



ARC RESERVE CURRENCY

## TECHNICAL WHITEPAPER

ARC Reserve Currency (“ARC”) is an intrinsic-value stablecoin. It is an ERC20 compliant token, whose price is related to a pool of underlying assets held by a special purpose vehicle<sup>1</sup> (“Issuer”).

The Issuer can (in addition to the standard ERC20 functions):

- *mint* new ARC coins at a price equal to the net asset value of the underlying assets per ARC coin (“NAVpC”); and
- *burn* ARC coins which have been sold back by the Issuer at a Coin Purchase Price – a price determined by reference to the NAVpC and amount of cash held by the Issuer.

This paper sets out the technical aspects of ARC, including the *minting* and *burning* activities.

**Note:** this is one of a series of papers that describe the nature and purpose of the ARC Reserve Currency. Please see [www.arccy.org](http://www.arccy.org) for further details, including the rationale for ARC.

ARC is a work in progress. Please contact us at [hello@arccy.org](mailto:hello@arccy.org) for comment and suggestions.

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<sup>1</sup> ARC Fiduciary Ltd (the “Issuer”) is an entity set out to hold the underlying assets of ARC

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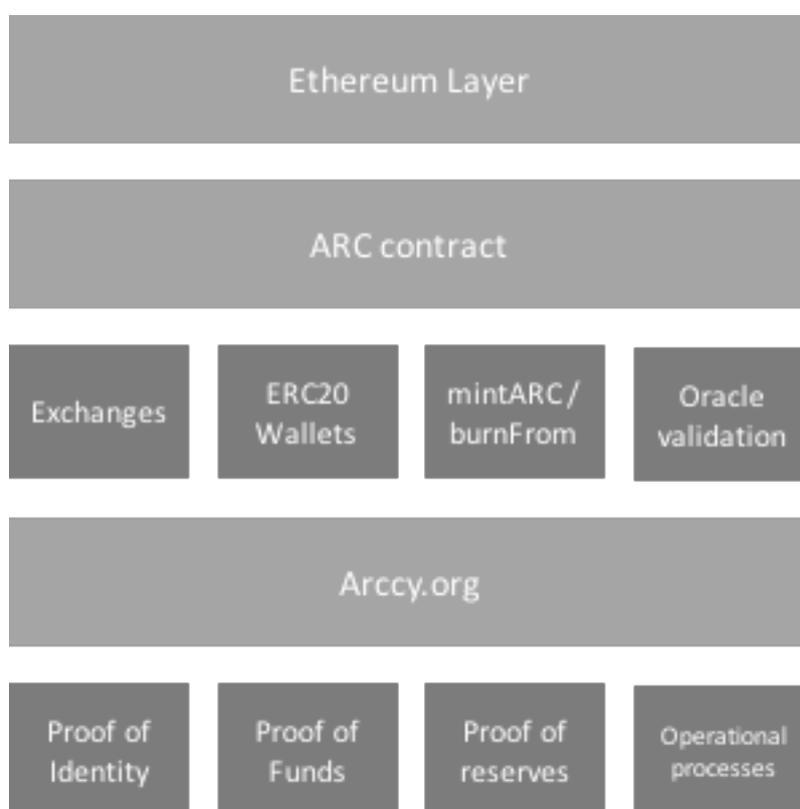
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## 1. Overview

The ARC technology stack consists of three layers:

1. The Ethereum layer protocol
2. The ARC coin ecosystem; the ARC is an [ERC20 compliant token](#) on Ethereum.
3. Arccy.org - a web-based system created in PHP and MySQL, establishing and providing oracle services to the ERC 20 contract and processes for:
  - a. Proof-of-Identity, AML/KYC validation services;
  - b. Proof-of-Funds, including validation of cash deposits;
  - c. Proof-of-Reserve, including Net Asset Value (“NAV”) calculations; and
  - d. Triggering the issuance (minting) and destruction (burning) of ARC coins.

