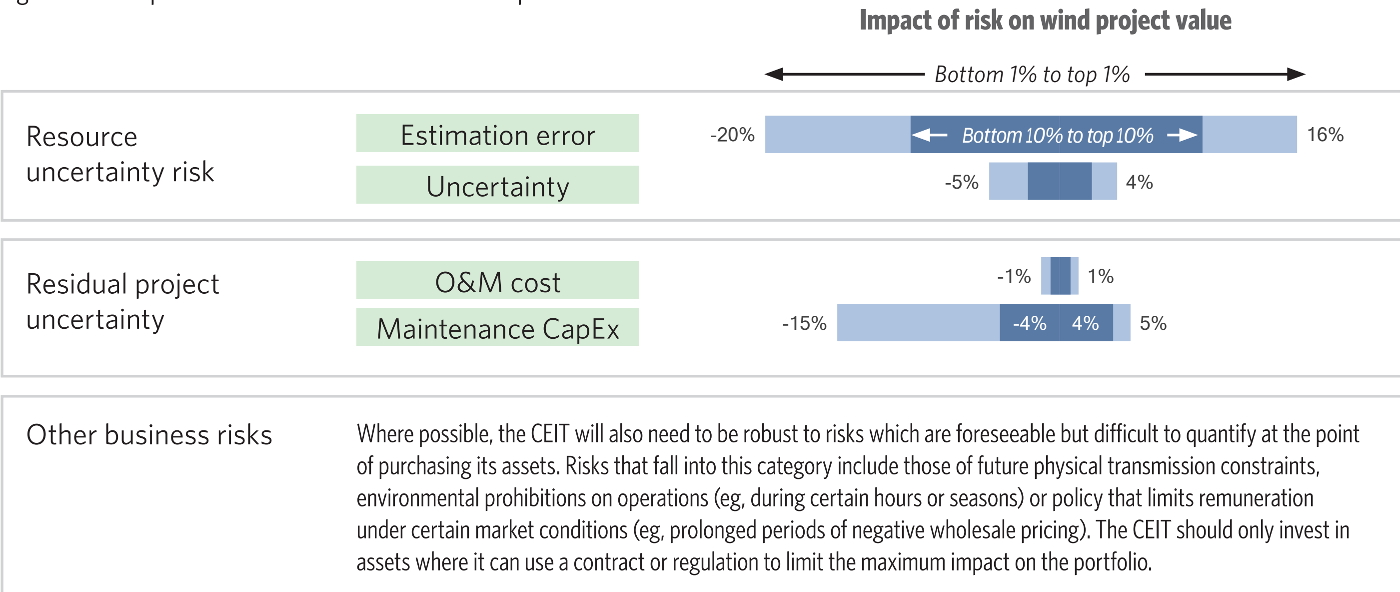
In severe cases (one in every 100 scenarios) a wind farm in the USA could receive 20% less revenue or spend 15% more maintenance capex relative to expected levels.

In project finance transactions, lenders limit their risk by requiring that there is expected to be more than enough cashflow to meet debt payments, with the excess cash going to equity investors. Lenders often use Debt Service Coverage Ratio (DSCR), the ratio of cash available to make debt payments to the payment due, as a metric to evaluate the security of debt repayments.

For example, a DSCR of 1 means that the debt is likely to be repaid and a lower value indicates a likelihood of default. If a DSCR is 1.3x we would expect that there would be 30% more cash in excess of the debt repayment that would then go to the equity holder.

The CEIT is – by design – a vehicle which distributes to its investors all the net cashflows from its assets. If it were a debt instrument, this would mean a DSCR averaging closer to 1x, meaning a higher level of financial risk relative to most investment-grade bonds.

Figure 8: The impact of the most material risks on wind portfolio value



2 These restrictions could be codified in the investment mandate or articles of association of the CEIT vehicle.

3 A forthcoming technical paper to accompany this work will detail the modelling methodology with summary statistics of historical US EIA and FERC wind asset performance data provided by Catalyst Cooperative and discuss summaries of DNV-GL wind estimation performance used to derive these risk impacts.

Financial structure

In a typical project finance structure, lenders are put in a risky position - they provide the majority of the capital and yet have no control over the operation of the asset. Lenders typically require contractual restrictions designed to offset risks relating to this misalignment of interests. They seek both to reduce the probability of default (eg, prohibitions on paying dividends if project performance is weak) and to increase recoveries in the event of default (eg, the ability to step in and control a defaulted asset and sell it in order to repay their debt).

Many of these protections are not necessary for a CEIT with a single layer of capital as there are not competing interests which need to be aligned in the same way as is true for project debt and equity providers. **However, the unlevered equity approach does create the opportunity for new structuring techniques, which provide additional protection to CEIT investors that are not available to project finance lenders.**

Using quantitative analysis

Using the Moody's methodology has enabled us to structure a hypothetical instrument with a 20-year life that looks to have a similar mix of risks to investment grade project bonds. However, our interviews suggested this analysis on its own would not be sufficient to convince most investors that a CEIT has an "investment grade" risk profile. Investors would be particularly wary in cases where the CEIT does not have contractually fixed return payments that must be satisfied to avoid a default (ie, unlevered equity).

To help investors get comfortable with the CEIT's investment-grade equivalence, we assessed the risk of CEIT investors not getting what they expect in every period throughout the 20-year life of the CEIT (ie, the risk of a "default") by performing Monte Carlo analyses. We then compared the results with Moody's assessment of the likely probability of default for investment grade bonds with a similar life.

The result is a cost-effective CEIT, which would pay investors no more and no less than their expected returns in 99% of cases – equivalent to a highly rated investment-grade bond.

3.2.3 CONSTRUCTING AN INVESTMENT GRADE CEIT

We reviewed a wide range of tools for mitigating project risks that a CEIT arranger could potentially use to create an instrument with an investment grade risk profile. Many of these are typical project finance strategies, while others are more novel.

Tools to reduce risk used in project finance provide familiar and well-understood options for the arranger of a CEIT. As the CEIT will need more stable cashflows than is typically the case in project finance transactions, we have reviewed commonly used tools and those which appear only rarely (or are emerging) which allow for greater risk transfer to a third-party but for a higher price (ie, a full service operations and maintenance contract lasting the whole life of an asset compared with one lasting only five years).

The novel structure of the CEIT – where the low-risk investor has full control of the asset – also allows other possibilities, including the ability to incentivise technology providers by giving them access to cashflows where a CEIT performs better than expected (see section 4) and using the flexibility of an investment without a legal maturity date to provide greater insurance that CEIT investors will receive their target return (see section 5).

Table 2 summarises the tools that we assessed and their effectiveness.

Box 4: Probability exceedance: finding the right level of confidence

Before committing to invest large amounts of capital in assets such as power plants, equity investors and lenders will model the likely future returns.

Due to the inherent volatility associated with weather and climate, windfarm investors typically estimate wind production to different levels of confidence.

The statistical average or the "expected" case is known as the P50, ie, the level of wind generation which would be exceeded in 50% of periods. Equity investors tend to use P50 estimates of production as their base case. However, debt investors are more conservative and often use P90 estimates of production when considering how much debt they are willing to provide.

Uncertainty of wind electricity generation is a variable in the CEIT structuring model, which relies on a statistical technique called Monte Carlo simulation. The model also takes into account other risks (eg, turbine performance, O&M cost, capital maintenance and curtailment) to identify whether potential structures are able to deliver the CEIT's expected returns in at least 99% of cases.

It is this level of certainty—at least 99% of cases—that a CEIT must achieve to attract liability-hedging investors.

Delivering the promised revenue for the life of CEIT with 99% certainty and at the lowest total cost is the fundamental dual objective of the CEIT; this optimisation problem is assessed at greater length in section 6.

