

## Introduction

Building-integrated photovoltaics (BIPV) hold significant potential to reduce PV installation costs and expand PV deployment. However, though BIPV has been under development for around four decades, BIPV consistently under-performs relative to its market potential. BIPV market penetration (as a share of its addressable market) is about an order of magnitude lower than penetration for conventional rooftop PV. Cost premiums are the primary barrier to expanded BIPV deployment.

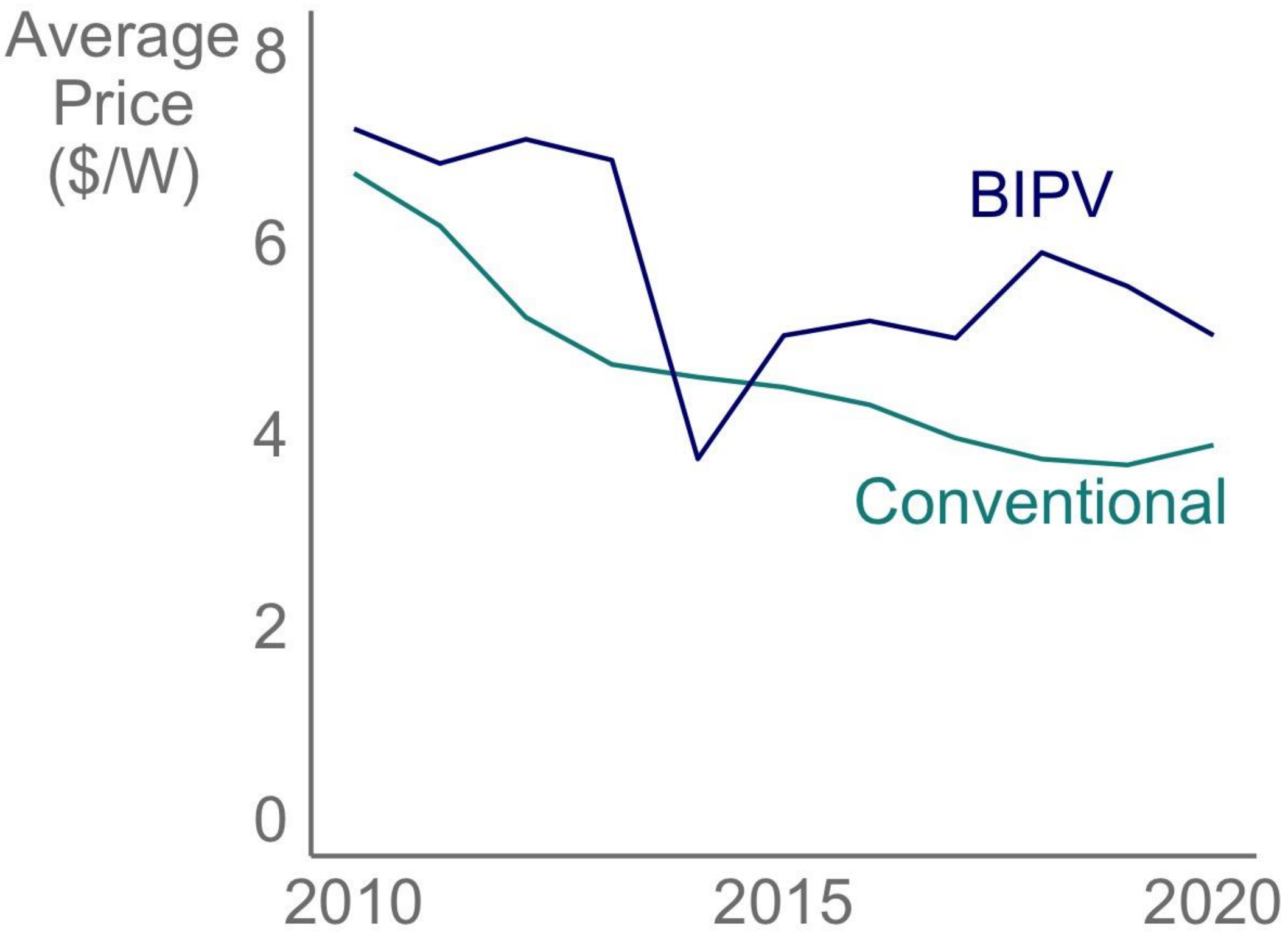


Figure 1. Average BIPV and conventional rooftop PV prices, 2010-2020

## Results

The overall installation process follows four basic steps. Step1 begins with all pre-installation activities including installation coordination, travel, unpacking of materials and staging. Step 2 begins when the team moves to the roof to mark the site and install relevant underlayment and fireproof material. In step 3, the team installs all equipment including flashing, pans, modules, and/or electrical equipment. Finally, step 4 completes the process when the installation team runs electrical wire and performs final quality assurance steps.