**Figure 1: ARC Technology Stack**



## 2. Why Ethereum and ERC20

Over 400 ICO's have been launched on Ethereum, with 7 of the top 10 largest ICO's by market cap, including the largest ICO to date<sup>2</sup>. Further, Ethereum has been widely tested at central banks: 57% of central banks are experimenting with either the public Ethereum network or a permissioned version<sup>3</sup>

<sup>2</sup> Bancor raised \$353million

<sup>3</sup> Hileman, Garrick and Rauchs, Michel, 2017 Global Blockchain Benchmarking Study (September 22, 2017) [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3040224](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3040224)

Ethereum will provide ARC with a proven network and the ability to rapidly develop and deploy the ARC coin using their well-defined and widely-accepted ERC20 token standard. Utilising ERC20 will ensure that ARC can be readily accepted and stored as it will be compatible with all ERC20 wallets at point of issue.

### 3. The ARC ERC20 Contract Overview<sup>4</sup>

The ARC ERC20 contract will contain the standard functions<sup>5</sup>:

- `totalSupply ()`
- `balanceOf ()`
- `transfer ()`
- `transferFrom ()`
- `approve ()`
- `allowance()`

The ARC ERC20 coin will be implemented with the following additional features:

- *mintARC* (address target, uint256 mintedAmount) public returns (bool success)

This function enables arccy.org to trigger the issue of coins to an account. The validation of this issuance will be included in the function by a call to the oracle provided by arccy.org, validating that minting the requested amount will not exceed the net assets.

- *burnFrom* (address target,uint256 burnAmount) public returns (bool success)

The function will remove the amount of coins from a specific account, and remove them irreversibly from the system as a whole. The function will call to the arccy.org oracle to validate this request before executing.

The *mintARC* and *burnFrom* functions will only be available to the central administrator of the contract, the Issuer via arccy.org.

### 4. Arccy.org

Arccy.org is a PHP, MySQL based web solution hosted in AWS created by BondMason's<sup>6</sup> development team. The site will establish and provide oracle services to the ERC20 contract, and a portal for users and operational processes.

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<sup>4</sup> The code is available at a GitHub repository, links available from [www.arccy.org](http://www.arccy.org)

<sup>5</sup> For details regarding the standard ERC20 contract see: [https://theethereum.wiki/w/index.php/ERC20\\_Token\\_Standard](https://theethereum.wiki/w/index.php/ERC20_Token_Standard)

<sup>6</sup> BondMason Group Ltd ("BondMason") is providing technical expertise to the Issuer. BondMason.com is a bespoke financial technology platform with processes and relationships that enable distribution of capital across many lending partners.

#### 4.1 Proof-of-Reserve

The Proof-of-Reserve constitutes the values that populate the Net Asset Value (“NAV”) calculation of the Issuer.

The underlying holdings are populated into arccy.org via API integrations with the Issuer’s:

- banking partner(s), and
- investment allocation and reporting partners.

These APIs provide up to date balances on cash in the relevant accounts, and investment levels. The APIs are typically provided as pull services and will be polled every 60 seconds.

##### 4.1.2 NAV – calculation methodology

To calculate the NAV, all bank balances and investment values held by the Issuer are calculated in terms of USD, using a notable source of exchange rates<sup>7</sup>.

The Net Asset Value of the Issuer is the total of:

- Plus: cash (and cash equivalents) held by the Issuer (“Actual Cash Balance”):
  - Amounts held in bank balances and digital wallets;
- Plus: value of investments held by the Issuer;
  - If investments are traded on a recognised exchange and have a quote then take the quote from the relative exchange; otherwise
  - If investments are not listed and quoted on a recognised exchange then they will be priced in accordance with the Investment Pricing Policy as set out on arccy.org
- Less: any amounts held in the *buffer account*<sup>8</sup>.

NAV will be audited by third-party auditors to confirm the balances held, and that these assets are unencumbered.

##### 4.1.3 NAV – publication

The NAV of the Issuer per ARC coin is provided on the website, available to anonymous and authenticated users both on the web page and as a REST service to allow integration by third-party exchanges.

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<sup>7</sup> E.g. Bloomberg. Source to be disclosed on [www.arccy.org](http://www.arccy.org)

<sup>8</sup> Please see ‘ARC Primer and Overview’ available at [www.arccy.org](http://www.arccy.org) The buffer account is used to accrue for expenses and smooth investment returns – it retains any surplus returns achieved above the Target Return, which may then be released back to the NAV calculation in the event of underperformance.