Table 2: Potential risk mitigating tools for the CEIT

	DESCRIPTION	STRENGTHS AND WEAKNESSES
Resource estimate	When deciding how much to pay for an asset, the CEIT will forecast its future cashflows. Forecasting future generation to a very high level of confidence (eg, P90) will lower the revenues considered for the CEIT product compared against a lower level of confidence (eg, P50).	The cheapest but bluntest tool to mitigate risk. Lower revenues reduce the value of the CEIT.
Diversification	A portfolio of assets with risks that are not correlated will mean the CEIT will be less severely affected eg, in the event of a poor wind year. A wide variety of risks can be diversified (resource, counterparty, regulatory framework).	A cheap way of reducing many risks but subject to diminishing returns. The ability to do this may be limited in practice by the difficulty of finding sufficient uncorrelated assets of an acceptable profile.
Separate tranche equity	A tranche of capital, which only receives returns after CEIT investors have been paid. Bears residual risks that have not been contracted out. Common in project finance.	A very effective risk mitigant, but very expensive because investors are not best placed to manage all residual risks.
Surplus investor	A third party, to whom a CEIT sells the right to receive any cashflows in excess of base case levels. This reduces variability in returns, which is important for liability hedgers. (See Section 4 for more details)	Parties with control over project performance (eg, O&M contractors) may value "upside" higher than CEIT investors seeking only their target return. Novelty of mechanism means contractual details are uncertain.
Tail investor	A third party, to whom a CEIT sells the right to receive cashflows from a CEIT's assets after their fixed-price contracts have expired. (See Section 5 for more details).	Parties with a long-term interest in the industry may value post-contract cashflows and a repowering option higher than CEIT investors seeking only their target return over a target period. Novelty of mechanism means contractual details are uncertain.
Seasoning	Require a fixed period of operation (eg, three months) before the assets can be included in a CEIT reduces the uncertainty around long-term generation forecasts, as initial operation data can confirm forecsts.	Performance of an asset with even a little operating history can be forecasted much more accurately than immediately post construction. May make the CEIT uncompetitive if the developer wants to sell earlier. May be difficult to coordinate timing of several assets in a portfolio.
Purchase price adjustment	An agreement between the CEIT and an asset's developer at the point of purchase to use early operating performance data to reforecast future revenues and adjust the final purchase price accordingly.	Shares the risk of long-term forecasting error. May make the CEIT uncompetitive if other buyers do not require one. May require a separate bank facility to cover the risk that the CEIT needs to make a payment to the developer.
Standard insurance	A contract to outsource risk(s) to an insurance company. Cover could be general or for more specific risks. Requires an upfront premium to be paid and an excess relating to any claim. Insurance company decides whether to pay out on a claim-by-claim basis	Can be effective if with a creditworthy insurer. Expensive if general rather than specific risk cover. Not a source of liquidity if insurer investigation precedes payment.

Parametric insurance	An insurance agreement with an in-built formula to determine the level of payout and in which situations. These are increasingly common in relation to weather risk.	More objective therefore a more effective source of liquidity. Currently only available for a limited number of risks.
Derivatives	A contract with a financial institution hedging a specific risk, ie, weather risk. The contract would specify a reference level of wind for a certain asset in a certain period. If wind levels fell below that reference, the financial institution would make up the difference to the CEIT, and if it exceeded that level, the reverse would happen.	A source of more bespoke risk protection than insurance. However, the CEIT may need to post-collateral to the financial institution – a liquidity risk.
Warranties	Equipment manufacturer (OEM) promises to repair certain faults free of charge for a certain period after purchase.	Longer-term warranties often tied to O&M contract. More valuable if OEM is a strong counterparty.
O&M contract	Contract with a specialist contractor who will agree to operate and maintain an asset for the length of the contract. Available in a variety of scopes – the most expensive lasting the entire life of an asset and covering the cost even of unplanned maintenance.	Can take on much of the O&M risk Generally includes bonus incentives (50% of additional revenue) for availability in excess of guaranteed level (usually 97%). Full-scope contracts are expensive but prices are falling as contractors start to understand the value of detailed performance data.
Cash reserve	A separate amount of cash set aside and only available to be used in certain prescribed circumstances. Usually used to help pay expected or contractual returns in cases where assets have performed badly	Solid risk reducing tool common in project finance transactions. Reduces the amount of cash that can be available to purchase the asset. Uncertainty about recovery at end of asset life.
Reserve facility	A reserve structured as above – but not funded up front. Here, a bank promises to make payments as and when required.	Increases the amount of cash available to purchase the asset. Comes with more strings attached than a cash reserve – the lender may require security.

An effective set of risk-mitigating tools

We found that there were very few cases where one tool provided sufficient protection to ensure that CEIT investors would receive their expected returns in 99% of scenarios. Even in these scenarios, the cost of providing protection through one tool (eg, through a very large cash reserve) would be so high as to make the CEIT an uncompetitive buyer of assets.

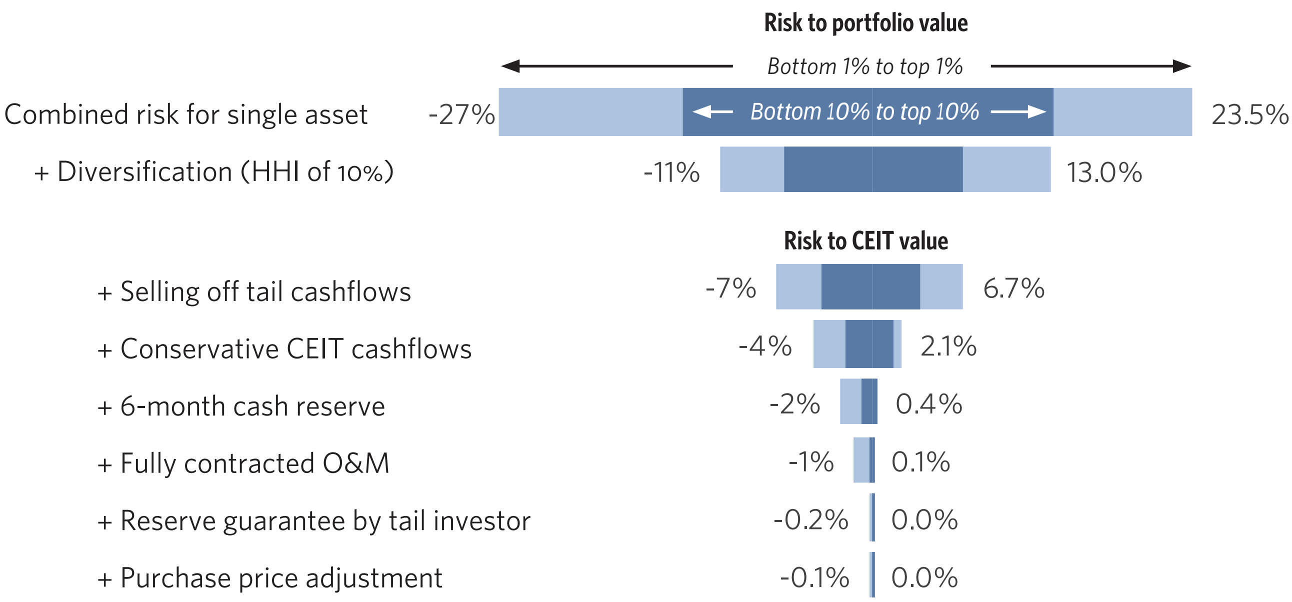
By layering one tool on top of another, we created a structure, which reduced risk levels below the desired investment grade threshold. Figure 9 below demonstrates how a diversified portfolio, a conservative estimate of wind resource, reserves and other structuring elements can result in a residual downside risk to CEIT investors of less than 1% of expected value.

How the CEIT can reduce the cost of renewable energy

The CEIT would not meet our objective for reducing the cost of renewable energy if it did not result in a cost of capital lower than that which is currently the case for project financed assets and yieldco-owned assets. We reviewed a number of packages of risk-mitigating tools which were effective at reducing risks for CEIT investors but not at reducing the cost.

However, we determined that there were structures, which could enable a reduction in the cost of renewable energy of between 15% and 17%.

Figure 9: A portfolio of risk reduction tools allows CEIT investors to receive their expected return in 99% of scenarios



The most cost-effective CEIT has the following features:

- An intention to pay investors a "base case" set of returns every six months based on an estimation of future net cashflows, which assumes an annual forecast of power generation that would be expected to be exceeded in 75-90% of years (ie, P75-P90)
- A diversified portfolio with a level of diversification akin to five to ten equally sized, uncorrelated projects of a similar size.[4] In practice, a portfolio of more than five to 10 assets is likely to be needed given the difficulty of sourcing genuinely uncorrelated assets and variations in project size.
- Long-term, full-service O&M contract(s), fixing O&M costs for the life of the assets and transfering away from the CEIT responsibility for paying for unexpected maintenance spend.
- A purchase price adjustment facility that will reduce the price paid by CEIT investors after a period of 24 months, in the case that the data show that long-term production will be materially lower than originally forecast.
- A cash reserve facility funded upfront, and sized to cover at least the next semi-annual expected distribution to investors, which will provide liquidity support in the case of unexpected events or lower-than-expected net cashflows from the portfolio.
- Coverage of some up-front structuring costs by contributions from the surplus investor (see section 4) and the tail investor (see section 5). These contributions could, for instance, cover part or all of the initial funding of the cash reserve facility.
- The tail investor will guarantee the restoration of any reserve shortfall at the completion of the fixed-price contract period or forfeit access to the tail revenues.

The simplest CEIT (and the case we consider for modelling purposes in the remainder of this paper) would likely be structured as unlevered equity, although as set out in box 5 below, the requirements of specific target investors will, in practice, influence the final design.