Across the four reroofing installs, it took 4 days on an average for the reroofing installations and [x] days on average for the new construction systems. [flesh out details based on times of different steps]

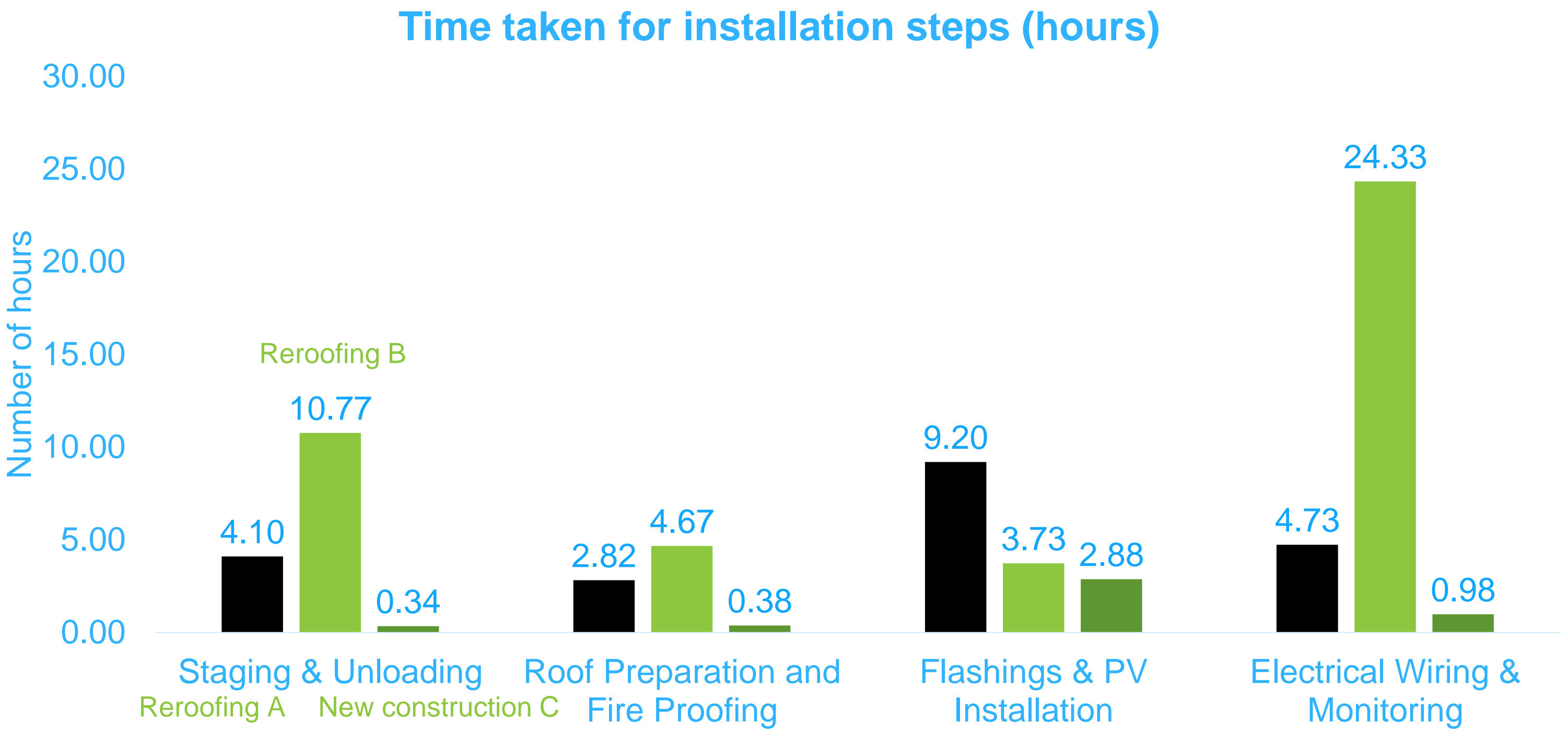


Figure 2. Distributions of BIPV installation timelines at four steps for reroofing and new construction installations

To explore how different system layouts affect installation times, we defined a variable that scored each project's complexity from 1 (least complex) to 4 (most complex) based on: 1) the number of floors of the home, 2) the number of roof planes the BIPV was going to be installed in, and 3) whether the array was a simple rectangle/square with no non-rectangle shapes. Figure 3 shows the installation time increases as system complexity increases. On average, a 1-roof plane project take 216 minutes, a 2-roof plane 345 minutes, and a 3-roof plane 450 minutes.