**Figure 2: Depiction of how NAV per ARC coin could be displayed on arccy.org**

Current NAV  
**\$102.3011**

Local			USD			
Currency	Cash	Investments	Exchange Rate	Cash	Investments	
\$ USD	4,850,000.00	43,650,000.00	1.00	4,850,000.00	43,650,000.00	
£ GBP	819,548.87	9,106,098.58	1.33	1,090,000.00	12,111,111.11	
€ EUR	1,889,830.51	17,008,474.58	1.18	2,230,000.00	20,070,000.00	
¥ JPY	123,863,636.36	1,114,772,727.27	0.0088	1,090,000.00	9,810,000.00	
A\$ AUD	558,441.56	5,025,974.03	0.77	430,000.00	3,870,000.00	
CHF	306,930.69	2,762,376.24	1.01	310,000.00	2,790,000.00	
			TOTAL	\$10,000,000.00	\$92,301,111.11	
				TOTAL NAV USD	\$102,301,111.11	
				NUMBER OF ARC COINS	1,000,000.00	
				NAV PER ARC COINS	\$102.3011	

#### 4.1.4 Supply of ARC coin

The total number of ARC coins in circulation will be published as part of the Proof-of-Reserves, and is also readily verifiable from the Ethereum blockchain, by calling the *totalSupply* function.

The NAV per ARC coin (“NAVpC”) is the NAV as calculated above, divided by the total number of ARC coins issued and outstanding.

#### 4.2 Proof-of-Identity: User Account Creation to Buy/Sell ARC Directly to/from the Issuer

A user will be able to register an account at [www.arccy.org/register](http://www.arccy.org/register). The user will provide account information to enable KYC/AML reviews, which will include:

- Full name
- Date of birth
- Address / nationality
- Client Nominated Bank Account<sup>9</sup> and;
- Other personal information that may be required to facilitate an effective Proof-of-Identity check.

The user will store their ERC20-compliant wallet public key as part of their profile as the destination for any coins they have purchased.

The Issuer will complete applicable AML/KYC reviews, which will be validated via an integrated API from a third-party information provider.

<sup>9</sup> This may be a USD account, or other account the client wishes to deposit and receive funds, and in accordance with the currencies accepted for ARC con purchases by the Issuer post ICO.

Following the successful completion of the *proof-of-identity*<sup>10</sup>, the user account will be created on arccy.org and the user will be able to:

- buy newly issued ARC from the Issuer having wired funds into the Issuer's nominated account, the details of which will be available on their dashboard, or
- sell ARC back to the Issuer by sending ARC to a specified wallet.

The User Account stores a record of all transfers into the system, and any pending balance awaiting to be exchanged to or from the Issuer.

During the ICO a user will also have the option of sending bitcoin (BTC) or ether (ETH) to fund their account. On the day of the ICO close, relevant exchange rates will be used to convert subscriptions into ARC. The coins will then be issued to subscribers.

Immediately post-ICO, transactions to and from the Issuer will be USD-based (with the ARC coin completing the currency pair). However, other currencies are likely to be accepted by the Issuer on a continuing basis in due course

#### 4.3 Proof-of-Funds (Approval Oracle)

Arccy.org will provide an oracle service to validate that any coins being minted are backed by the total assets under management. This method will be called from the *mintARC* function of the ERC20 contract ensuring that no coins can be issued without Proof-of-Reserve.

#### 5. Outline of user ARC new coin purchase and issuance process (including *mintARC*)

The Issuer will issue new coin at a price equal to NAV per coin ("NAVpC") (as set out above).

*Please note: the Issuer will only ever issue ARC at NAV per coin. It does not hold ARC – any ARC repurchased by the Issuer will be burned (see below) – and therefore the Issuer won't (can't) sell ARC at any price other than NAVpC.*

Arccy.org polls the bank API every 60 seconds and is notified of any new deposits. The following actions are then triggered (each step assumes the success of the previous step):

1. Check within arccy.org if the user has completed the AML process. (If not, then funds are transmitted back to the Client's Nominated Bank Account).
2. Funds are moved from the Client Money Account into the Issuer's USD bank account.
3. The user account is updated on arccy.org to reflect the new currency balance.
4. An administration action is generated within arccy.org requesting that the Issuer approve the process of minting the coins.
5. The Ethereum API is called from arccy.org with a call to *mintARC* to the wallet ID associated with the investor:
  - a. The ARC contract checks the balance of the account on ARCCY.org that is associated with that wallet via a call to the oracle implemented on arccy.org.
  - b. The ARC contract checks the NAV per ARC coin via a call to the oracle implements on arccy.org
  - c. The number of coins to be minted is calculated

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<sup>10</sup> If the user fails the proof-of-identity, they will only be able to buy/sell ARC from a third-party, i.e. not the Issuer.