4 We can achieve the equivalent diversification through a number of different project size mixes, say, two larger projects and 6 smaller projects. We use a measure of portfolio concentration based on the Herfindahl-Hirschman Index (HHI), in which 5 equally sized projects achieve a rating of less than 20%. HHI is calculated by summing the squares of each independent asset's share of generation. Thus, a single asset portfolio has an HHI of 1 (1x1 = 1), a two independent asset portfolio 0.5 (0.5x0.5 + 0.5x0.5 = 0.5) and a 3 independent asset portfolio where the largest comprises 50% of generation and the other two a quarter each, would have an HHI of 0.375. We have adopted this index of portfolio share, as it corresponds mathematically to the benefits of diversification.

Box 5: Optimising the CEIT for institutional and regulatory requirements

The ideal CEIT would have a simple structure with only one layer of capital ensuring alignment of interests between all capital providers. However, it is not likely that institutional investors would consider a 100% debt instrument for their liability-matching portfolios as it would be unlikely to be considered investment grade. Therefore, we conceived of the CEIT as an "unlevered" or 100% equity instrument.

However, there are other regulatory and economic considerations (which we analysed in our *Barriers* paper) that may influence the question of whether investors prefer a debt or equity instrument, including the financial regulatory and tax framework that governs it (if it is subject to one at all) and the flexibility of a particular investor's investment mandate.

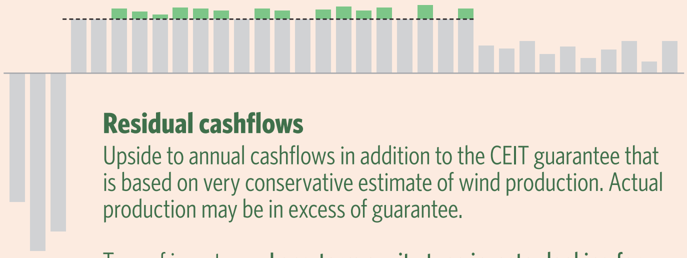
Financial regulatory and tax framework – For insurers, solvency regulation varies by jurisdiction – in particular, the rules around what assets are admissible for liability-matching. If rules in a given jurisdiction rendered an equity-based CEIT inadmissible for inclusion in a liability-matching portfolio, this could push towards a CEIT structured as debt. For example, as the Solvency II framework in Europe is generally more prescriptive than its US equivalent, this could mean greater demand for an equity-based CEIT from insurers in the US than Europe.

The reverse could be true for pension funds. For US investors with non-profit status, interest income is tax-exempt in many cases, which may drive a clear preference for an instrument legally structured as debt – at least in the short term. With many countries considering limiting the tax deductibility of interest expense for issuers and with a downward trend in corporate tax rates, the tax benefits associated with debt for both investors and issuers are declining.

Investment mandate – as a relatively novel product, the CEIT will not easily fit into most institutions' typical investment frameworks as it will deliver a return too low for most equity or infrastructure portfolios and will be a more complex proposition than those typically considered by fixed income desks. The full benefits are likely to be seen when there are sufficient issuances/listings to support indices (eg, as has happened with US Master Limited Partnerships); derivative products (eg, exchange-traded funds) and specific asset allocations (eg, as has increasingly happened with green bonds).

4. Surplus cashflows in the contracted phase

Cashflows from the CEIT will be priced based on very conservative energy generation forecasts. While the CEIT maximizses the value of cashflows that are nearly certain, there is additional value in surplus generation. Our analysis showed one in 10 portfolios feature returns in excess of 35% and one in 100 in excess of 50%. A surplus cashflow from a CEIT valued at $1bn would have a market value of around $10m to $30m which would be too small for a public listing. The types of investor in this cashflow would be looking for higher returns and would likely prefer a private vehicle.



Residual cashflows

Upside to annual cashflows in addition to the CEIT guarantee that is based on very conservative estimate of wind production. Actual production may be in excess of guarantee.

Type of investor:	**Long-term equity type investor looking for high returns, eg, equity investors, traders, developers, independent power producers and electricity retailers**
Rate of return:	**12% to 18%**
Period:	**18-20 years**

With the CEIT sized to P90 cashflows, ie, power generation forecasts are exceeded 90% of the time, this means that 10% of the time cashflows will be lower than the CEIT requirements. For these 10%, diversification, reserves, contracts and other tools bring the cashflows up to the P90 level. The other 90% of the time cashflows are likely to exceed those committed to the CEIT. Since these cashflows are uncertain, the typical CEIT investor would assign almost no value to them. However, investors with different risk-return profiles will be more willing to take the risk. Our analysis shows that bringing in this class of investor can create value.

Three questions arise:

1. Who are the likely investors in these cashflows and why?
2. How risky are these cashflows and how much are they worth?
3. What is the best structure for packaging these flows?

Surplus investors as opposed to the liability-hedging CEIT investors, the surplus will interest either:

- Long-term equity type investors looking for high-risk, high-return investments,
- Speculators,
- Investors who are looking to hedge risks that are offset by renewable energy performance such as power price or weather risk that could be related to renewable energy performance. For example, an investor who is exposed to power prices that would fall if there is a large amount of wind energy produced, might like to have a hedge by taking exposure to higher levels of wind production.
- Developers, equipment manufacturers or O&M contract providers in the project that can either influence the value or benefit from a small continued stake in a part of the project.

These investors may include equity and traders, as well as commodity traders, power marketers, independent power producers, retail electricity providers, property & casualty insurers, or other corporates with weather-linked liabilities, or the relevant developers or contractors. These investors are likely to have return requirements in the range of 12% to 18%.

4.1. The riskiness and value of the surplus cashflows

As a first approximation, the value of the surplus cashflows should be the difference between average expected cashflows, that is P50, minus the P90 cashflows promised to the CEIT, discounted by the 15% required return.

For a typical US onshore wind portfolio of 10 independent assets, P50 minus P90 cashflows represent approximately 5% of the total cashflows. Applying a 15% discount rate rather than a CEIT discount rate of approximately 4.5% would yield a present value for the sum of the surplus cashflows equal to 1-2% of the value of the CEIT.

Of course, different portfolios will have different P50-P90 spreads. Solar PV production, for instance, is easier to predict and varies less from year to year, so there is a smaller difference between P90 and P50 levels. As a result, the surplus investor will be relatively smaller. We expect differences between different wind portfolios, as well as portfolios that could have different mixes of onshore wind, offshore wind and solar.

Our analysis shows that the volatility in surplus cashflows for a typical wind portfolio of 10 independent assets for a P90 CEIT structure at the end of the previous section could be substantial. On the downside, we see negative surplus investor returns (<-5%) for one in ten portfolios and near complete loss of invested value (<-90%) for one in a hundred portfolios. On the upside, we found that one in ten portfolios feature returns in excess of 35% and one in a hundred in excess of 50%.

Beyond this first approximation lies the uncertainty of the difference. We would expect some portfolios to have greater uncertainty and volatility around the P90 and P50 levels. This volatility might not affect the expected value but could increase or decrease the discount rate applied.

Finally, the valuation of the surplus cashflows will depend upon the various tools used to reach investment grade. Some of them, including claw backs and purchase price adjustments, could increase the risk or lower the excepted cashflows of the surplus investment product.

4.2. Creating an investment structure around the surplus cashflows

While the surplus cashflows are clearly an equity product, some questions arise around whether that product should be publicly traded or private, whether the surplus equity investment should, itself, be levered, and whether the surplus investment components should be sold off as a combined portfolio or as separate products for each project within the portfolio.

Public versus private. In the long-term we would expect that CEITs could reach market caps in the range of $1bn or more – large enough that a public, exchange-traded equity vehicle could make sense. The surplus cashflows of a $1bn CEIT would have a market value, in the range of $10m to $30m. This investment size is too small to justify a public listing. Furthermore, many of the natural investors for such a product are likely to prefer a private vehicle.

Levered or unlevered. Some investors may choose to borrow against the surplus investor cashflows to achieve even higher returns. Unlike the CEIT, this borrowing will not be investment grade, and may end up being a corporate loan rather than project financed. Project finance type loans will end up being reasonably high cost, while balance sheet corporate loans will depend on the financial strength of the individual investor. This leverage could enhance returns to investors, but increase their risk as well. The decision will depend upon the investor preferences in each specific case.

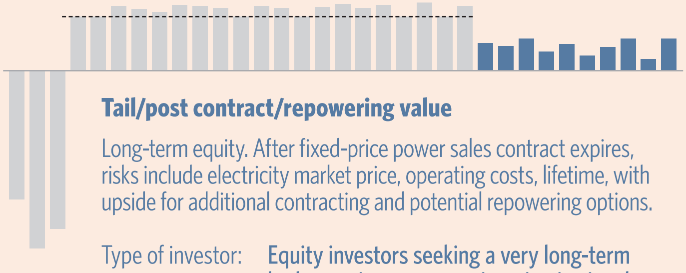
Portfolio or separate investments. Once again, the choice of whether to sell the portfolio of surplus cashflows as a single product or to separate it into project level investment components will depend upon the specific projects and investors involved. A portfolio of projects is likely to have less volatility and thus a greater certainty that there will be at least some value. Such a design may also be easier to use as one of the tools of mitigating risk for the CEIT. Additionally, with diversification, investors will find it easier to leverage the portfolio to reach the desired return.