[conclude something, no clear cost reduction opportunities? Compare to Quintanilla? What is the key outcome of this study?]

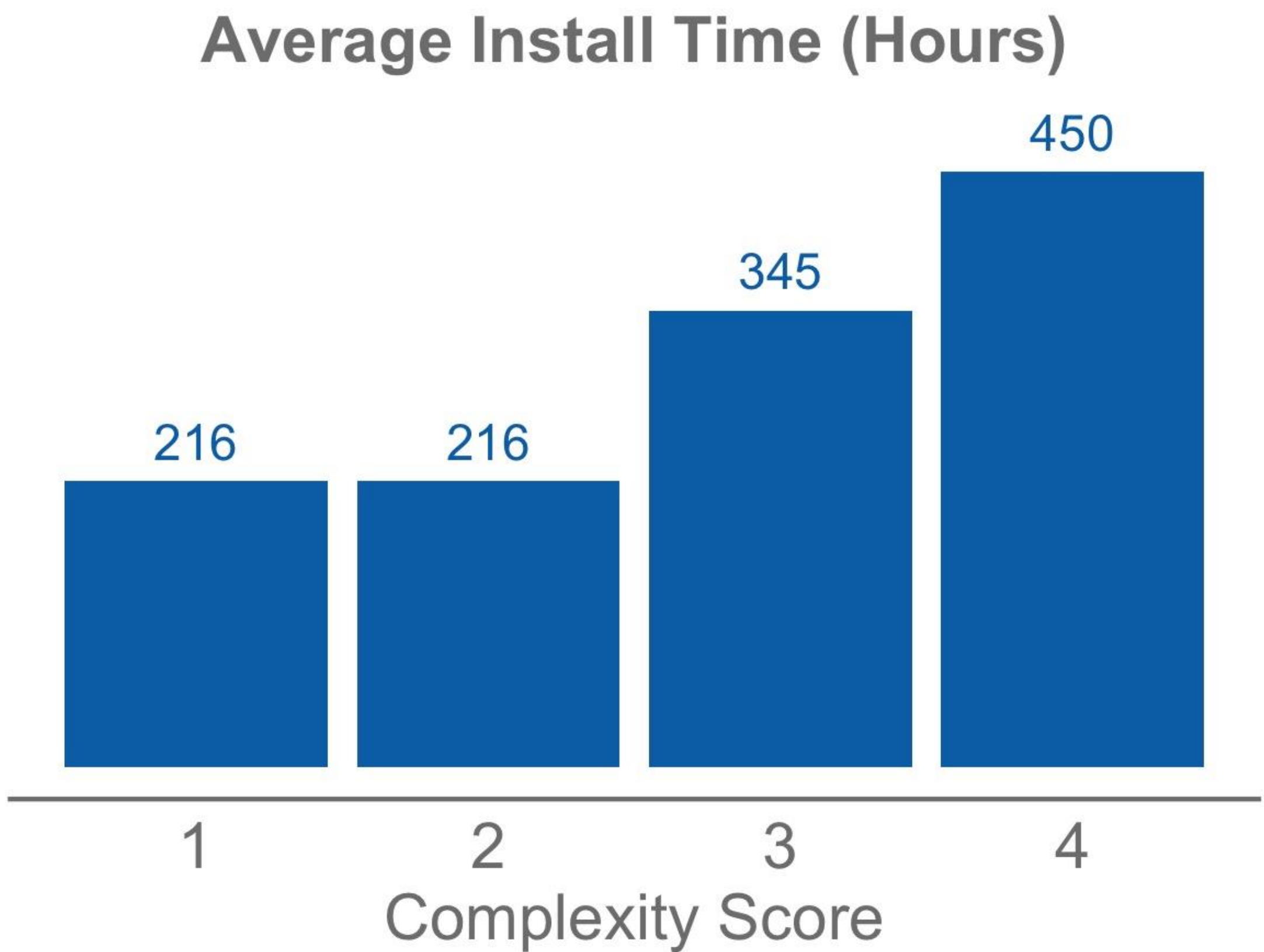


Figure 3. Average install time by system complexity score (1=least complex, 4=most complex)

## Conclusions

This research has identified several key conclusions:

- The **re-roof and new construction markets** are prime targets for residential BIPV deployment.
- **This equates to approximately 3 million homes per year through 2030.**
- BIPV products vary in complexity and installation times.
- BIPV products are increasing in market share
- **Barriers relating to customer education, contractor training/product knowledge, and cost and supply chain challenges will impact BIPV penetration.**



Figure 1. General BIPV Installation Process