- d. The balance of the user account is debited
- e. The appropriate number of coins is minted directly to the users ERC20 compatible wallet by calling *mintARC*

### 5.1 Subsequent transactions of ARC

Any transactions of ARC, not with the Issuer as a counterparty, will be handled in the standard way for an ERC20 token, i.e. through peer-to-peer transaction or via an exchange.

## 6. Outline of user ARC sell process (including *burnFrom*)

The Issuer can buy-back ARC at the Coin Purchase Price (“CPP”). Users will be able to obtain a sale price per ARC coin that they wish to sell, and then can choose sell ARC coin at this price.

Users will also be able to submit their sell order directly, without acquiring an estimate first. To sell ARC coin back to the Issuer, users will need to pass relevant KYC / AML checks (proof-of-identity). The repurchase activity of the Issuer does not restrict the ability for holders of ARC to set their own price to buy and sell ARC to each other, or via a third-party exchange.

### 6.1 Estimated Sale Price

The user visits [arccy.org](http://arccy.org) and enters the number of ARC they wish to sell:

1. Arccy.org uses this information to calculate:
  - a. the estimated price per coin (by reference to the Coin Purchase Price – see below);
  - b. the gas cost for processing the transaction; and
  - c. the total net proceeds (being the number of coins being sold multiplied by the total estimated value of the coin, less the gas cost).
2. The user can then confirm their intent to execute the transaction, or cancel the transaction:
  - a. To execute the transaction, they will send ARC to a unique wallet ID (see section below);
  - b. To cancel the transaction, they can navigate away from the webpage or click cancel.

### 6.2 Selling ARC Coin to the Issuer

The user is given a unique wallet ID on their dashboard to send ARC coin. Upon receipt of ARC the following actions will trigger:

1. Check within [arccy.org](http://arccy.org) if the user has completed the AML process (if they haven't completed the AML/KYC process then ARC is returned using *transfer()* function)
2. An administration action is generated within [arccy.org](http://arccy.org) requesting that the Issuer approves the process of burning the coins.
3. The Burn function is called within the ERC20 contract from within [arccy.org](http://arccy.org) requesting a burn of the ARC within the wallet - the contract calls the [arccy.org](http://arccy.org) oracle to ensure the wallet has the appropriate balance.
4. The coins are then destroyed by calling *burnFrom*
5. The client account within [arccy.org](http://arccy.org) will be credited with the appropriate amount of USD based upon the Coin Purchase Price (“CCPP”).
6. [Arccy.org](http://arccy.org) calls the banking API transferring from the Issuer's USD account to the relevant Client Money Account.

7. The client's account on arccy.org is updated to reflect that the transaction has occurred (creating a duplication of the blockchain record).
8. A transfer is made from the Client Money Account to the ARC seller's nominated bank account in accordance with their arccy.org user details.

## 7. Calculating the Coin Purchase Price (Bid Offered by the Issuer)

To sell ARC back to the Issuer, and prior to calling *burnFrom*, the Coin Purchase Price ("CPP") for the sale of ARC coins is calculated for each transaction.

The CPP is set by reference to the NAVpC and the Actual Cash Balance held by the Issuer; this is an important part of the price controlling and support actions, which are fundamental for ARC.

### 7.1 Cash held by the Issuer

#### 7.1.1 Cash Remaining

The Cash Remaining amount is calculated by reference to the Actual Cash Balance, which is established as part of the NAV calculation process.

For the purposes of calculating CPP, the Actual Cash Balance is reduced by the value of the ARC coins that are being sold back to the Issuer to set the 'Cash Remaining' figure:

$$\text{Cash Remaining} = \text{Actual Cash Balance} - (\text{No. of ARC coins being sold} \times \text{NAVpC})$$

#### 7.1.2 Target Cash Amount

The Issuer retains an amount of its NAV in cash (and cash equivalents) to provide liquidity and pricing support – the Target Cash Amount ("TCA").