On the other hand, developer and equipment manufacturer investors will prefer the individual project model, where they can invest specifically in the upside of their own projects or actions. Individual projects might also be more tailored to hedging specific risks.

In sum, the decision on structuring this private equity product will depend on the circumstances and opportunities associated with each CEIT and its component projects.

5. Designing an investment vehicle around post-contract 'tail' cashflows

Renewable energy projects could operate as much as 10 years or more after a fixed-price tariff or contract regime expires. With prices no longer fixed and aging plant offering less certain output, these cashflows would provide little value to liability hedging CEIT investors seeking predictability. However, other investors would find these riskier, future cashflows interesting if the price were right, particularly if they can be bundled into a tradeable investment vehicle.



Tail/post contract/repowering value

Long-term equity. After fixed-price power sales contract expires, risks include electricity market price, operating costs, lifetime, with upside for additional contracting and potential repowering options.

Type of investor:	Equity investors seeking a very long-term hedge against energy prices; institutional investors; O&M contractor; equipment manufacturer & developers
Rate of return:	12%-15%
Period:	25-30-years; returns 10 years post contract

Fixed-price contracts or tariffs are nearly always fixed term. But the expiration of the contract does not mean that a wind or solar project can no longer produce and sell energy to generate cash and value. Unfortunately, for the CEIT investor, this value is highly uncertain. Energy prices, O&M costs, market regulation 20 years hence are far from predictable – so unpredictable, in fact, that a typical liability-hedging CEIT investor will ascribe them little or no further value. Yet, other investors with different investment criteria and needs, should be willing and able to value these risks and cashflows. Thus, separating these cashflows and packaging them in a way that attracts a more appropriate investor will create value. This value can also be used to further enhance the value of the CEIT.

To understand the value of this post-contract – or tail – investment with cashflows far into the future and then how it can be used to enhance the CEIT, we must address four questions:

1. What are the expected cashflows, their risks, and other associated value streams for the tail investment?
2. How much would these cashflows and values be worth at the date of contract expiry and how much would they be worth today?
3. What types of investors could be interested in these tail assets, and why?
4. How could, and should, an investment product be structured to attract these investors?

5.1. Valuing the post-contract cashflows from CEIT projects

The tail investors will see four main revenues and costs:

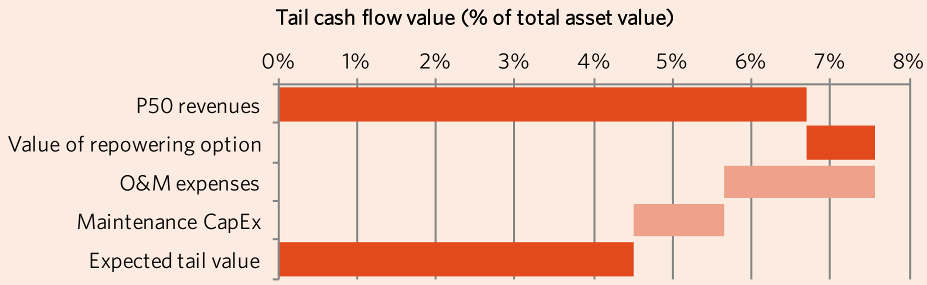
1. **Power market revenues** – As long as the facility can continue to generate, it can sell that energy to wholesale markets. While we expect annual production to fall gradually as the equipment ages, wholesale prices could move up or down depending on energy prices, interest rates and, crucially how the market is structured and regulated. Twenty years is a long time – particularly in the midst of a transition to a low-carbon economy that could result in wholesale changes to markets and regulations. Nevertheless, there are a number of reasonable assumptions that could be made, such as future prices that will be determined by the cost of new renewable energy projects, which are likely to fall.
2. **Maintenance CapEx and O&M** – Offsetting these revenues will be the O&M costs. It is safe to assume that the O&M contract will expire when the fixed-price tariff or contract expires. Without the security offered by such a contract, these costs would be expected to rise. Thus, tail maintenance CapEx and O&M will be much more uncertain and probably higher. The worst case scenario might be zero net revenues, but that would be extreme.
3. **Repowering options** – Even if the existing plant generates no positive net cashflows, the project may still have value in terms of ownership of the site. Although future regulation and planning processes are uncertain, the project is likely to have established infrastructure that will reduce costs,

Box 6: Valuation and risks of the tail cashflows of a typical wind project

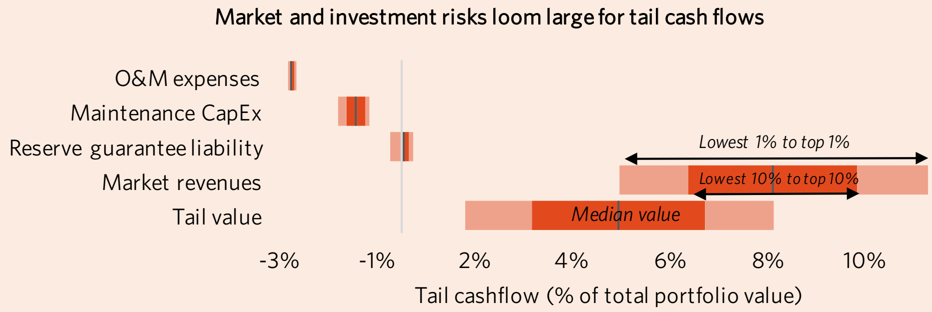
As an example, consider a wind project with a 20-year fixed-price contract. To estimate the expected value of the tail cashflows, we assume that:

1. On average, the asset will operate for another 10 years, consistent with the 30-year life currently assumed by regulated utilities for rate-based wind
2. Availability drops by 10% relative to contracted phase
3. Market power prices escalate by 1.7% annually (based on EIA AEO 2016 low gas price scenarios) relative to the original fixed contracted price, but are highly uncertain (roughly 20% standard deviation across scenarios)
4. O&M expenses and CapEx double
5. The option for repowering the asset has a value of roughly 10% of the original project cost, reflecting potential upside from the cost and performance of new turbines.
6. Retirement costs are roughly offset by the salvage value

With these assumptions, we find that the value of the tail cashflows for a wind project (expressed as a percentage of total asset or portfolio value) is still driven by the highly uncertain future market value of the energy it generates, even though we have assumed doubling of expected O&M expenses and CapEx during the tail period.



Further, we find that market and investment (repowering/maintenance CapEx) risks are the dominant sources of potential volatility in tail value. Note that the risk to tail value of guaranteeing a P90 CEIT with 10 assets is relatively small compared to market and investment risks.



as well as a much higher probability of receiving permission to build new plant on the site, and probably lower development costs. Buying sites with the purpose of installing new, more efficient equipment is already an attractive proposition in some markets and investors are likely to consider this proposition.

4. **Cost of removal net of salvage** – Finally, another cost to consider could be potential future costs associated with eventual dismantling and decommissioning of the assets, net of any salvage value.

In a typical project, the expected annual net tail cashflows can be comparable to cashflows during the contracted phase, ranging from 60-90% of annual contracted expected net cashflows. However, since these cashflows and values are far into the future, the present value of the tail at the time a CEIT begins operating is likely to be much lower. If a CEIT investor were to value them at the CEIT cost of capital, these cashflows would have 15% of the value of the contracted cashflows.

5.2. Valuing the tail at the CEIT's inception

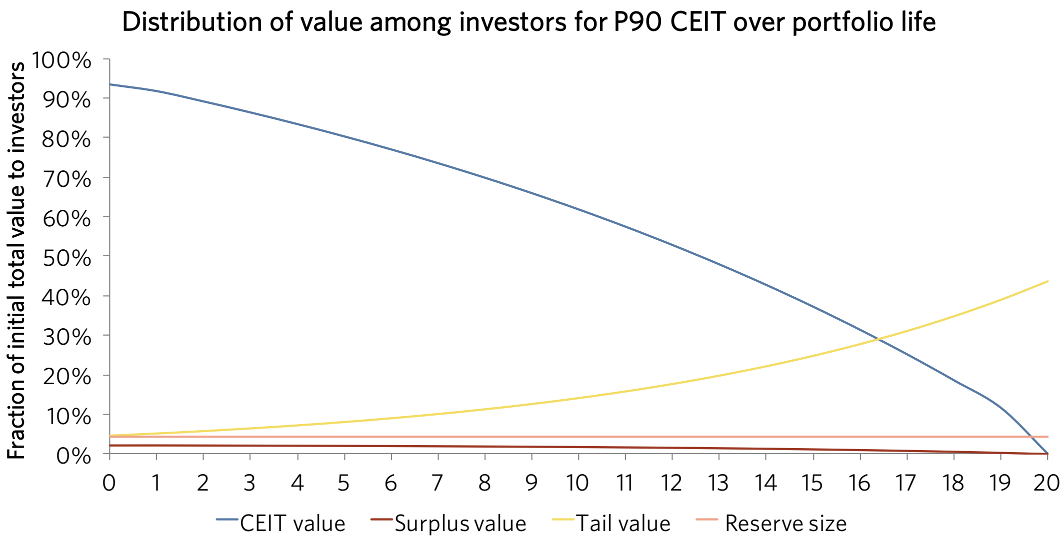
With 20 years of discounting before the first cashflows arrive, the tail will not have very much value at inception. Based on discussions with investors, we believe that this product would have a return requirement or annual discount rate in the range of roughly 12%-15%. Thus, the 12%-15% valuation falls to 3%-5% at inception. However, with such a high discount rate, and with a low likelihood that there would be material changes to assumptions in the early years, the value of this project would grow at the rate of the discount expectations. As the start date nears, however, more information will be available and the price might rise more rapidly or more slowly.