Immediately following the ICO the TCA will be 25% of NAV<sup>11</sup>. The TCA (and Actual Cash Balance) will be published on the arccy.org website.

The TCA will be set by reference to the liquidity of the underlying investments. The more liquid the underlying investments are, the less cash will need to be held by the Issuer – as greater liquidity will enable faster conversion of investments to cash (at values close to their NAV).

The liquidity of the underlying investments will be categorised as follows:

- If the underlying investment is listed on a recognised exchange, it will be considered to be realisable on the same day (daily liquidity)<sup>12</sup>

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<sup>11</sup> This assumes the ICO proceeds will be \$100M.

<sup>12</sup> If the Issuer holds a material portion of any listed position (e.g. more than 5% of the asset; or more than 10% the average day traded value) then the value arising from the liquidity of this asset will be discounted to reflect that ARC selling its position may reduce the price in the market.

- If the underlying investment is not listed then the remaining term for the loan will be used (this may include the amortisation profiles for capital repayment loans); and
- Cash (and cash equivalents) are assumed to be fully liquid.

The TCA will be set at a value to ensure that:

- 25% of the NAV of the Issuer can be liquidated within 1 week or less<sup>13</sup>; and
- 33% of the NAV of the Issuer can be liquidated within 3 months or less.

Subject to the TCA being between: (these target thresholds take precedent over the calculation immediately above):

- a minimum of 5% of the NAV of the Issuer; and
- a maximum of 25% of the NAV of the Issuer.

From time to time the actual cash balance may be higher than the TCA (immediately following the issue of new coins) or lower (as a result of price support activities):

- If the Actual Cash Balance is higher than the TCA then further investments will be sought;
- If the Actual Cash Balance is lower than the TCA then investing activities will be put on hold until the TCA is reached, from:
  - Underlying loans repaying capital and interest to replenish cash balances;
  - ARC coin issuances increase cash balances;
  - The average remaining term for underlying investments reduces and shortens the TCA; and/or
  - Selling investment positions.

### 7.1.3 Target Cash Remaining Proportion

The Target Cash Remaining Proportion is the proportion of cash remaining compared to the TCA:

$$\text{Target Cash Remaining Proportion} = \frac{\text{Cash Remaining}}{\text{Target Cash Amount}}$$

Typically, the higher the Target Cash Remaining Proportion is, the higher the price the Issuer will offer to pay for ARC coins (the repurchase price).

## 7.2 ARC Repurchase by the Issuer

### 7.2.1 Base Level Support

The Base Level Support provides a basic level of support for the currency at a price per coin close to the NAVpC:

- The price bid by the Issuer per ARC coin, the Base Level Bid Price (“BLBP”), is the NAVpC:

<sup>13</sup> Following a sufficiently long trading period for ARC – e.g. 1 year – these percentages may be varied to reflect the net traded selling activity experienced for ARC – to ensure sufficient (and not excessive) liquidity in the system to facilitate the price support activities. We do not consider it appropriate to adopt market statistics from pre-existing cryptocurrencies due to their speculative nature.

- less a negligible amount (for example, 0.001%), and
- less a market-spread test<sup>14</sup>, being the greater of:
  - the average market bid-offer spread of three leading cryptocurrencies across the three leading exchanges<sup>15</sup>; and
  - the average 90-day bid-offer spread for ARC:USD on three leading exchanges.
- Volume:
  - The Base Level Bid Price will be available while the Cash Remaining in the Issuer is more than 50% the Target Cash Amount.

### 7.2.2 Continuing Support

When the Cash Remaining is less than 50% (half) of the TCA in cash (and cash equivalent) balances, the Issuer will be willing to continue to repurchase ARC, but at a declining price per coin, based on the following formula:

$$\text{Continuing Support Bid Price} = \text{BLBP} \times \left(1 - e^{-8 \left(\frac{\text{Cash Remaining}}{\text{Target Cash Amount}}\right)}\right)$$

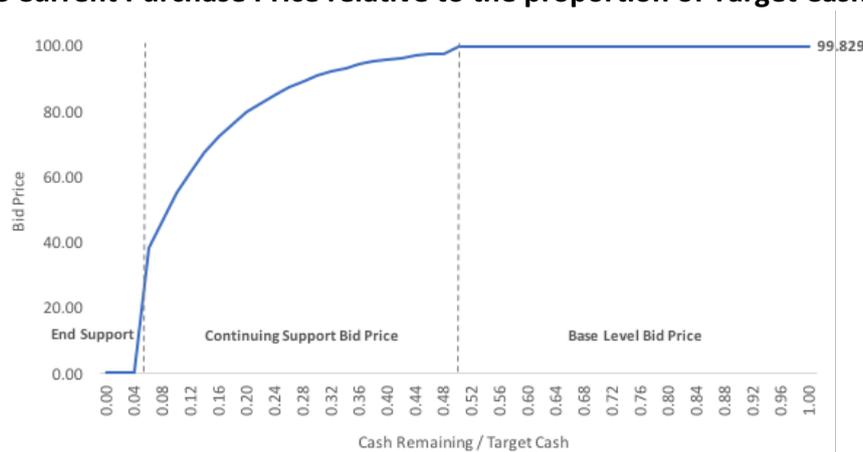
### 7.2.3 End Support

If the Issuer's cash balances falls below 5% of the TCA, then the Issuer will not make further bid orders until its cash balances increase to more than 5% of the Target Cash Amount.

### 7.3 Example Coin Purchase Prices

The chart illustrates example CPP (Bid Prices) offered by the Issuer, based on the proportion of cash (and cash equivalent) reserves relative to the TCA held by the Issuer.

**Figure 3: ARC Current Purchase Price relative to the proportion of Target Cash Remaining<sup>16</sup>**



<sup>14</sup> This is to ensure that the action of the Issuer does not impact the naturally trading and exchange activity for ARC.

<sup>15</sup> As at October 2017, this would be 0.17% based on Bitcoin, Ether and Ripple market spreads across the three largest exchanges. The leading exchanges are defined as exchanges with the largest volume of trades on a rolling 3-month basis.

<sup>16</sup> Assumptions underpinning the chart:

- NAV per coin is 100
- Base Level Bid Price is 99.829 (market spread is 0.17%, less 0.001%)

There are two steps in the curve of the bid price function:

- When the remaining cash is less than 5% of the target cash – the bid price is set to 0 (removed)
- When the remaining cash is more than 50% of the target cash the bid price jumps to the Base Level Bid Price (which is higher than that computed by the Continuing Support Bid Price at this level).

## 8. Summary of Issuer Bid-Offer Mechanisms

The Issuer will only issue (sell) ARC at NAVpC. The Issuer will never sell at a price below NAVpC.

If the price of ARC drops below NAVpC then ARC will be purchased by users through an exchange or peer-to-peer from existing holders of ARC, in preference to purchasing newly minted ARC from the Issuer.

If ARC is under downwards sale pressure, and liquidity of the Issuer is reducing, then the Issuer will only repurchase ARC in transactions that will increase the NAVpC. This delivers ‘natural buoyancy’ for ARC.

Patient holders of ARC will be rewarded with a faster appreciation in value per coin in these circumstances.

The CPP will be displayed on [arccy.org](http://arccy.org)<sup>17</sup>, available to anonymous and authenticated users both on the web page and as a REST service to allow integration by third-party exchanges.

The bid-offer actions are central to the ARC construct and will be specified in the ARC ICO Private Placement Memorandum<sup>18</sup>, which, subject to legal confirmation, is intended to create an implied contract between (1) holders of ARC and (2) the Issuer which issues and maintains ARC. This will provide holders of ARC reliance upon the proposed price support actions of the Issuer.

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<sup>17</sup> Noting that the actual CPP may be lower, depending on the total value of ARC coins being sold back to the Issuer.

<sup>18</sup> The ARC ICO Private Placement Memorandum (ARC ICO PPM) (or other subsequent, similarly-described document) is being drafted to set out a legal basis on which purchases of newly issued ARC from the Issuer will be conducted. *Please note: the ARC ICO PPM is the only document in the ARC Series of Papers which is intended as a legal document and supersedes any information contained in any other document. The remaining documents are for assistance only and must not be relied upon for any legal purpose.*