5.3. Finding investors for the tail

Several different investor profiles could be interested in this opportunity:

- Investors seeking a very long-term hedge against energy market prices. The tail investment could be a relatively inexpensive way to build this hedge.
- In the early years, with the right design and liquidity or accounting convention, this investment could interest investors seeking the steady, high returns that would come from this source of value coming one year nearer each year. Institutional investors might be interested in mixing this into their portfolios.
- As with the surplus investment, the O&M contractor, developer or equipment manufacturer might wish to take on this investment stream either because they have a higher confidence in the value, or because they can invest to make it more valuable.

Figure 10: The bulk of the value of the structure initially lies with the CEIT, but the tail value of a P90 CEIT exceeds the reserve value almost immediately, and rises to nearly 10x the reserve value



- The surplus investors may be interested in this cashflow alongside the other investment flows.
- Finally, later in the project life, developers might be interested as a way to build a pipeline for future development.

5.4. Creating an investment structure for the tail

Like the surplus investor product, there are also clear choices to made about how to design this investment vehicle.

Public versus private. Like the surplus product, this vehicle is likely to be small in size, so a private investment may make more sense, depending on the investor. The key difference is that this investment will rise steadily in the first years, due to the heavy discount, and thus could interest some investors if a liquid traded vehicle could be devised which allowed marking to market or sales that would reliably allow investors to monetize or record this growth.

Levered or unlevered. Without cashflows for up to 20 years, there would be nothing to support debt. As a result, we expect that this product will be unlevered.

Portfolio or separate investments. As with the surplus vehicle, the choice of whether to sell the portfolio of tail cashflows as a single product, or separate them into project level investment components will depend upon the specific projects and investors involved. Again, some investors might want to have the upside value of particular projects, while other might seek diversified future energy market hedges.

6. Putting the pieces together to minimise financing costs

In Section 3, we found constructing an investment grade-like vehicle for CEIT investors required a package of risk reducing tools, including cash reserves, diversification, long-term O&M contracts and adjustments to the purchase price early in the life of assets.

We further saw in Sections 4 and 5 that neither "surplus" cashflows during or after the fixed-price contract period would be appropriate for CEIT investors. Furthermore, by selling these cashflows upfront to investors who value them, CEIT investors can save on funding up-front structuring costs as the proceeds from the sale can be applied towards funding the cash reserve, for example.

The post-contract investor can also be an important part of the risk mitigation toolkit, as it would guarantee the restoration of any reserve shortfall at the end of the fixed-price contract period or else forfeit access to the tail revenues.

In this section, we provide a description of how these pieces can fit together to create a structure that can deliver a CEIT with investment-grade-like risks, thereby minimise financing costs by maximising the value of low-risk contracted cashflows and reducing the cost of electricity by 15-17%.

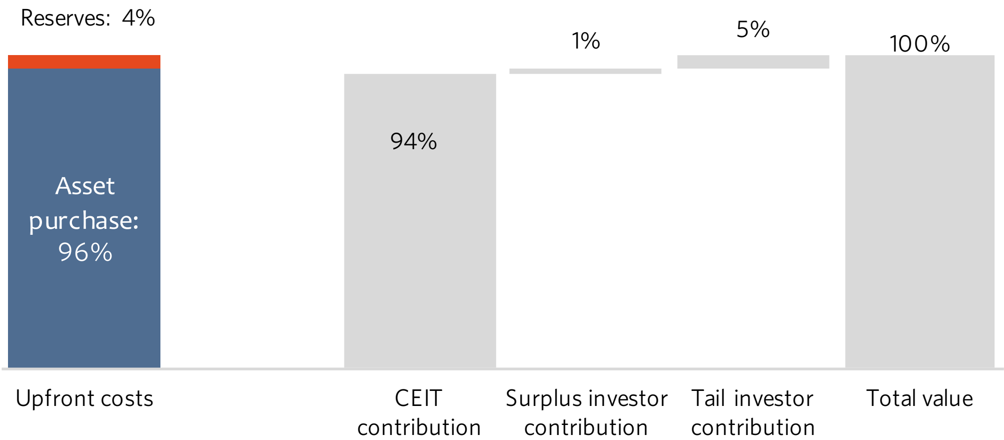
6.1. How the CEIT deal structure works in practice

As we described earlier, there are four key investor classes involved in the CEIT mechanism:

- The **developer(s)** develop, build and sell portfolio assets to the CEIT.
- The **CEIT investor** receives the bulk of the contracted cashflows over the contracted life of the portfolio. The CEIT sets target cashflows based on P75-P95 expectations (ie, cashflow expectation will be exceeded at least 75-95% of the time).
- The **surplus investor** receives in a stream of risky surplus cashflows (beyond CEIT expectations) over the contracted life of the portfolio.
- The **post-contract investor** invests in the value of the asset upon expiration of the underlying contracts.

The bulk of the value in a CEIT structure is in the low-risk cashflows owned by the CEIT investor – with the tail being the next largest component, and surplus investor holding the smallest piece, as shown in greater detail for a P90 CEIT in Figure 11.

Figure 11: The distribution of value between investors in each of the last three cashflow streams.

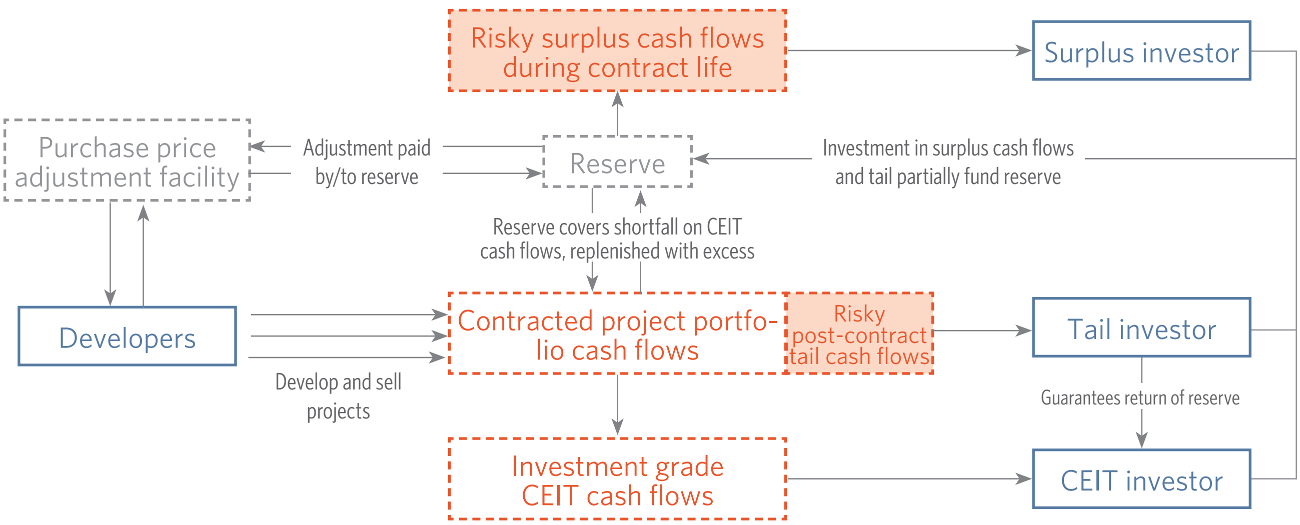


In addition, there are several key risk-mitigating tools in the financial structure of the CEIT which include:

- A **purchase price adjustment facility**, which serves to adjust the price at which assets are purchased by the CEIT based on a re-estimate of plant energy output after two years of operation.
- A **reserve**, which serves to supplement cashflows that fall short of CEIT expectations.
    - » The reserve is sized to cover at least six months of expected CEIT cashflows.
    - » The reserve is funded initially by the upfront contributions of the surplus investor and the tail investor, with any remaining reserve needs met by the CEIT investor.
    - » If the reserve is drawn down, surplus cashflows in future years are used to replenish the reserve before any are distributed to the surplus investor.
    - » If there is a purchase price adjustment (see below) that involves the developer returning some of the asset acquisition cost, this additional amount is placed in the reserve (because of the increased risk of asset underperformance with a downward adjustment of energy output estimates).
    - » At the end of the contracted life, the original reserve amount is returned to CEIT investors, while any excess reserve (eg, from a purchase price adjustment) is transferred to the tail investor.
- Finally, a key aspect of risk mitigation comes from the use of a conservative cashflow expectation from the CEIT. **By setting CEIT expectations at the P75-P90 level, rather than average expected cashflows, the CEIT is much more likely to meet expected cashflows, lowering risk and lowering the cost of capital.** In this case, the surplus investor will receive a greater share of the portfolio cashflows during the contracted life.

The relationship between each of these investors and the structuring elements described above is described in more detail for a representative CEIT in Figure 12 below.

Figure 12: Representative deal structure for a CEIT



So how do the components of this combination of structures work in practice? In Figure 13 below, we graph the cashflows for an example portfolio of assets generated using historical project performance data, assuming the use of the CEIT deal structure described above. Note that the purchase price adjustment in this case provides additional cash that supplements the reserve, which is utilized in various years to address potential shortfalls. At the end of the life of the CEIT, we see that the reserve is actually in excess – upside that is claimed by the tail investor.

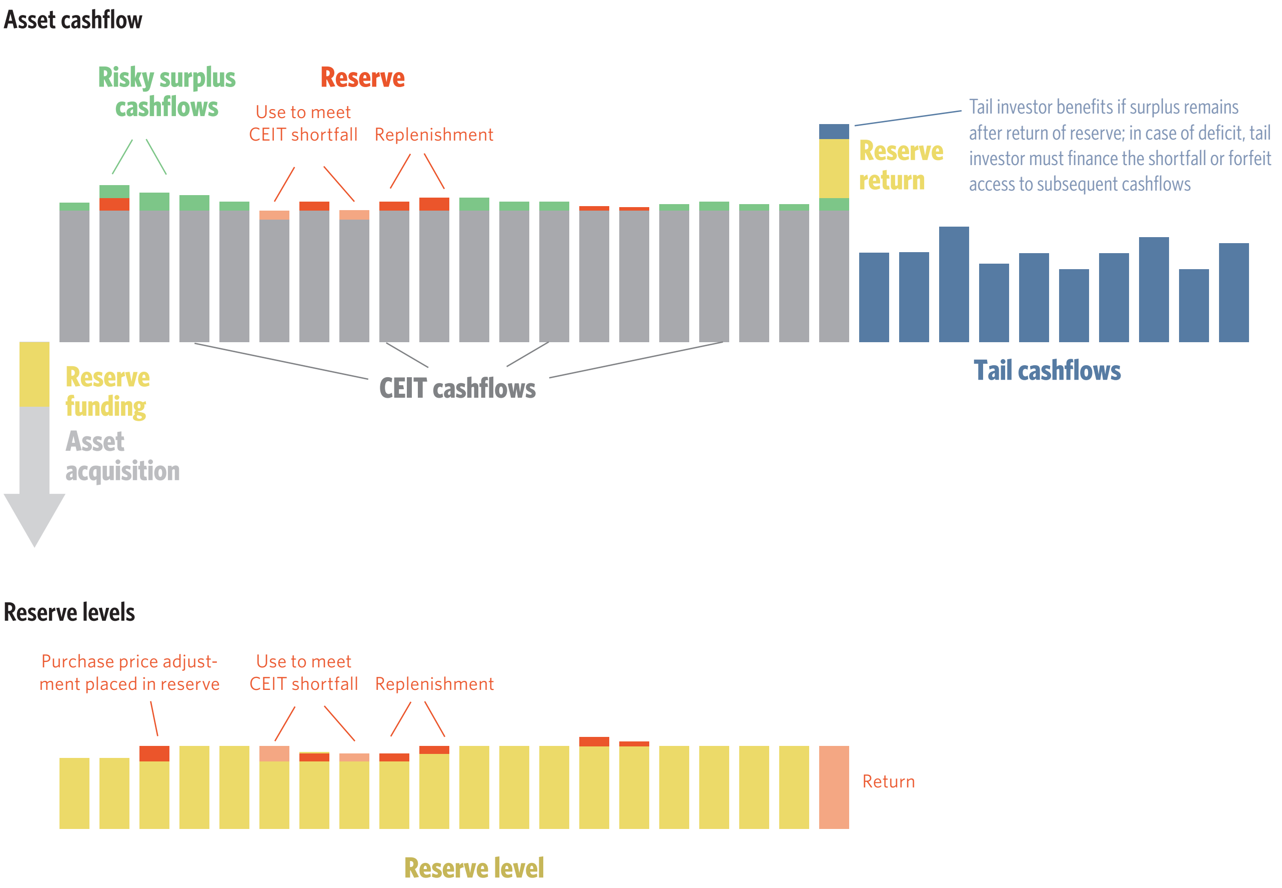
We note in particular the importance of the relationship between the CEIT investor and the post-contract investor embedded in the structuring of the cash reserve guarantee:

1. Concurrent with acquiring the assets, the CEIT sells the rights to the post-contract period and to upside cashflows during the life of the project to a return-seeking investor;
2. The cash raised from the sale is used to fund a portion of the cash reserve; and
3. The return-seeking investor has the obligation to make up any shortfall at the end of the contracted life, and this obligation is secured on the value of the post-contract period, which we have seen is significant.

That is, this structure uses some of the post-contract revenues to provide greater return certainty to CEIT investors, creating an opportunity to monetize the value of these future cashflows up front.

Finally, we note that additional opportunities to efficiently address the boundaries and relationships between the four cash streams may exist. For example, a CEIT investor may be able to more easily secure assets if some late construction risk can be taken. This may be particularly attractive for solar rather than wind due to its simpler construction profile and the significantly lower resource risk levels. However, additional structuring and contractual provisions would need to be in place to insulate the CEIT investor from such risk.

Figure 13: Allocation of cashflows between investors, and role of reserve



6.2. Minimising financing costs with the optimal CEIT

When it comes to creating a CEIT, there will be many feasible combinations of assets, contracts and third-party investors. However, not all will meet our two principal objectives: a) a low-risk investment-grade instrument that is attractive to liability hedging investors, and b) a financing package with a lower cost of capital than that currently used to value assets in the market.

In creating a new package of investments in post-construction renewable assets, a successful CEIT would generate more value (measured as a Net Present Value, or NPV) than assets do under existing financing structures. Part of this is achieved by using structuring techniques to allocate risks in a more targeted way than in today's financing structures. So long as the benefit of a given structuring option offsets its cost, then it should be beneficial for reducing overall renewable energy asset financing costs.

We conducted a series of interviews and an extensive literature review to understand the scope of the market for renewable asset risk mitigating tools and to understand any emerging trends that could disrupt this picture in future. This work and subsequent analysis supported our initial hypothesis that more targeted tools (eg, O&M contracts) were likely to be cheaper than less targeted ones (eg, private equity). Several targeted tools are currently in their infancy (eg, parametric resource risk insurance) and too expensive to help reduce renewable financing costs, although they could make a significant impact in future.

While we ran scenarios to assess the cost-effectiveness of a whole range of risk mitigation tools, we identified three groupings for our optimal CEIT design that have the most material impact on CEIT financing costs:

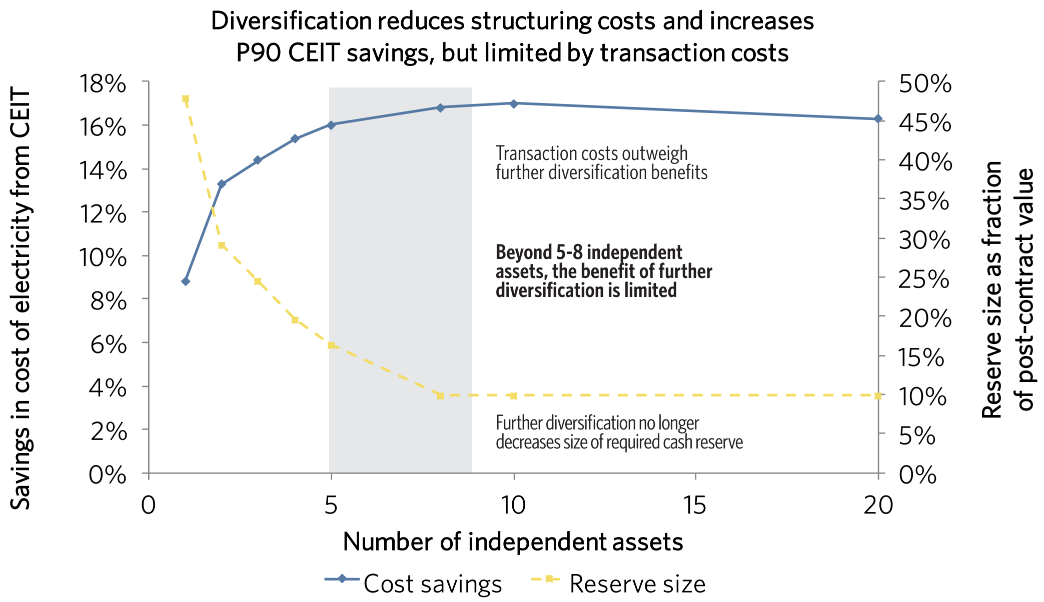
1. Level of diversification as set by the CEIT asset manager;
2. Split of value between the CEIT and surplus investor;
3. Size of the cash reserve, which has implications for the split between the CEIT.

Diversification

Diversification is a standard technique for most investors seeking to balance their exposure to specific risks or assets within a portfolio by making a series of "uncorrelated" investments. Most investors in renewables portfolios believe that they can mitigate site-specific volatility resulting from risks such as resources, availability, O&M costs and counterparty credit risks.

More diversified portfolios should decrease the volatility of cashflows, creating a benefit in the avoided cost of risk mitigation tools that would otherwise be required to ensure an investment-grade risk profile. The costs of this structuring tool are the transaction costs associated with the purchase of each additional asset. However, at some point, the fixed costs per transaction start to offset the benefits associated with lower earnings volatility.

Figure 14: Diversification reduces the volatility of CEIT cashflows, thereby increasing potential savings in cost of electricity from a CEIT



To assess the optimal level of diversification for a CEIT, we modelled a series of hypothetical portfolios with different numbers of uncorrelated assets. For each portfolio, we assumed that the CEIT received net cashflows based on a P90 resource estimate and calculated the NPV using our estimate of the discount rate that is used to value wind assets in today's market. Portfolios with the highest NPV have the greatest potential to reduce financing costs for future renewable energy projects.

Figure 14 below illustrates how the potential financing cost reductions (and NPV) rise steeply from 1 to 5 assets uncorrelated assets. However, after 8-10 assets, there is no incremental benefit from diversification, as the size of the cash reserve cannot be reduced below 6 months (ie, enough to meet the CEIT's next payment obligation and as such the minimum liquidity expected of investment-grade instruments). After this point, the transaction costs associated with additional assets start to reduce the value of the CEIT and therefore reduce the scope of potential financing cost reductions.

Due to the difficulty of finding assets that are truly uncorrelated, CEIT asset managers may need to acquire more assets to achieve the desired level of diversification or, alternatively, accept less diversification and pay for additional risk mitigants.

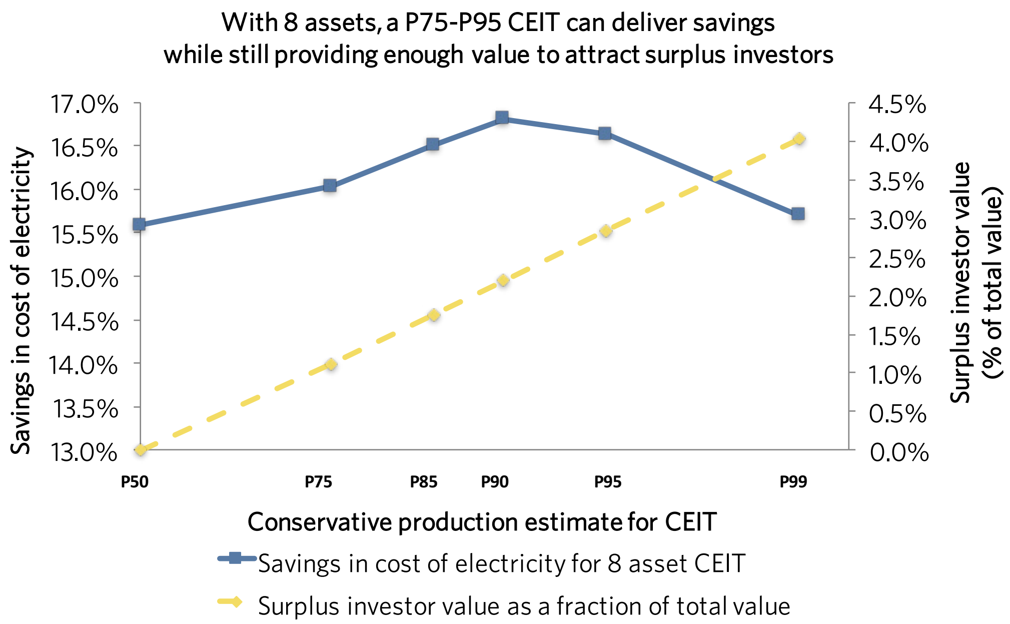
Split of value between sizing of CEIT expected returns and surplus investor

Renewable energy project finance tends to split the value in the operating phase between at least two investors. Traditionally, it is the high-cost (equity) investor that uses structuring to allocate a chunk of value to a low-cost. In the case of the CEIT, this process works in reverse, since the low-cost CEIT has control of the assets and allocates a share of the total value to higher-cost "surplus" investors.

At the start of this paper, we said that we would seek to maximise the cashflows allocated to the CEIT as the lowest-cost piece in the renewable asset capital structure. However, in section 3 we recognised that renewable asset cashflows are not sufficiently stable to place 100% of the risk with the CEIT and retain an investment-grade risk profile. We needed a separate "surplus" investor identified in section 4 to bear the risks and rewards associated with the "excess" returns over and above the amount "promised to the CEIT". The viability of the CEIT as a liability-hedging instrument is therefore dependent on the ability to sell the surplus investment product as part of the structuring process.

In splitting the value between a CEIT and the surplus investor, there are two important parameters. A CEIT with too high a proportion of cashflows allocated to it (ie, where CEIT investors expect to receive net cashflows based on a relatively low "P" value resource estimate) could leave too little value left for the surplus investment such that to produce the target return (around 15%) after accounting for transaction costs. By contrast, a CEIT with too low a proportion of cashflows allocated to it (ie, allocating a very high "P" value) will produce a sizeable and attractive "surplus" investment opportunity, but this would be counterproductive if it resulted in an overall increase in the Weighted Cost of Capital. Indeed, a split that saw 10-15% of value allocated to high-cost investors would be akin to existing

Figure 15: Balancing optimal cost savings with creating sufficient value to attract surplus investors suggests moderate conservativism (P75-P95) in sizing CEIT cashflow (P75-P95)



project finance structures that we are trying to improve upon.

To assess what the optimum split in value between CEIT and surplus investor might be, we modelled a series of hypothetical CEITs with 8 assets but with different splits in value between CEIT and surplus investor. This modelling calculated the NPV of the whole set of cash flows in the operating phase (ie, CEIT plus surplus investment) for each case, using the market discount rate for the CEIT and the surplus investor target return for the surplus product. Those portfolios with the highest NPV have the greatest potential to reduce financing costs for future renewable energy projects.

Figure 15 above shows the potential financing cost reductions peaking in the case where the CEIT receives cashflows based on a P90 resource estimate and the surplus investor receives just over 2% of total value.

Different splits (CEIT cashflows based on resource estimates between P75 and P95) could also deliver both an investable surplus product and significant finance cost reductions and may be preferable depending on what combinations of other risk mitigating tools are available.

Sizing of reserve account

In standard renewable energy project finance, a loan or bond will be backed by a series of conditions and restrictions agreed at "financial close". One of those will be a secure reserve account arranged by the equity shareholder, funded on day 1 in cash (or backed by a letter of credit) and committed for the life of the loan. The purpose of the reserve is to cover any shortfall in paying debts in the event of a temporary impairment of the asset. Whatever is left in the reserve is returned to the shareholder at the end of the project. If the amount to be returned falls short of the original funded balance, in most cases it is the shareholder whose return is diminished while debt providers receive 100% of what they expected to receive.

In the case of the CEIT, it is the responsibility of the low-cost investor to fund the reserve. If there is a shortfall at the end of the project, investors in the CEIT, which is meant to mimic the performance of debt, would not receive 100% of what they expected to receive at the start of the project; this situation would be equivalent to a default.

For the CEIT to remain investment grade, we must use structuring to reduce the risk of "default" at the end of the project to near zero while still ensuring that the size of the reserve does not fall below the minimum level expected of an investment grade bond (ie, large enough to pay the next expected CEIT distribution).

Apart from the "rating" constraint that puts a floor on the reserve size, in theory we should seek to minimise the level of the reserve as it is capital committed that does not earn a return and hence it operates as a drag on the net present value of the CEIT.

Our analysis showed that the best method to offset a risk of "default" from a shortfall in the reserve at the end of the contracted operating life is to pass the obligation to replenish any shortfall to another party – the "post-contract" investor we discuss in detail in section 5. Should there be a surplus on the reserve at the time the post-contract investor takes over the project, the post-contract investor would retain that surplus.

An investor looking at the post-contract investment will consider the relative size of the value associated with a possible reserve surplus vs. the liability to make good any reserve shortfall. There will be a maximum size of contingent liability that a post-contract investor will be able to bear. To pay any liability that crystallises on asset handover, the investor will likely need to seek a bank facility. A bank will only lend to cover this payment if it is convinced that the post-contract investor would be able and willing to repay the lending. This means that there needs to be sufficient value available to the investor after covering the reserve liability to incentivise it to continue operating the asset until the end of the design life.

Therefore, the CEIT will only be viable if the size of the reserve guarantee liability is low compared with the potential sources of value to the post-contract investor.

To assess what the optimal reserve size might be given the conclusions above on diversification and the split of value between CEIT and surplus investor, we again modelled a series of hypothetical portfolios to understand which combinations produced the highest net present value.

Figure 16 suggests that the size of the reserve guarantee liability should be manageable for a post-contract investor, provided that the CEIT portfolio is well diversified and that the CEIT/surplus investor value split is in line with our findings earlier.

Summary

This analysis illustrates that there are a variety of CEIT structures, which could create an investment grade CEIT. However, some CEITs will be significantly more effective than others in reducing future electricity costs. The optimum choice in any given market for any given technology will vary depending on the particular circumstances.

The analysis suggests that:

- CEIT portfolios should have between 5-10 independent assets.
- CEIT investors should be promised cashflows based on exceedance probabilities between P75 and P95 wind resource expectations with the rest of the value being sold to a surplus investor.
- In most cases, it will be more cost-effective to use targeted risk mitigation tools (eg, O&M contracts) rather than oversized cash reserves to achieve an investment-grade level of risk. Oversized cash reserves both reduce returns and could jeopardize the attractiveness of a potential post-contract investment.

Figure 16: Limiting the size of the cash reserve can both reduce overall costs and limit the liability of the tail investor

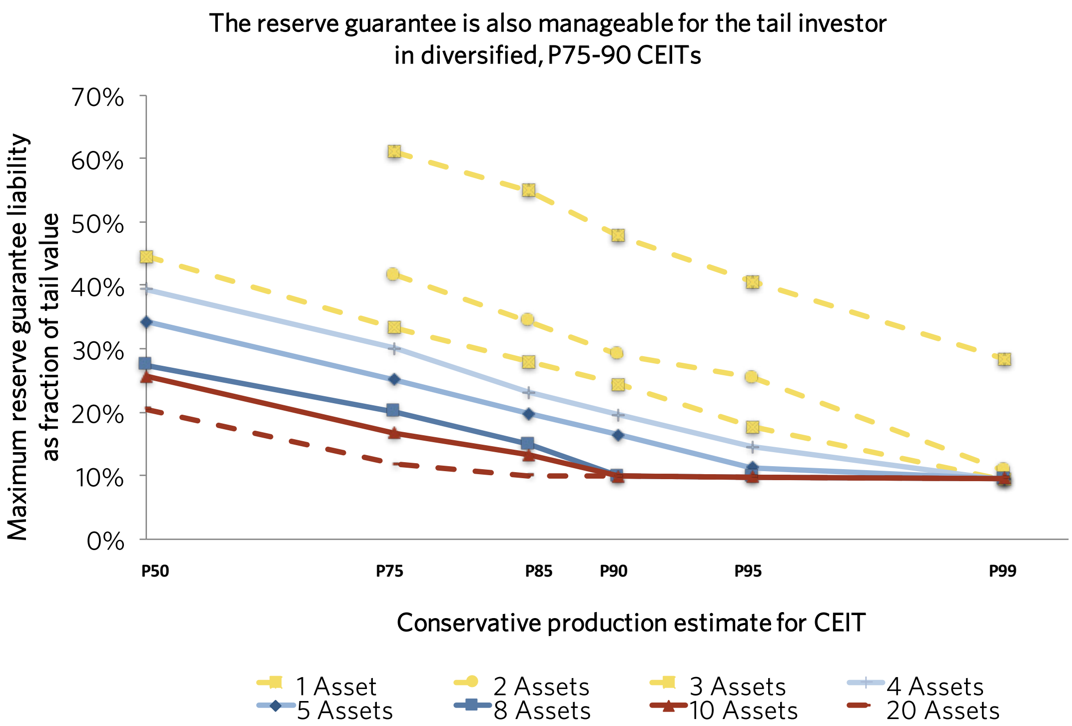
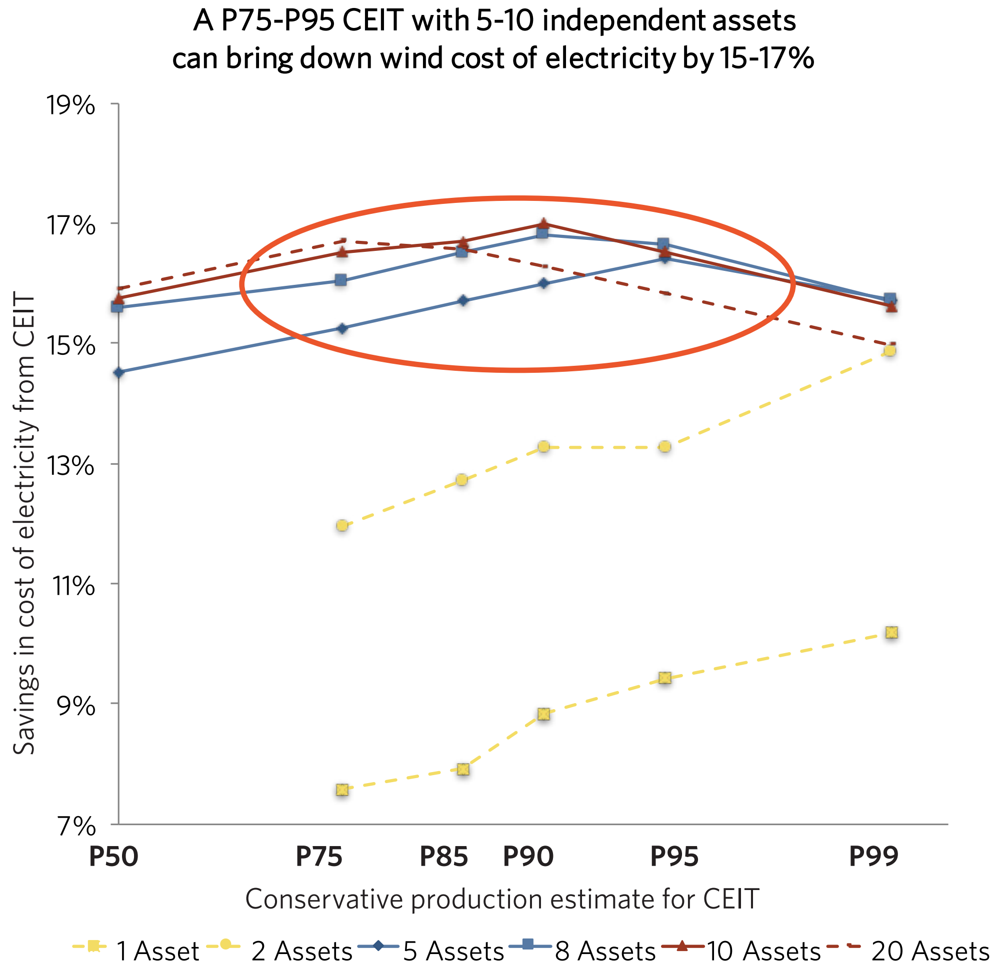


Figure 17: We find that P75-P95 CEIT structures with 5-10 independent assets and reserves of less than 20% of tail value could help bring down the cost of wind by 15-17%



6.3. Final comments

There is a path to an even lower cost clean energy system than we have now. That path lies through creating the right markets and market signals and the appropriate regulation to guide this transition. But it also lies through rethinking where those markets and regulations lead us and how the industry structure itself might change.

We have seen that building new investment vehicles that are designed around the intrinsic characteristics of the new clean energy sources can significantly reduce the costs relative to following the same old models of finance. With the right market environment and pricing, renewable energy projects, with no fuel costs and lower operating costs, resemble bond investments more closely than the typical generation projects of the past. Creating new investment vehicles that reflect these differences requires some creative thinking, but is not necessarily any more complex than existing project finance structures, and can substantially reduce the cost of clean energy.

The reward is high. Not only will the CEIT lower electricity costs by 15-17%, it will also encourage market reforms that can lead to even lower costs and risks. In the long run, the development of CEITs is likely to change the size and structure of electric utilities, but that can be an opportunity, as well as a threat. One thing is certain, the CEIT process will increase the amount of investment that can flow to renewable energy projects without needing to resort to the financing capacity of the investor owned utilities.

So how do we get there? The real challenge is creating the first one or two CEITs to set as an example for the market. Our analysis shows that first-movers could realize a significant upside to the value of their existing assets if they develop a CEIT and sell their assets off before anyone else. At the same time, first-mover investors like insurance companies and pension funds may be able to get stable cashflows they seek at a much lower cost than for the similar investment grade bonds.

The value is there and we have shown how the design can work, so the question now is who will get there first?